United Nations
Economic Commission
for Africa

Zimbabwe

Republic Of South Africa

United Nations
Educational, Scientific and
Cultural Organization

REPORT OF THE

AFRICAN REGIONAL SCIENCE, TECHNOLOGY AND INNOVATION FORUM FOR THE SGDS.

Theme: *2020-2030: A Decade to Deliver a Transformed and Prosperous Africa through the 2030 Agenda and Agenda 2063*

Elephant Hills Resort
Victoria Falls
Zimbabwe
24 February, 2020

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The African Regional Science, Technology and Innovation Forum 2020

The second African Regional Science, Technology and Innovation (ARSTI) Forum was held on the 24th February 2020, in Victoria Falls, Zimbabwe. This was a follow-up to the successful first ARSTI Forum held in Morocco on 16 April 2019. The ARSTI Forum was established by resolution 960 (LI) of 15 May 2018 of the Conference of Ministers of Finance, Planning and Economic Development of the Economic Commission for Africa. The resolution called upon the United Nations Economic Commission for Africa (ECA), the African Union Commission and other partners, to take all steps necessary to organize on a regular basis a multi-stakeholder forum on science, technology and innovation as an input into the work of the African Regional Forum on Sustainable Development. This resolution is based on the General Assembly resolution 70/1 of 25 September 2015, adopting the outcome document of the United Nations summit for the post-2015 development agenda: Transforming Our World: the 2030 Agenda for Sustainable Development that established the Multi-stakeholder Science, Technology and Innovation Forum for the SDGs.

The second ARSTI Forum was held back-to-back with the sixth session of the African Regional Forum on Sustainable Development (2020 ARFSD), under the theme: "2020–2030: A decade to deliver a transformed and prosperous Africa through the 2030 Agenda and Agenda 2063". The 6th ARFSD reviewed all SDGs and were grouped in five subthemes: People, Prosperity, Planet, Peace and Partnerships. It was the first time since the adoption of the 2030 Agenda for Sustainable Development, all the 17 Sustainable Development Goals were under consideration.

Objectives of ARSTIF

- To establish a platform to strengthen collaboration and exchange of best practices amongst development partners and AU members states in the area of education, science, technology and innovation.
- To identify effective approaches, mechanisms, strategies and policies for applying science, technology and innovation to development in Africa;
- To identify technological options that will likely have a greater impact on efforts to achieve the Sustainable Development Goals;
- To identify opportunities for scaling up actions to apply science, technology and innovation at the regional, national and local levels;
- To identify technological gaps, institutional voids and potential barriers to applying science, technology and innovation in Africa and ways to overcome them;
- To showcase scientific, technological and innovative solutions developed in and for Africa that are significantly accelerating the attainment of the SDGs;
- To launch key initiatives, collaborative platforms and communities of practice.

Organization and participation

The ARSTI Forum was organised by the Government of Zimbabwe, under the leadership of the Ministry of Higher Education, Innovation, Science and Technology Development in partnership with the United Nations Economic Commission for Africa (UNECA), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the Department of Science and Innovation (DSI) - South Africa.

Over 800 delegates, representing African Members States, the United Nations agencies, academia, civil society, the youth, marginalised groups, people with disabilities and the private sector, were in attendance. In the spirit of leaving no one behind and responding to the recommendations of the Marrakech Declaration, the preparatory process emphasised the need for active participation of the Youth in the Forum. As such a two-day Youth STEM Boot-camp with a focus on artificial intelligence (AI), robotics and 3D printing technology was organised by the Ministry of Higher Education, Innovation, Science and Technology Development in collaboration with UNESCO and the Youth Council of Zimbabwe. About 250 students drawn from universities, colleges of education and polytechnics from all administrative provinces of Zimbabwe were exposed to innovative technologies such as rapid prototyping using 3D technology, Robotics, Artificial Intelligence, and introduced to entrepreneurship.

