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A post-COVID-19 IDEA to strengthen research, innovation, and development in Africa

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ABSTRACT

Globally, research, innovation, and the associated education and entrepreneurship are essential for youth and socioeconomic development. Governments, universities, research institutions, and private sector play various roles in the innovation value chain. The weak research and innovation systems in Africa are often linked to the overarching challenges of poor financing, inadequate capacity, weak infrastructure, and processes. Many African universities and research institutions are challenged to validate and transition their ideas and discoveries from the laboratory to field evaluation, and downstream development, registration, and commercialization processes. The critical discovery–development interface that is normally driven by the private sector is also not well developed. Overcoming these constraints require concerted local and global partnerships, sharing of available resources and assets, and training and use of suitable Information and Communications Technology and digital tools to boost productivity. Importantly, this requires private sector engagement and development. We discuss how the Innovation Development and Entrepreneurship Africa aims to use available assets in Africa to support institutions and youths to stimulate innovation. Redoubling efforts toward African development in the post COVID-19 era, in alignment with the African Union Agenda 2063 and the Sustainable Development Goals, will require investment in support of these ideals. We offer some policy recommendations in this context.

Keywords: Africa, post-COVID-19 Pandemic, Research, Development, Innovation, Manufacturing, Sustainability, IDEA

INTRODUCTION

Lessons of COVID-19 pandemic on research, development, and manufacturing in Africa

The COVID-19 pandemic reinforced the importance of building strong research and innovation systems in developing countries, especially African countries, not only for health but also for other sectors such as agriculture, the environment, and trade. The nearly half a century debate, for or against, local manufacture of essential health products in Africa,[1] has suddenly and overwhelmingly shifted in favor, due to the inequity that characterized access to COVID-19 vaccines and related health tools.[2,3] The manufacture of essential health tools in Africa has now become recognized both as public health and security issues, consistent with years of advocacy along those lines.[4]

The over dependence of several African countries on well-intended aid, including through some under-resourced global access mechanisms, raised ethical and humanitarian questions.[5] This became the catalyst for global, regional, and national quest for the COVID-19 messenger RNA (mRNA) vaccine manufacturing technology in various African countries due to the perceived ease of the technology and desire to strengthen existing manufacturing capacity.

A "fire brigade" response and sustainability

The Africa Centers for Disease Control and Prevention at the African Union (AU) became a critical regional mechanism for advocacy, channeling of funds, and coordinating disease control activities.[6] The World Health Organization (WHO) launched African Regional hubs for COVID-19 vaccine manufacturing, while some countries collaborated with vaccine companies to establish mRNA vaccine manufacturing facilities.[7,8] Some of these efforts are still under development, and the hope is that the momentum surrounding them will be sustained beyond the COVID-19 pandemic led "fire brigade" that characterized their roll out.

Talking of sustainability, it is critical for the related research and innovation required to sustain a robust and viable manufacturing endeavor be simultaneously addressed. It is certain that the African continent does not want to focus only on the manufacture of products discovered and developed overseas, including those where it has little or no control over the surrounding intellectual property rights and know-how. Indeed, the African continent needs sustained investment across the research and innovation value chain to remain competitive, rather than the usual fragmented and largely aid dependent approach.[9] This scenario is true not only for health but more broadly in other science and technology sectors.

It is heartening to see the launching of the African Pharmaceutical Technology Foundation by the African Development Bank (AfDB) with the goal to work with the AU to boost Africa's capacity to produce drugs, vaccines, diagnostics, and therapeutics all along the value chain.[10] This follows earlier initiatives and efforts on the continent before the COVID-19 pandemic to build capacity for health innovation,[11-13] but suffered financial setback. Some of those initiatives, such as the African Network for Drugs and Diagnostics Innovation (ANDI), contributed to some of the current progress that the continent is seeing today, and indeed the AfDB and some other relevant African government ministries and institutions sat on ANDI's Board.

