E-HEALTH

AFRICA 4 TECH
Digital Talks
INTRODUCTION

Over the next 25 years, it is projected that Africa’s economic growth rate will continue at around 5-6% percent per annum \(^1\) with a significant increase of its population. Some countries like Nigeria are expected to double their population size in less than 20 years. If this economic expansion is a vector of opportunities for the continent, a healthy population is required to sustain this development. To address this issue, African countries have made significant efforts over the past years to improve the health outcomes of their population. However, African health systems suffer from lack of funds, well qualified human resources, infrastructure etc. While some existing studies have been made on a diagnostic scope\(^2\)\(^3\), other more recent studies focuses on the prospective point of view\(^4\) to address the African Health System challenges.

Today, it is now well admitted that the digitization of Africa is a fantastic opportunity to address some of those African Health System challenges. eHealth development is thus an interesting and promising path for African countries. The World Health Organization defines eHealth as the cost-effective and secure use of information and communication technologies (ICTs) for health and health related field\(^5\). Hence, developing an African based eHealth framework has become an interesting paradigm to explore. Thanks to its eHealth bootcamp workshops, Africa4Tech addresses this issue by gathering African eHealth innovators and international experts of different domain to address those issues on a cross-fertilization, collaborative and disruptive perspective.

The current report provides an overview of African eHealth state of the art, highlights some promising on-going eHealth project/initiative and going straightforward proposes some tracks to explore based on the outcomes of already deployed solutions.
OVERVIEW OF HEALTH AND EHEALTH IN AFRICA

Africa’s population size is expected to reach 2.7 billion in 2020. Although the majority of this population is young, the proportion of people aged 60 or older is increasing and is expected to reach 13% over the next 50 years. This imply a double challenge for Africa Health Systems: how to build and improve the traditional Healthcare offer and Quality of Service (QoS) even in isolated areas while addressing the tricky challenge of adopting eHealth innovations to sustain African population growth.

In this section, an overview of African Health system is provided along with a presentation of eHealth as a valuable mean to strengthen and overcome the limitations of existing African Healt systems.

II-1/ OVERVIEW OF AFRICAN HEALTH

Africa is still the continent with the lowest average life expectancy, 58 years in 2012. As shown in Table 1 While the average life expectancy in relatively higher in North African countries (76 year in Morocco; 75 years in Tunisia; 75 years in Egypt; 74 years in Algeria - 2011) this ratio drastically decreases in sub-Saharan countries (52 years in Nigeria; 55 years in Cote d’Ivoire; 53 years in South Africa; 56 years in Benin; 51 years in Mali). In Africa, gender is not a factor of significant differentiation while speaking about average life expectancy. Currently African’s women outlive men by an average 2.6 years, which is relatively slow in comparison to more developed regions of the world (average 6.7 years gap between women and men).

Since the increase in life expectancy is correlated to increase of GDP per capita, based on a GDP grew rate of 3.3 percent a year during the last 5 years (2010 to 2015), it is expected that Africa average’s average life expectancy grows to reach 80 years in 2060.

African Health context is characterized by the predominance of communicable diseases such as HIV/AIDS. In Africa, communicable diseases account for 72% of the disease burden while this ratio is of 40% in the world. The emergence of HIV/AIDS in the 1980s has badly impacted the performances of African Health Systems. However, the global effort to
tackle HIV and the rapid rollout of the antiretroviral drugs (ARVs) over the last decade decades has helped to significantly reduce the impact of HIV/AIDS in African countries. By the same time Africa Health systems are also impacted by the burden of malaria which particularly affects children.

**Table 1: Average Life Expectancy – Source AfDB**

Adult Mortality Rate has increased while Infant Mortality Rate reduces in the last decades (Cf. Figure 1). On the other side, significant efforts have been made to reduce the Maternal Mortality Ratio.

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<tr>
<th>Country</th>
<th>Life Expectancy in 1960</th>
<th>Life Expectancy in 2011</th>
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Many African Health systems focus their efforts on communicable diseases while reducing their attention on non-communicable diseases which has been growing and currently accounts for 22% of the disease burden. To address those challenges, African countries are developing healthcare services and are strengthening their health strategies by developing eHealth potential.

II-2 OVERVIEW OF EHEALTH AND EHEALTH INNOVATIONS IN AFRICA

During the last decade, ICTs becomes an important vector of African countries development.