The ARSTI Forum showcased efforts that the public, private sector and individuals are deploying to accelerate the implementation of Sustainable Development Goals. Ten winners of the UNECA Innovation Call from Cameroon, Ethiopia, Lesotho, Nigeria, Rwanda, South Africa and Uganda, were showcased through presentations in the plenary and parallel sessions. Criteria for selection of winners were based on their contribution to the implementation of the SDGs. For details see https://www.uneca.org/astif2020 and https://www.uneca.org/sites/default/files/images/Science_Tech/winners_of_the_innovation_call.pdf

Youth, Gender & the Fourth Industrial Revolution

To fully maximise on the potential of Africa's demographic dividend it was recognised that it was imperative to include and involve the youths in the proceedings from planning to execution and follow-up. Women make up almost half the global population and have been historically marginalised in STI disciplines. As such there is need to ensure that there is gender equality in STI, not only because it is a fundamental human right, but because respective countries and the region will benefit more from the diverse workforce.

The Fourth Industrial Revolution (4IR), has the potential to transform Africa's economy, through increased productivity. There is great need for Africa to take advantage of the 4IR technologies, such as 3D printing, Artificial Intelligence, drones, big data, robotics, nano- and biotechnology for socio-economic development.

The 1st Annual ARSTI Youth Boot Camp 2020

The main objective of the training workshop was to expose the youths to different approaches to address community and global challenges, using the latest advanced 4IR technologies such as AI, robotics and 3D Printing. The training sought to expose the youths to the technologies, which are being minimally exploited in the context of Zimbabwe, and push them to think outside the box, as they attempt to solve present and future problems.

The World Economic Forum estimates that by 2022 big companies will have adopted emerging and advanced 4IR technologies such as machine learning, artificial intelligence (AI) and robotics. These technologies are poised to

transform modern society in profound ways. The changing climatic environment has made some of the commonly used technologies untenable and expensive to solve the current and future global challenges. The role played by STI, in achieving global goals such as those contained in United Nations Agenda 2030, African Union Agenda 2063, Africa Union's Science, Technology and Innovation Strategy for Africa (STISA-2024) and Zimbabwe's Vision 2030 is widely acknowledged. Science, Technology, Engineering and Mathematics (STEM) skills form the basis of most of the fastest growing jobs such as data scientists, AI and machine learning specialists and software applications developers and analysts.

The very rapid evolution of new technologies and the digital workplaces requires governments, the education sector, industry and innovators to urgently reimagine, rethink and be innovative in the ethical application of these technologies for socio-economic development. The use of innovative, immersive, and hands-on experience with these 4IR technologies, with creative problem solving is critical in order to be fully equipped with the relevant skills set needed to thrive in the digital workplaces as well as to solve the global challenges such as climate change, poverty, corruption, food, water and energy insecurity, diseases and gender inequality. This is even more important in Africa where economic development is hampered by a lack of critical skills to solve the numerous challenges bedevilling the continent.

At the regional level, Africa Union's Science, Technology and Innovation Strategy for Africa (STISA-2024) provides the enabling environment, which is aimed at accelerating the transition of African countries to innovation-led and knowledge-based economies by improving STI readiness in Africa and implementing specific policies and programmes in these areas which address societal needs in a holistic and sustainable way. This technology and innovation thrust are critical in facilitating the achievement of Africa Union's agenda (AU Agenda-2063) call to action on the enhancement of science, technology, research and innovation, to build knowledge, human capital, capabilities and skills to drive innovations and for the African century. This justifies the need to fully exploit these new technologies to bridge the skills deficits, and assist in the social and economic development agenda of Zimbabwe and the region at large.

Objectives of the STI Youth Boot Camp

- To introduce youths attending the ARSTIF, to the latest technologies, offering opportunities for instruction, showcasing applied solutions, knowledge sharing and hands-on sessions on using AI and Robotics to solve current and future societal problems;
- To assist participants to identify the wide range of potential applications and role of AI and Robotics, in order to deliver the promises of the Sustainable Development Goals;
- To inspire youths to, not only apply AI and Robotics, but to also be actively involved in higher level research in these fields, to ensure that Africa is not left behind in AI and Robotics research, and only relegated to end-users;
- To help participants to realise the potential in the application of AI and Robotics, without overlooking the associated ethical issues;
- To assist the youths with skills in entrepreneurship, project management

and resource mobilisation, to be able to monetise their products and services.