Research is a critical driver and enabler for sustainability and development

The research and innovation required to support manufacturing and the broader development policy come from various institutions, and this should include African Research and Development (R&D) and manufacturing institutions, universities, private sector, and policy centers. The timely development and manufacture of the mRNA[14] and other COVID-19 vaccines would not have been possible if not for the decades of research investment at various research institutions and universities in America, Europe, and some emerging economies outside Africa. The outcome of some of that research was licensed to industry for further development and commercialization while others led to the establishment of small biotechnology companies that accelerated the development and commercialization of the innovations. We are witnesses to the work of biotechnology companies such as BioNTech and Moderna on mRNA COVID-19 vaccines. Furthermore, academic research using traditional vaccine technology led to the development of the other COVID-19 vaccines, such as the Oxford/AstraZeneca and other vaccines. We should also recognize the efforts of Chinese, Russian, Brazilian, and Indian institutions in developing and/or manufacturing COVID-19 vaccines. The exemplary genomics research work by South Africa scientists and others supported the world with the prompt identification COVID-19 variants.[15,16]

The AU's Agenda 2063 (Agenda 2063),[17] and the United Nations Agenda 2030 for Sustainable Development or Sustainable Development Goals (SDGs),[18] both recognize the importance of research and innovation in achieving their sustainable development targets. However, research driven innovation structures are not well resourced and prioritized in Africa. Indeed, strengthening and sustaining research and innovation in Africa will not be possible without strengthening the capacity and competencies of African research institutions. The said research and innovation should cut across sectors and involve different types of scientific, technological, social, and policy research. While several challenges linked to financing, infrastructure, capacity, and weak policy structures are often cited, a systematic approach to leverage available opportunities and intellectual assets within African institutions to strengthen research and innovation has not received much attention.[9] We address this issue, especially in the context of how Innovation Development and Entrepreneurship Africa (IDEA) seeks to contribute in addressing Agenda 2063 and SDGs by leveraging available assets within African Universities, to stimulate, and drive research and innovation.

RESEARCH AND INNOVATION IN AFRICA – A MIXED BAG OF CHALLENGES AND OPPORTUNITIES

Landscape analysis and lessons learned over the years that led to the conceptualization of IDEA, which identified several challenges and opportunities for research and innovation in Africa.[9,19] These include:

i) On one hand, the continent needs to strengthen and support its institutions to prepare and empower its students and youths with meaningful competencies to participate in solving societal problems and creating jobs. On the other hand, the teaming population of African youths within and outside these institutions that have embraced or ready to embrace community service and entrepreneurship present an obvious opportunity.
ii) The multifaceted challenges of many African universities and R&D institutions, researchers, and innovators to validate and progress potential discoveries from the laboratory to field evaluation, registration, and commercialization are well-documented. This situation exists not only in the health and biotechnology space but also in the general areas of Science, Technology, and Innovation as well as various businesses. The good news is that there are several national, regional, and global resources and programs that can be systematically harnessed and shared to address these challenges. Some processes such as suitable Information and Communications Technology (ICT) platforms should be developed to facilitate partnerships, sharing of research resources and know-how. Some tested relevant training programs, such as a previous Emory University and ANDI Program,[20] and others should be leveraged and scaled up.
iii) There are limited African institutions that address the training and vocational needs of the massive African informal sector businesses (small and medium enterprises [SME's] and micro small and medium enterprises [MSME's]) and entrepreneurs which significantly contribute to the GDP of the continent.[21,22] The African informal sector presents a unique platform for innovation if it can be nurtured and supported through access to targeted venture financing and specialized short-term training programs. Furthermore, opportunities exist for African countries to leverage available intangible assets as a source of financing to support innovation and drive SME's and MSME's.
iv) It is acknowledged that the number of universities and graduates emanating from across African countries are continually increasing. In most cases, what is lacking for these students is exposure to job creating opportunities and strong research and innovation programs that support marketable innovations and associated entrepreneurship. In addition, post-primary and post-secondary vocational and technical training programs are not well developed, and where they exist, they are rarely aligned with research-based innovations.
v) Across Africa, there are many successful business and entrepreneurial developments, for example, in the ICT's and digital space, but they are based largely on technologies developed from overseas, or adaptations thereof, and not on substantive local technical innovation. There is the opportunity to leverage ICT's and digital growth to meaningfully strengthen research, research collaborations and partnerships, managed sharing and access of R&D, and learning resources. It can also support the development of a critical mass of capacity and competencies. Furthermore, the African informal sector entrepreneurs and apprentice systems in various countries and regions are potential sources of original local innovations but they have limited avenues to strengthen and scale their operations.
vi) Sustained data and evidence generation and their analysis to inform policy and decision-making at governmental, institutional, and private sector levels need to be strengthened. This is particularly relevant and important in this era of big data. Existing structures to collect, collate and analyze data systematically are dominated by foreign institutions with few emerging local firms. The good news is that there are several offices of statistics within government ministries with huge amounts of information and data that can collaborate with independent experts and firms, and universities to strengthen data analysis and reporting. There is the opportunity for specialized training in big data analytics and reporting. For example, the world witnessed the generation of various data relevant to the management of the COVID-19 pandemics from the Johns Hopkins University,[23] Institute for Health Matrix at the University of Washington Seattle,[24] and Our World in Data[25] from the University of Oxford and so others. Some African agencies did an excellent job in generating local COVID-19 data, but there is room for improvement.