Internet generates economic growth and social transformation in different sectors. In financial services, for example, M-Pesa’s mobile money solutions have brought millions of Kenyans onto the financial grid for the first time. African Health systems are taking advantage of the success story of mobile penetration to explore and develop alternative solution. For example, remote diagnostics are expanding medical services to rural areas that have few healthcare professionals. The added value of ICTs in African Health systems relies on the fact that they can contribute to significantly improve the exchange of information. Since exchange of information is important, African eHealth recent advances contributes to improve Health systems at each level of the Health chain:
II-2.a African eHealth contribution at awareness (prevention) level

The need of information is crucial at prevention level to: inform the population about the risks (epidemic risks for example: The last Ebola epidemic in West Africa); communicate about vaccination campaign; control the authenticity of drugs or give information about mandatory vaccines. Current African eHealth ecosystem addresses this issue by using SMS to alert, prevent and inform the population. An example is **OPISMS** (promoted by YAI Eche Noel N’Drin, CEO of OPISMS, Cote d’Ivoire) which aims to increase coverage via SMS reminders of vaccination dates and spreading awareness about to the importance of this medical procedure. [Source: OPISMS]. Another example is **GiftedMom** (promoted by YAI Alain Nteff, CEO of GiftedMom, Cameroon) which consists of a preventive SMS and voice maternal engagement and notification service which notifies pregnant women and new mothers on when to go for their next antenatal care service or baby vaccination, and empowers them with healthy habits to cultivate in order to have a safe pregnancy. [Source: GiftedMom].

II-2.b African eHealth contribution at diagnostic level

At the diagnostic level identifying and tracking the patients especially in cases of infectious diseases is a crucial issue. Moreover accessing to reliable databases and providing remote diagnostic in isolated areas is an important challenge. Among recent African eHealth initiative **DOCTOCLINIC** (promoted by YAI Tantchonta M’PO, Benin) allows patients to get treated by a healthcare professional without the travel and to pick up at the nearest pharmacy for their prescription without having to queue. [Source: Doctoclinic].

Another example is **Sihat-e** (promoted by YAI Mohamed & Hakim, Morocco) which enable access to health care through telemedicine to people living in the rural area. Each center is equipped with telemedical tools used by the technician to connect the patient with a doctor using live feed. [Source: Sihat-e].

II-2.c African eHealth contribution at treatment level

Treatment requires receiving pharmacovigilance follow-up, checking the efficiency of the prescription thanks to inter-professional exchanges, controlling the authenticity of drugs. ICTs can help solving this issue by
II-2.d African eHealth contribution at patient follow-up level

In order to follow pregnant women and mothers of under-5, or to follow the progress of the patients on their recovery process or to assist patient suffering from chronic diseases, African Health systems need remote medical transmission systems. In this scope, African eHealth initiative such as e-room (promoted by Saad-Eddine Said, Co-Director of NGO Terre Sans Frontière, Morocco) uses using open source technology to connect people in remote areas with a professional team of volunteers to either assist during emergency situations or to set-up classes for the children of the community [Source: e-room]. Concerning the follow-up of pregnant women, OMOMI (promoted by YAI Emmanuel Owobu, CEO of MOBicure, Nigeria) is a mobile platform for pregnant women and mothers of under-5 that enables them to monitor their children’s health, provides access to specific and life-saving maternal and child health information, as well as medical expertise at the touch of a button [Source: OMOMI].

II-2.c African eHealth contribution at improvement and learning level

Improving Africa Health systems requires also forming health workers, improves inter-professional exchanges and connecting isolated medical centers with cities hospitals which are generally more equipped. African eHealth ecosystem addresses this issue by developing innovation such as Chartler (promoted by YAI Omasirichukwu Udeinya, CEO of Novadge,
Nigeria). Chartler is a software that improves the efficiency of health systems, facilitating collaboration between practitioners and access to medical information and clinical quality standards\textsuperscript{16} [Source: Chartler].