Proceedings

Youth groups, such as, the Zimbabwe Youth Council (ZYC) and Zimbabwe Youths for Sustainable Development Goals (ZYSDGS) were tasked with the role of mobilising the youths to the Boot Camp. A transparent process was carried out for the mobilisation process. A call for applications was posted through various media platforms and a panel consisting of representatives from relevant UN groups, government ministries and youth groups selected successful youths. At least 250 youths from Zimbabwe's 10 Provinces took part in the initiative. Among these were few youths from other African countries. A fair gender representation of male and female youth participants was noted at the Boot Camp. In fact, out of the 194 youths, 100 were female, and 94 were male. Besides being a fundamental human right, gender equality is a critical requirement for the achievement of sustainable development.

Representation of the youths in terms of age was also observed at the Boot Camp which catered to youths in the workforce, university students (e.g. University of Zimbabwe, Great Zimbabwe University, Midlands State University and Chinhoyi University of Technology), high school students (e.g. Prince Edward Boys High, Mabelreign Girls High, Mosi Oa Tunya High School) and primary school students (e.g. Chinotimba Primary School, Happy Primary School). The youngest participant of the Boot Camp was 5 years old. Programmes were designed accordingly to cater to the needs of all age groups. Young people are a significant human resource for development and agents for social change, especially when equipped with knowledge, skills and opportunities.

There was also disability representation at the Boot Camp. Disability is recognized as an issue that cuts across several parts of the 2030 Agenda. The shared global vision for sustainable development emphasizes that the full and complete realization of the human rights of all persons with disabilities is an inalienable, integral and indivisible part of all human rights and fundamental freedoms.

Being the pioneers of such a great initiative, the young people were highly motivated and eager to learn. The youths were tasked perform various tasks in groups which were pre-determined. The organisers of the event randomly placed the young people into 15 groups of 12-14 people prior to the commencement of the Boot Camp. The group categorization was thus a fair and transparent process which enabled youths from different backgrounds to come together to perform tasks irrespective of gender, age, level of education and profession.

Creativity and imagination were a great part of the learning process at the Boot Camp. Once broken down into clusters, the youths were tasked to envision their groups as real life business entities. Thus, each group was to come up with a business name, company mission and values. The youths appointed company officers such as the CEO, Chief Engineer, Programming Manager, Product Tester, Marketing Director etc. As part of the company mission, each group was to identify a

social problem and devise a way to solve this problem using Artificial Intelligence and Robotics.

Once companies were established, the groups were broken down into two clusters, to improvise on space and equipment. Groups 1-7 embarked first on the Robotics and 3D printing exercises delivered by UNESCO, and groups 8-15 received a Project Management lecture from Mr Fredrick Mandizvidza.

Equipped with manuals and robot making kits, groups 1-7 set out to create innovative solutions to identified social problems using robotics, and 3D printing. At the end of the two challenges, the groups were given an opportunity to reflect on their learning process, and ask questions for clarity.

Youths involved in a hands-on activity on Robotics

Delegates speaking at the second day of the bootcamp

Day 2 of the Boot Camp started with lecture from Professor C. Masimirembwa on how to pitch a business idea in a convincing manner. Groups were tasked to come up with a social problem and a solution that would be sold to a potential buyer through a pitch.

Ms Sicelo Dube, gave the youths a lecture on how to find gaps and problems, capitalise on the identified gap and become a brand in the chosen area. She highlighted that in starting a project, one needs contact, human resources and networking more than just finances. After lunch, groups 8-15 were given the opportunity to embark on the robot assembly challenge while groups 1-7 received the Project Management Lecture from Mr Fredrick Mandizvidza. The Minister of Higher and Tertiary Education, Innovation, Science and Technology, Professor Amon Murwira, witnessed groups 8-15 assembling their robots. Thereafter, the Honourable Minister Murwira addressed all youths. The Honourable Minister, called for the youths to take up the lessons they had learnt during the two days, and come up with products and services for problems faced in Africa. He went on to further advise the participants to ensure that the outcomes of their innovations are carefully designed for the African context to avoid developing solutions which will not work in the African context, or solution with minimal or no sustainability.