Most of these identified gaps and challenges are linked to the overarching challenges of poor financing, capacity, and infrastructure, and they are implicitly acknowledged in the SDGs,[18] and the AU Agenda 2063 ("The Africa we want").[17] Unfortunately, these important global strategies and regional agendas are also struggling to meet their implementation targets with only a few years remaining from the crucial the decade of the SDGs. As further elaborated below, we recommend that the opportunities identified here be leveraged to address the research and innovation challenges as part of the implementation of agenda 2063 and the SDGs through available instruments like IDEA.

AU AGENDA 2063 AND IDEA

The AU Agenda 2063[17] is a long-term developmental framework for the continent. It aims to strengthen and improve the socioeconomic development of the continent, including in the areas of education, science, technology, and innovation. A section of Agenda 63 states: "In this

new and noble initiative, past plans and commitments have been reviewed, and we pledge to take into account lessons from them as we implement Agenda 2063. These include: Mobilization of the people and their ownership of continental programs at the core; the principle of self-reliance and Africa financing its own development; the importance of capable, inclusive and accountable states and institutions at all levels and in all spheres;……and holding ourselves and our governments and institutions accountable for results. Agenda 2063 will not happen spontaneously; it will require conscious and deliberate efforts to nurture a transformative leadership that will drive the agenda and defend Africa's interest. We are deeply conscious that Africa in 2015 stands at a crossroads and we are determined to transform the continent and ensure irreversible and universal change of the African condition."

Making progress in various African countries toward the AU Agenda 2063 will require "all hands-on deck" – African people, their institutions and countries working together to fill the identified gaps through various mechanisms. One avenue is by scaling up practical education, research, and mentorship on innovation and entrepreneurship that impacts various sectors.[19] Such training shall instill confidence and leadership skills that will nurture innovation and entrepreneurial mindset, support community, and private sector development. We discuss ongoing mechanism to integrate IDEA centers within existing universities in Africa to contribute to addressing some of these gaps.

Rationale for IDEA

The rationale for the development of IDEA with focus on supporting African institutions on innovation and entrepreneurship capacity building and education is to address some of the identified challenges by capitalizing on available opportunities and assets. IDEA responds to the lessons learned over the past three decades in promoting and managing research and innovation in Africa and engaging in local, continental, and international dialogue on African research and innovation.[19] Some of these efforts have involved international and regional organizations and development partners, such as WHO, UN agencies, development banks, NGOs, AU, and donors. These lessons have been reinforced by the events of the COVID-19 pandemic, which left many African countries struggling to access personal protective equipment, diagnostics, and vaccines as well as its impact on global economic outlook. Therefore, the IDEA concept is grounded in evidence and can easily adapt or be adopted to specific needs of countries and institutions.

There is a welcome rise in business and entrepreneurship in general across the African continent but the level of home-grown technological or social innovations and associated businesses remain low. Many entrepreneurial developments, for example, in ICT and evolving digital sector, are largely based on technologies developed from overseas or adaptations thereof and not on substantive local technical innovation. The African informal sector is an important source of innovations, but the entrepreneurs in this sector have limited avenues to train, improve, and scale up their businesses. Furthermore, post-primary and post-secondary vocational training programs need to be strengthened.

It is enlightening to draw some lessons from aspects of development in Asia. In post-war Japan and at the end of the 20th and the early 21st century in China, business development initially focused on low tech innovations and entrepreneurship.[19] However, these were transformed in later years into high tech innovations with strong vocational training for artisans and service providers. These and other countries such as South Korea, India, and Singapore achieved success because as they were developing low tech manufacturing and service businesses. They were also investing in science and technology to pave the way for globally competitive high-tech innovation and associated entrepreneurship. Similar investments in science and technology driven innovation and entrepreneurship have been slow in much of Africa.

In a discussion paper, Education, Research, and Innovation in Africa: Forging strategic linkages for economic transformation,[26] the late Calestus Juma stated "Africa must create "innovation universities" if it is to achieve economic transformation, sustainable development and inclusive growth." This is consistent with AU's Agenda 2063 and the IDEA initiative.