African eHealth ecosystem is also positively impacted by major projects such as the Telemedicine Network for Francophone African Countries (RAFT)\textsuperscript{17} [Source: RAFT], HINARI Access to Research in Health Programme\textsuperscript{18} [Source: HINARI], ePortuguese Network and Pan-African e-Network Project\textsuperscript{19} [Source: ePortuguese]. In sub-Saharan Africa some countries such as Benin, Burkina-Faso, Burundi, DRC, Cote d’Ivoire, Ghana, Kenya, Madagascar, Mali, Mauritania, Niger, Rwanda, Senegal and South Africa are implementing telemedicine and eLearning projects. Those projects rely on computer science or mobile phone to support the delivery of health care, awareness and education; remote data collection; remote monitoring and home care; communicating treatment to patients; reporting and responding to disease outbreaks and emergencies. Others are using satellite technologies to broadcast health promotion to patients and health workers in hospitals and clinics\textsuperscript{20} [Source: Leveraging eHealth]. Going straightforward, dedicated communication channel such as SanTév (promoted by YAI Amine Sebti, CEO Santév, Morocco) are emerging in the continent. Santév is a TV channel whose mission is to educate and raise awareness around health and fitness (casings facility broadcasting 4-minute capsules loop in the waiting rooms of doctors’ offices)\textsuperscript{21} [Source: SanTév].

Among the challenges to overcome for extensive adoption of eHealth in Africa countries need to overcome problems such as: awareness about eHealth; building adapted policy environment; develop the leadership in eHealth promotion; strengthening human resources capacity; solving the problem of ICT infrastructure and services; providing enough financial resources; creating or reinforcing monitoring and evaluation systems.
CHALLENGES AND OPPORTUNITIES

The general observation is that African countries are far from reaching the Millennium Development Goals (MDG). Thus, there is a need to explore new paradigm by developing an African based eHealth framework which could be globalized by the end of the day. Bearing this goal in mind, ICT could help overcoming some African Health system challenges. In this section, key African health system breakthroughs are counterbalanced by the opportunities and eHealth based solution that they can leverage.

III-1/ THE LACK OF QUALIFIED HEALTHCARE WORKERS

Africa needs more than 1.5 million health workers and this gap is increasing each year. Rural areas suffer the most of this deficiency of qualified professional which increases the Urban-Rural inequality. African countries have traditionally had fewer healthcare workers per head than anywhere else in the world. On average, there are only two physicians per 10,000 of population, compare to a global average of 14 physicians per 10,000 of population\textsuperscript{22} [Source: AfDB]. Moreover the number of health workers capable of leveraging ICT in their work remains limited. Health workers are not systematically trained in the use of ICT. There are insufficient numbers of health workers with the capacity to design, deploy and effectively manage eHealth projects and programme\textsuperscript{23} [Source: Leveraging ehealth].

Aiming to increase the amount and the quality of health workers, ICT can provide help to face this situation through training and knowledge support in the concerned domains. Elearning and Telemedicine could bring significant help in the improvement of human resources for health by providing the workers training and information needed to address issues like emergency
crises. For instance, programs having as prime objective community health workers include Botsana’s elearning program for community health workers at the KITSO AIDS training Program, a partnership that includes private and the public sectors, The Ministry of Health and Harvard Medical School. More innovational types of support for frontline health workers are the applications like CommCare, mHealth company Dimagi, which programs divers health worker protocols for different kind of patient interactions into a mobile phone complete with picture [Source: ICT for Health]

III-2/ THE LACK OF HEALTH INFORMATION SYSTEMS

In Africa, countries with adequate and complete Health information are few in number. The recurring situation in Africa’s health system is the lack of technology for communication between households, care providers and decision makers.

ICT can help to face this situation by making available adequate IT platform. In Rwanda for instance, three main digital health system are being carry out. Rapid SMS being the first, gives power and control to community health workers with mobile platform to bring more improvement to maternal and child health. Secondly, Rwanda’s Health Management Information System (HMIS) collects data for improved policy-making. The electronic medical record system – Rwanda Health Information Exchange (RHIE) – develops a platform able to exchange information between various points in the system. Patients are now being registered into the system at hospitals with plans for roll-out facilities. Other promising initiatives such as the project Visa Santé (promoted by YAI Thierry & Chris, Initiator of the project, Senegal) worth being highlighted. Visa Santé is a custom card showing the complete medical record of each individual; on the card will figure ordinary information (names, photo, nationality etc on the front, and the logos of the various partners as a publicity overleaf). Adherence to this card entitles systematically two free test: blood group & electrophoresis [Source: Visa Santé]
III-3/ THE LACK OF SUPPLY CHAIN AND EQUIPMENT

The need of drugs, equipment and supplies increases the mortality rate sometimes because of inefficient dissemination of available resources at regional or national level.