Mr. Jean-Paul Adam, the Director for Technology, Climate Change and Natural Resources Management, UNECA, applauded the Government of Zimbabwe and UNESCO Regional Office for Southern Africa, for organising this event, and called for the youths to take full advantage of such an initiative.

Groups were then given the opportunity to perfect their pitches which were thereafter presented before the Minister and a panel of other dignitaries. Groups were awarded certificates for attending the Boot Camp.

Prof Collen Masimirembwa goes through the SDGs with the school children whilst, Honourable Raymore Machingura, the Deputy Minister of the Zimbabwe's

Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development looks on.

The boot camp was a resounding success, which sparked a lot of interest from the youth, in the recent advancements within the Fourth Industrial Revolution as well as opportunities inherent. The interest prompted requests for access to more information, and further training workshops across the country and even in other African countries. The boot camp also caught the attention of different organisations who intend to build on the success of this boot camp to reach other audiences, for example to youths living in children's homes, and youths in Cyclone Idai affected regions. One of the students at the boot camp was awarded a chance to present at the Youth's session with the Deputy Secretary General of the UN, Ms. Amina Mohammed.

At the youth session with Ms. Amina Mohammed, the youths called on the UN to allocate enough resources to STI development and capacity building. The UN was also called on to have stringent monitoring and evaluation mechanisms for its initiatives and programs to ensure uptake and sustainability. Youths were also challenged to take up places in policy making and positions of power in industry. There is need to take bigger steps to include people with disabilities in programmes and initiatives.

Recommendations

- It was observed that some of the youths had no prior experiences with some of the technologies even after finishing university studies, and as such, there is need to expand the program, to ensure that youths are ready for the disruptive 4IR.
- The youths called for more training workshops from the grassroots level to ensure that no one is left behind. They also called for such training workshops to be supported by industry so that they can easily identify linkages and synergies.
- Capacity building in STI should be given utmost importance and should not be bottle-necked by policies that are not moving with the times
- Youths were called to be innovative starting with the minimal resources available in the local communities or surrounding and then scaling up.
- The Boot camp was proposed to be a mainstay of the Science, Technology and Innovation Forums, as well as other Science and Technology events such as the World Science Forum.
- There is need to develop material to introduce the 4IR concepts to the general public in an easy to understand way, so that there won't be resistance when trying to develop communities using these technologies.

Key Outcomes of ARSTIF 2020

Opening Ceremony Session

The Minister of Higher and Tertiary Education, Innovation, Science and Technology Development, Zimbabwe officially opened the session. The forum reiterated that STI is central to the successful implementation of the SDGs and the AU Agenda 2063. These Agendas call for transformational change in many sectors such as health, energy, climate change, food security, mobility and transportation, ICTs, water, sustainable cities, and others. It also calls for a strong positioning of science as a foundation for the successful implementation of the SDGs.

The opening session also stressed the need for redesigning education systems in Africa to respond to societal issues and the current challenges in the continent. Most importantly to align the critical skills at country level to effectively respond to a future that will increasingly be driven by STI. It was highlighted that innovation and entrepreneurship skills and capabilities were critical to empowering learners such as knowledge gained from the education system is translated into goods and services. It was further pointed out that teaching, research and community services should be supported by innovation and industrialization, making the 5 main pillars of education that should be included in a redesigned education system in Africa – Education 5.0. Therefore, in order to transform the African education system, there is an urgent need for development and implementation of legal framework and STI policies that promote national development, based on sound scientific evidence. Good STI policies would play a catalytic role in leap-frogging Africa's development.

Rapid technological advancements in Artificial Intelligence, as well as other emerging technologies, such as nanotechnology, biotechnology, combined with high-speed computing and big data are key drivers of this 4IR. This will lead to profound transformations of how we will work and live in the future.

While the World is moving into the 4th Industrial revolution, much of Africa still needs to reap full benefits from the 2nd and 3rd revolution. It is time for the continent to a strategy to leapfrog the the previous industrial revolutions and achieve sustainable development. As such, Africa could save significantly on time and resources, by maximising opportunities, and by avoiding immensely expensive mistakes made by others..