The 1980s witnessed the emergence of the concept of entrepreneurial university that encourages interaction between university, industry, and government to support innovation and knowledge-based development.[27,28] Since then, many universities around the world, especially in the developed and emerging economies, have gone beyond their traditional teaching role to strengthen research that advances innovation and entrepreneurship. This approach is more needed today in Africa as most African universities and post-secondary institutions are lagging in research and innovation outputs. Some major western universities, such as Stanford, and Harvard, have created programs in some African countries to support internship training of young entrepreneurs.[29,30] Such programs present an opportunity for partnership that supports some of the proposed activities to fill the gaps outlined in this paper. In addition, many of these universities have practical experience in launching innovation and venture programs that support development, for example, Oxford University.[31] Accordingly, and in line with IDEA, we recommend as a matter of policy that African

universities be encouraged and supported to establish mechanisms that support collaboration with industry and at the same time leverage their innovation output to support indigenous SME and MSME development.

Implementation of IDEA and its value proposition

IDEA has started operation as a virtual academy collaborating with some existing universities and institutions in Nigeria, to strengthen, scale and sustain their research, innovation, and entrepreneurship ecosystem. IDEA is intentional and determined to expand to other African countries, and if these initial activities are successful, IDEA may establish an independent University site in Africa to complement its distributed activities through existing institutions.

IDEA's vision is to serve as a specialized Center of Excellence that strengthens and scales human capital for research, innovation, entrepreneurship, and sustainable development in Africa. Its mission is to educate and train students, researchers, leaders, innovators, and entrepreneurs to solve societal challenges and contribute to development.

A unique feature of the IDEA's business model is its initial integration within existing institutions, which makes its operation nimble, collaborative, efficient, and cost effective. The hallmark of this virtual and partnership driven model is to maximize available resources and achieve impact. This will be achieved by: (i) leveraging the assets of existing institutions in the form of capacity and infrastructure to support, strengthen, scale research, innovation, and entrepreneurship in Africa; (ii) supporting education and training through short-term continuing education courses, and degree programs in relevant areas, (iii) strengthening research collaboration and impact among local and international institutions, and (iv) close collaboration with industry and provision of advisory services on research and innovation.

The Godfrey Okoye University in Enugu Nigeria[32] is the first university in Africa to host and operationalize an IDEA center. It established a Professorial Chair on Innovation, Development, and Entrepreneurship in Africa for the Center. Several activities have been initiated at the center and this is the subject of a publication in preparation. IDEA has also established a presence at the Plateau State University Bokkos, Nigeria and other universities have expressed interest in hosting IDEA center within their institutions. An international outreach office has been established in Geneva Switzerland to support global partnership development, advocacy, and fundraising.

The operational activities of IDEA include two interlinked programs focusing on innovation and entrepreneurship, and consultancy support services as described in Box 1.

Box 1: Operational activities of IDEA.

1. Innovation and entrepreneurship program–the objective is to build a critical mass of capacity and adaptive competencies for innovation and entrepreneurship in Africa. Specific activities include:
   - Continuing education and training resulting to degree programs and non-degree programs, conducted virtually and in-person.
   - Implementation of digital platforms, services and virtual labs to support and strengthen learning and research through sharing of resources/infrastructure and stimulations partnerships/collaboration.
   - Training to understand the Innovation value chain, advancing innovations from one phase to another and venture or business development.
   - Implementation of train the trainer programs on innovation and entrepreneurship and support for formal and informal sector entrepreneurs.
   - Implementation of policy research and ethics support for innovation and entrepreneurship.
   - Working with private sector and Implementing workshops and conferences.
2. Consultancy support program–The objective is to provide advisory services to African institutions, universities and companies on research, innovation, and entrepreneurship as well as generate and analyze data to inform policy. Specific activities include:
   - Advising governments, universities, and individual public and private sector entities.
   - Supporting institutions on management of research and innovation, intellectual property, technology transfer, and contracts.
   - Analyzing data to inform policy and provide business intelligence.

IDEA: Innovation Development and Entrepreneurship Africa

Role of the private, philanthropy and civil society on implementing IDEA and Agenda 2063

The role of the private sector, civil society, universities, and philanthropy in national and regional development is often under-stated. This is particularly important in research, innovation and its translation to products and services that impact society. The earlier discussion around COVID-19 pandemic in Africa shows the importance of these sectors and public-private partnerships in development. IDEA is modeled along these partnership ideals that involve the private sector and philanthropy as already presented above. We recommend as a matter of policy that these often-missing links in African research and innovation, identified by IDEA, be harnessed, and strengthened in support of implementation of Agenda 2063.