Non efficient supply chain system in low income countries – resulted from poor transport infrastructure (road) which hinders delivery, and poor energy system which eliminates the option of a cold chain – can result in suburb health posts being out of stock or under stock of very important health products like: contraceptives for reproductive-aged women and vaccinations for children.

Thanks to ICT distributed multi-agent paradigm, it is possible to achieve a more efficient resource allocation. Hence, eHealth initiative such as Rwanda’s eHealth blood distribution drone airport, allows overcoming geographical barriers such mountains and helps responding to national emergency blood provisioning challenges which is still a problem even in developed countries\(^{26, 27}\). In the private sector, other interesting initiative worth to be noticed. Hence, Bloodna (promoted by YAI Hafid Elmam, CEO of Bloodna, Algeria) is a platform that connects patients looking for blood donors, and those wishing to donate blood (Opensource). Bloodna aims to facilitate information problems between the public health systems and the citizens, starting with the blood donation\(^8\). [Source: Bloodna]

Another interesting initiative is echOpen. echOpen is an open and collaborative project and community, led by a multidisciplinary core of experts and senior professionals with the aim of designing a functional low-cost (affordable) and open source echo-stethoscope (ultrasound probe) connected to a smartphone, allowing the radical transformation of diagnostic orientation in hospitals, general medicine and medically underserved areas. This initiate is aimed for health professionals from southern and northern countries\(^9\). [Source: echOpen]
III-4/ THE LACK OF PUBLIC INFORMATION ABOUT PREVENTABLE DISEASES AND NON-COMMUNICABLE DISEASES

Providing information about preventable diseases such as malaria can help to significantly reduce population exposition to those diseases. Moreover non communicable chronic diseases such as diabetes, cardio-vascular diseases, hypertension, obesity, cancer and respiratory diseases need more and more care. These diseases are expected to overtake communicable disease such as HIV/AIDS. In this context, relying on intensive data collection campaigns could allow generating macro-views for efficient public services planning while providing precious materials for medical experts to study and help combatting those diseases. **IDMPS** (International Diabetes Mellitus Practice Study) *initiated by SANOFI* is an example of such achievement. IDMPS is a 5-year survey documenting changes in diabetes treatment practices in developing countries[^20] [Source: IMDPS]. Another interesting initiative is **Medical caravans** (promoted by YAI Anass El Hilal, CEO Medtruck, Morocco) which allows patients with chronic conditions receive care close to home, allowing them to live a normal life. Moreover **Metruck** and **MedTracking** initiate by the same promoter (YAI Anass El Hilal, CEO Medtruck, Morocco) use geo-location of patients to enable a precise mapping and calculating an ideal route for mobile units designed for the specific structures, allowing more people access to care[^31]. [Source: Medtruck]
III-5/ THE LACK OF FUND IN AFRICA HEALTH

Regularly health care becomes unavailable only because patients or relatives cannot afford the medical fee themselves. On the other side, the government still have ways to go to provide adequate financial resources for setting up health system infrastructure, researches and innovations. The size of health expenses from external sources has increased significantly over the decade in twenty African countries. In Malawi and Liberia, external resources now account for more than half of the countries’ health expenses. However, the private sector is acting a significant part as far as financing health care is concerned (Cf. Figure 2).

Personal finance to boost health systems are many since both call for components like user IDs, identity authentication and security measures; those measures are great opportunities. By allowing patients to put specifically funds aside for health, and effectuate easier payments, efficient provision of health becomes quicker and more cost effective.

Among African eHealth initiatives addressing the financing constraints problem, bimaAFYA (promoted by the YAI Lilian Makoi, CEO of bimaAFYA, Tanzania) is a promising solution. Actually, bimaAFYA is a mobile micro-health insurance product designed for people from the low income population. Using technology they eliminated 99% of administration costs to arrive at a paperless health insurance product at cheapest premium prices of as low as $1 per month.\[Source: bimaAFYA\]

[Figure 2: Out-of-pocket spending is the main source of private health expenditure]

III-6 OTHER AFRICA HEALTH SYSTEMS WEAKNESS

If Africa Health Systems still suffer from other difficulties such as the lack of ICT based civil registering system, the lack of communicable diseases tracking, the lack of remote ordering/delivery platforms, the lack of drug recycling platform, it is worth noticing that promising initiatives such as I-Civil, Cartomalaria, Counter9, Jokkosanté respectively address those weakness.

I-Civil (promoted by Adama Sawadogo, CEO of I-Civil, Burkina Faso) is an integrated solution based on a mobile application that allows Birth Registration. With this new system, the data for each newborn is sent by SMS from the mobile phone of the health worker, after coupling to a single authentication and tamper-proof. SMS is received instantly on the server of the civil relevant center of his town. From there the pair SMS authenticating information automatically create a birth certificate ready to be printed by the competent authority. [Source: I-Civil].

Cartomalaria (promoted by YAI Kisito Gamene, co-founder and vice-president of Ouagalab, Burkina Faso) is a public health initiative to digitize areas at risk of malaria to guide (the scientific database) actions of different actors. Coupled with an outreach service through SMS, it also allows to advise at-risk populations on appropriate conduct. [Source: Cartomalaria].

Counter9 (promoted by YAI Ceisile Madi, founder and CEO of Counter9, Senegal) is a mobile application that allows customers to upload prescriptions, order over-the-counter products, multivitamins, supplements, medical devices and homeopathic products and have them delivered to a place and time of their convenience. [Source: Counter9].

Jokkosanté (promoted by YAI Adama Kane, founder of Jokkosanté, Sénégal) is a web and mobile application allowing more equitable access to medicines. Indeed, members of Jokkosanté can drop their unused medicine at affiliated health centers and receive points in return. These points are equivalent to the financial value of registered drugs. [Source: Jokkosanté].
IMPACTING THE CHANGES: HOW TO INVENT/RE-INVENT AN EFFICIENT AFRI-CAN BASED EHEALTH FRAMEWORK?

The African eHealth framework is characterized by a young dynamic, fast changing innovation under constraint paradigm. Thus, recent IT based solutions could help addressing next 50 years African Health System challenges; We propose different tracks to address those issues.

IV-1 BUILDING USER-CENTRIC EHEALTH SYSTEMS BASED ON END-TO-END SERVICE ORIENTED ARCHITECTURE

The Service Oriented Architecture (SOA) aims at de-correlating services. SOA separates functions into distinct units, or services, which developers make accessible over a networks in order to allow users to combine and reuse them in the production of applications. Adopting SOA approaches can help businesses respond more quickly and more cost-effectively to changing market conditions. Promising approaches such as the work of Hsieh SH et al present the successful experiences of an integrated, collaborative, distributed, large-scale enterprise healthcare information system over a wired and wireless infrastructure in National Taiwan University Hospital (NTUH). In order to smoothly and sequentially transfer from the complex relations among the old (legacy) systems to the new-generation enterprise healthcare information system, they adopted the multitier framework based on service-oriented architecture to integrate the heterogeneous systems as well as to interoperate among many other components and multiple databases. The newly developed NTUH IIS based on Service Oriented Architecture, provides an open and flexible environment not only to share medical information easily among other branch hospitals, but also to reduce the cost of maintenance.
The issue of access to health services in the most remote areas in Africa is a challenge that requires new approaches. Possible solutions can be explored by applying solutions from the access and sharing of resources in highly constrained IT systems. Thus, the principle of multi-agent systems with local interaction which can be self-organized in order to perform optimally can be explored. For instance, a resource pooling system at a remote town may be envisaged by considering each clinic or health center as well as the resources available as an opportunistic multi-agent running in a distributed computing system. Modeling the “cluster” thus formed, can then be performed as shown in Figure 3. Resource optimization algorithms can be used either in optimizing logistics chain at the local or even global scale with inter-cluster exchanges.
IV-3 DEVELOPING APPROACHES OF “COOPETITION” FOR BETTER EFFECTIVENESS OF ECOSYSTEM HEALTH IN AFRICAN COUNTRIES

In many cases in African countries, antagonisms between the stakeholders, sometimes the great heterogeneity of policies and decision of non-concerted decisions of the authorities may reduce the flow of trade between the stakeholders and even lead in some cases to situations of exacerbated competition so that they can lead to the destruction of the efforts and progress in improving the health of ecosystems in Africa. New mechanisms such as the strategy of establishment of “coopetition” between stakeholders can be envisaged.

According to Torres Blay [Source: Torres Blay], a business ecosystem is the combination of different companies and organizations, namely “a heterogeneous coalition of businesses in different sectors and forming a strategic community of interest or networking values structured around a leader who manages to impose or to share his commercial conception or technological standard. “ In other words, a sharable central competence (a technological standard, expertise, standard, will lead to the development of collective strategies resulting a common strategic destiny: companies will find themselves united (on the basis of formal cooperation or not) to promote a specific standard.