In the developed world, the private sector is the largest funder of R&D. In developing countries, global philanthropic organizations like the Bill and Melinda Gates and Wellcome

Trust, and development partners as well as the corporate social responsibility of companies are playing an increasing role in research and innovation. Some local African foundations such as the Dangote, Tony Elumelu, and Mo Ibrahim Foundations are thriving in their areas of focus. The hope is that these and other local and international philanthropy will partner with governments and initiatives like IDEA to support and promote research and innovation.

There is a need for advocacy and communication on the importance and engagement of the private sector, civil, and philanthropy in the implementation of Agenda 2063. That engagement should go beyond established multinational and pan African companies and philanthropic entities, to emphasize the need for investment toward the development of SMEs, MSMEs, and entrepreneurial business on the continent. One sustainable avenue to achieve this is by creating close collaboration between African universities, the private sector, philanthropy, and international development entities to support the translation of research and innovation from universities to products and services that impact society. An example of this approach is the establishment of a novel multi-million Euro project collaboration between Godfrey Okoye University Nigeria, International Center for Migration Policy Development, EU, and private investors to establish Institute of Practical Skill and Start-up Center at the University.[33] IDEA is closely collaborating with this Center at the University.

An important recent development in Nigeria and indeed Africa is the commissioning of a multi-billion USD integrated Dangote Refinery in Nigeria, which has been described as one of Nigeria's single largest investments.[34] We say integrated because the facility has in house R&D components,[35] and its potential to catalyze or stimulate new local research, partnerships, and businesses should be harnessed. This is an example of the importance of the private sector in development.

Potential outcomes and sustainability

A critical element of IDEA is its focus on outcomes and impact. Most young African graduates come out of school with poor prospect of securing government or private sector jobs. Furthermore, they are ill prepared to venture into creating jobs for themselves due to lack of adequate training and incentives, including access to venture or grant financing required for such entrepreneurial endeavors. Interestingly, most of these young graduates excel when they find themselves overseas, where they get access to necessary support systems.

IDEA is not only focusing on developing a critical mass of capacity in Africa to advance research, innovation, and entrepreneurship, but it is also emphasizing and advocating for the enabling processes that support these goals. It's approach of creating partnerships that will share resources and infrastructure to address local challenges is novel. It is promoting the establishment of shared ICT laboratory infrastructure across African and global institutions to help in advancing research, partnerships, training, and education. These processes will bring efficiency and prudent use of resource in the often-expensive research and innovation. IDEA believes that this approach will attract new resources to research and innovation in Africa and support the broader implementation of Agenda 2063.

SUMMARY OF POLICY RECOMMENDATIONS

While we consider that the various parts of our paper contain useful policy recommendations and learnings, we emphasize some of those with the hope that they will be helpful for the implementation of Agenda 2063, IDEA, and other African programs:

1. The opportunities outlined, such as the teaming African youth population, partnerships, and sharing of resources among existing institutions, should be leveraged to address the research and innovation challenges in Africa as part of the implementation of Agenda 2063 and the SDGs through available instruments like IDEA. The capacity of African post-secondary institutions to collaborate with each other while also fostering broader South and North South partnerships should be strengthened.
2. African universities and postsecondary institutions should establish mechanisms that support collaboration with industry and leverage their research innovation output to support the development of MSMEs.
3. Concerted advocacy and communication of the Agenda 2063 among all Africans and African institutions should be urgently implemented. Unfortunately, this important pan-African framework is not well known outside the AU Commission, some government structures, and development partners. The majority of people that this Agenda is intended to support do not know about it. We contend that these people should be part of the implementations.
4. There is need for a deliberate effort to coordinate and strengthen local and international investment in research driven innovation capacity in Africa. This will bring coherence, prevent fragmentation, and ensure proper leadership and ownership of research and innovation in Africa.

CONCLUSION

An integrated approach to research, innovation, and entrepreneurship is acutely needed in Africa. The growing population and resilience of the African youth,

strengthening R&D institutions and universities, the private sector, philanthropy, and effective government institutions present an unprecedented opportunity to strengthen the development of the continent. This requires renewed efforts to strengthen education, training, and research that will systematically convert promising ideas and innovations to products and services that benefit society. IDEA promises to contribute to these ideals.

Declaration of patient consent

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