We thus talk of business ecosystem to designate the sets of complex, and heterogeneous networks often linked to new technologies, but that may be encountered in other more traditional industries.

To the extent that this collective strategy offer many advantages for the management of organizations by Astley and Fombrun [Source: Astley and Fombrun], ecosystems of African e-health can thus and in some respects may have an interest in developing a business ecosystem to improve their efficiency. The African e-health systems will be able to establish a partnership together and relationship with other business ecosystem to develop.
IV-4 PROVIDING FUNDS OR FINANCIAL MODELS BY LEVERAGING THE GLOBAL CROWDFUNDING EXPANSION TO SUSTAIN EHEALTH SERVICE DEVELOPMENT ALONG WITH FINANCING THE YOUNG PRIVATE SECTOR EHEALTH SERVICE INDUSTRY

Thanks to the internet, crowdfunding systems are booming and can mobilize large amounts of capital for both the individual and financing business. This lever is now so important that it is even integrated in the economic development policy of certain countries. The e-health systems in Africa could capitalize on the crowdfunding to fund e-health infrastructure or support innovative projects that are emerging on the continent. As an example, Cardiopad the first fully touch screen medical tablet developed and assembled in Cameroon and in Africa, begin broad assembly of the tablets thanks to a crowdfunding campaign.

IV-5 DEVELOP A DATA CENTRIC APPROACH BY PROVIDING PLATFORM FOR DATA COLLECTION TO PROVIDE A SYSTEMIC VIEW OF DISEASES EXPANDING BY THIS WAY THE SURVEILLANCE

Instead of using traditional health systems data storage, applying new approaches such as implementing data-centric approaches can help improving the efficiency of future eHealth system. Data-centric means emphasizing the value of information according to accessibility and content over the traditional parameters of storage media, location and cost. Taking a data-centric approach to ehealth reduces the real-time delay response of HIS (Health Information System) improving by the way their effectiveness. Such an approach was used when designing the Information Systems during the recent Ebola crisis in West Africa.
IV-6 REDUCE EHEALTH CONSTRAINTS BY STRENGTHENING ITS IMPORTANCE AS A COMPONENT OF COUNTRIES HEALTHCARE STRATEGIES

In South Africa, the commitment on the part of the Ministry of Health to put resources forward to launch a national program rather than small pilot projects significantly increase the ehealth and mHealth programs. Indeed, strong partnerships are critical in making mHealth a success, including early involvement with the private sector. For example, the MomConnect program in South Africa has scaled rapidly, registering over 400,000 women in less than 10 months. It was designed to create demand for, and improve the supply of, maternal health services at a national scale. Hence, considering eHealth as a valid part of countries healthcare strategies improves the successful rate of eHealth project.

IV-7 DEVELOP CLOUD BASED EHEALTH SERVICE BY PROPOSING NEW EMERGING AND UNIFIED EHEALTH STANDARDS

Although standardization is seen as the key to ensuring interoperability of healthcare information systems, the large numbers of standards available can make the selection decision difficult especially for a developing nation. Actually, in their work Funmi Adebesin et al. address this issue by highlighting the fact African eHealth systems development is badly impacted by the limited participation in standards development process, the lack of involvement of diverse users of standards in the development process, the lack of understanding of the importance of standards at national level, the lack of foundational infrastructure, the lack of human resource capacity for standards development, the lack of implementation guidelines. To address this issue, the adoption of cloud computing could be a promising solution. Based on South Africa experience, Thembayena MGOZI et al. proposed a conceptual cloud computing model to improve healthcare delivery, such a model could be generalized to other African countries.
Other promising issues worth being investigated to further develop African eHealth ecosystem. For example, using ICT as a mean to increase the transparency on African countries Health policies and spending can help to reduce the dependency on external aid which distorts African Health systems priorities. By the other side, African eHealth and mHealth developers and makers need local support. Hence, initiatives such as AFRICA4TECH addresses those issues.

Based on the framework outlined above, Africa4Tech’s eHealth workshop are focused on 3 challenges: How ICTs can help addressing the problem of Diabetes in Sub-Saharan Africa? - How ICTs can help addressing the Sickle cell disease or drepanocytosis in sub-Saharan Africa? - How ICTs can help addressing African health system governance?
APPENDIX
AFRICA’S PROGRESS IN INCREASING LIFE EXPECTANCY


PREDICTED POPULATION SIZE IN 2050

Source: AfDB (2011a).
Higher national income associated to higher life expectancy

Burden of communicable diseases

Source: World Bank, World Development Indicators (2012).^{13}

Source: adapted from WHO (2011b).
Life expectancy at birth (years)

- More developed regions, excluding Eastern Europe
- Latin America and the Caribbean
- Eastern Europe
- Asia
- World
- Developing Oceania
- Africa


Billions of US dollars

- Total health expenditure with donor growth
- Total health expenditure without donor growth
- Private health expenditure with growth
- Public health expenditure with growth
- Donor aid with growth
- Donor aid without growth

CLOUD BASES EHEALTH ARCHITECTURE – SOUTH AFRICA

REVENUE BREAKDOWN BY SECTOR AND TYPE OF COMPANY
AFRICAN COMPANIES VS THE REST OF THE WORLD

Growth of African companies vs. rest of world by sector, 2006–14
Local currency basis

Profitability of African companies vs. rest of world by sector, 2013–14
Net operating profit less adjusted taxes (NOPLAT) as % of revenue

1. n = 4 for health care due to sector size and data availability.
2. Other services includes information technology, media, real estate, marketing, and other business services.
3. Banking profitability measured by return on assets in percentage terms.

SOURCE: McKinsey Corporate Performance Analytics; McKinsey Global Banking Pools; McKinsey Global Institute analysis
FASTEST-GROWING CATEGORIES INCLUDE HEALTH CARE

<table>
<thead>
<tr>
<th>Country</th>
<th>Food and beverages</th>
<th>Other consumer goods</th>
<th>Housing</th>
<th>Health care</th>
<th>Financial services</th>
<th>Telecommunications</th>
<th>Hospitality and recreation</th>
<th>Other</th>
<th>Overall growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>28.7</td>
<td>10.9</td>
<td>16.8</td>
<td>8.1</td>
<td>3.1</td>
<td>1.9</td>
<td>10.5</td>
<td>14.3</td>
<td>94 (2.3)</td>
</tr>
<tr>
<td>South Africa</td>
<td>9.5</td>
<td>7.6</td>
<td>8.7</td>
<td>3.0</td>
<td>3.0</td>
<td>1.1</td>
<td>8.8</td>
<td>6.3</td>
<td>48 (2.3)</td>
</tr>
<tr>
<td>Egypt</td>
<td>19.2</td>
<td>19.1</td>
<td>20.4</td>
<td>8.7</td>
<td>7.1</td>
<td>0.9</td>
<td>16.9</td>
<td>21.7</td>
<td>114 (4.1)</td>
</tr>
<tr>
<td>Algeria</td>
<td>4.4</td>
<td>4.4</td>
<td>4.7</td>
<td>1.9</td>
<td>1.3</td>
<td>0.1</td>
<td>4.2</td>
<td>5.2</td>
<td>26 (3.3)</td>
</tr>
<tr>
<td>Morocco</td>
<td>6.2</td>
<td>4.8</td>
<td>5.5</td>
<td>2.4</td>
<td>1.7</td>
<td>0.2</td>
<td>4.2</td>
<td>5.8</td>
<td>31 (4.2)</td>
</tr>
<tr>
<td>Sudan</td>
<td>6.3</td>
<td>2.9</td>
<td>4.0</td>
<td>1.9</td>
<td>1.8</td>
<td>0.5</td>
<td>2.5</td>
<td>2.8</td>
<td>23 (3.5)</td>
</tr>
<tr>
<td>Angola</td>
<td>14.5</td>
<td>5.6</td>
<td>6.7</td>
<td>3.1</td>
<td>~0.1</td>
<td>0.7</td>
<td>4.1</td>
<td>7.9</td>
<td>43 (5.9)</td>
</tr>
<tr>
<td>Kenya</td>
<td>9.1</td>
<td>4.9</td>
<td>5.8</td>
<td>2.7</td>
<td>1.1</td>
<td>0.8</td>
<td>3.8</td>
<td>5.8</td>
<td>34 (5.3)</td>
</tr>
<tr>
<td>Rest</td>
<td>69.0</td>
<td>32.5</td>
<td>38.3</td>
<td>17.4</td>
<td>7.7</td>
<td>6.2</td>
<td>24.5</td>
<td>36.5</td>
<td>232 (5.3)</td>
</tr>
<tr>
<td>Overall</td>
<td>167 (3.1)</td>
<td>93 (3.6)</td>
<td>111 (4.4)</td>
<td>49 (4.3)</td>
<td>27 (2.3)</td>
<td>12 (2.3)</td>
<td>80 (5.1)</td>
<td>106 (4.0)</td>
<td>645 (3.8)</td>
</tr>
</tbody>
</table>

1. Includes health services and medical products.
2. Other includes education and transportation.

SOURCE: McKinsey Global Banking Pools; Canback Global Income Distribution Database (C-GIDD); Euromonitor; WCIS; BMI; Owum; Yankee, McKinsey Global Institute analysis

PATIENTS AND CARRIERS EXPECTATION TOWARD HEALTH APPS

Which of the following would convince you to use health apps regularly? (per cent)

- Provide trustworthy, accurate information: 69%
- Is easy to use, simpler well designed: 66%
- Provide guarantees that my personal data is secure: 62%
- Be free of charge: 56%
- Contain no advertisements: 51%
- Work effectively and consistently over time: 44%
- Not expensive to buy, provide value for money: 28%
- Allow me to network with other people important to me: 26%
- Be packed with detail (don’t mind complex apps): 23%

What is the single most important service you think health apps should provide? (per cent)

- Give me understandable info on symptoms/medical conditions: 23%
- Help me communicate with my doctor/nurse: 17%
- Allow me to examine my health records/medical tests online: 16%
- Help me track my medical symptoms: 14%
- Help track activities to improve my health, or keep me healthy: 13%
- Give me understandable info about how to live a healthier life: 7%
- Help me communicate with other people important to me: 6%
- Allow me to comment about, or rate, local healthcare services: 3%

Source: PatientView survey of 1,130 people with a long term condition, 2014
Mobile technology in Africa is helping overcome the lack of health infrastructure to support more agile and flexible working: serving populations and saving lives

- In Kenya mobile health technology has improved antiretroviral medication compliance by 11 per cent
- Botswana has successfully deployed a mobile-enabled programme that reduced government response time to malaria outbreaks from four months to three minutes
- Delivering prevention and awareness information via text message to pregnant young mothers in Mali has helped to reduce perinatal and maternal mortality by 30 per cent.

62% Data export and communication
62% Insulin and medication recording
82% Mobile phone penetration in Africa reached 82 per cent in 2014
47% Diet recording
43% Weight management

62 per cent of the population of Africa live in rural areas where access to medical facilities is extremely difficult

How mobile technology could be used to connect staff with patients and support staff to work differently, including connecting across organizational silos

Urgent and emergency
- Telecare service to transfer alarm calls to the most appropriate responders, which can reduce emergency service activity
- Teleconsultation between community, ambulance service and acute care
- Telehealth monitoring of patients not transported to hospital
- Telehealth for pre-operative assessment

Hospital acute elective
- Test and renewal appointment reminders
- Telehealth for pre and post-operative assessment and teleconsultation to maintain pre-operative behaviour
- Telemonitoring and telecare
- Telecare/telehealth to support earlier discharge

GP practice
- Self-monitoring tools in practices for routine assessments
- Telehealth to assist with self-care and triaging access to primary care
- Teleconsultation for those who are hard to reach or have mobility issues
- Teleconsultation with specialists to prevent unnecessary hospitalisations
- Telecare for care supports, medication management, falls intervention

Care home
- Education and training app and web portal to support staff
- Telehealth for care homes including teleconsultations between care home, primary and acute settings
- Telehealth between care home, primary and acute settings
- Telecare alarm systems, falls monitoring, pendant alarms

Home – including re-ablement
- Telecare and telehealth to support rehabilitation, e.g. after stroke
- Telecare for post-operative recovery assessment
- Digital imaging in rehab rehabilitation tailored to home environments
- Internet-based therapeutic interventions and care support

Community care
- Telecare to support people with dementia or at risk of falls or at end of life
- Telecare palliative care system
- Remote audio and video conferencing with care team and patient
- Teleconsultation to maintain helpful behaviours and apps to support people to self-care
- Medication management apps to encourage correct use of medication

Source: Deloitte Research, 2015
ENDNOTES


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