In the energy sector, Africa can harness the high levels of solar radiation to improve its energy mix and expand the use of renewable energy, reducing its dependence on unsustainable hydrocarbons and meet the global commitments under the Paris Agreement.. Africa can use emerging technologies in the design of its its transportation, communication, energy and water infrastructure.

To meet these goals, countries need to address the severe capacity gap in engineering and other science and technology related fields, accelerate women's participation in science and technology, and reflect on the role of universities as engines for STI capacity development, for innovation and for Research and Development (R&D) in the continent.

It was noted that presents a mixed picture. While Africa's higher education sector was expanding at about 25% a year, Africa's accounts for about 2.3% of the world's researchers in R&D, and 1.1% of global scientific articles. That is far from Africa's share of the global population – about 16.7%. Similarly, Africa is home to 11% of the global internet users and 9.1 % of unique mobile subscribers. Yet, Africa's share of the global Internet traffic is less than 1% and captures only 3.7% of the $3.9 trillion global contribution of the mobile economy to global GDP.

To ensure Africa captures its fair share of global economy, considerable investment in

infrastructure and capacity building in STEM were highlighted as pre-requisites for scaling up Africa's development. Such investments will push countries rich in natural, cultural and human resources up the value chain, and generate economic growth, jobs and prosperity for all Africans.

High-level policy dialogue on the role of Emerging Technologies associated with the 4th Industrial Revolution to meet Agenda 2030 and AU Agenda 2063

It was emphasised that efforts to map the alignment of the STI targets in the Global 2030 Agenda and Africa's Agenda 2063 and the Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) should be included in the design of national STI policies, strategies and roadmaps if they are to be met concurrently. For instance, STISA-2024 has more ambitious goals with only four years to go; but provides a clearer template for STI policy making with a focus on technical competencies, innovation and entrepreneurship and infrastructure.

Recognizing emerging technologies such as artificial intelligence (AI) could accelerate Africa's development, the governments were encouraged to align their socio-economic agendas with the requirement of the 4IR. For Africa to take full advantage of the opportunities offered by these emerging technologies there is an urgent need to build capacity in the basic sciences and engineering.

It was noted that very few African countries, have a clear national strategy for harnessing the opportunities offered by the fourth industrial revolution or manage any of the potential negative impacts especially on people, planet, peace and economy. To overcome existing knowledge gaps and deficits, it was recommended that African countries develop regional strategies to guide national efforts and plans in alignment with their national priorities and aspirations.

Open Innovation Platforms to accelerate knowledge sharing, innovation and technology development

To respond to the calls over the years to design mechanisms for co-creation, collaboration and sharing of knowledge and information, two platforms recently developed by two teams were showcased as examples. Both platforms are open to all individuals and institutions in Africa and beyond. These include:

i. *Euro-African Open Biomedical Engineering e-platform* for Innovation through Education, a platform funded by Horizon 2020 and used by students, researchers and innovators from all sectors of the economy to collaborate in design and development of healthcare solutions to current and future challenges.
ii. *The Innovation Bridge*, an open platform sponsored by the Department of Science and Innovation, South Africa, and developed by Council for Scientific and Industrial Research (CSIR) that offers innovators and entrepreneurs a place to showcase their innovations/solutions to the world, access funding and partners as attract potential clients.

A book titled "Digital Labour Markets and Jobs for the Future" authored by Fredrick

Mandizvidza was launched by the Deputy Minister for Higher and Tertiary Education, Innovation, Science and Technology Development, Zimbabwe. The book offers suggestions on how Africa can prepare for the upcoming fourth industrial revolution.

Session on People

Discussions focussed on the need to ensure access to information, the establishment of a one-stop-shop where information could be found and properly packaged for the various groups such as youth, women, etc. This is particularly important in improving education, advancing life-long learning, encouraging good health and empowering people to meet their own aspirations. Participants called for identification, documentation, replication, and scaling-up of good practices. These could be cases that have improved the general wellbeing and empowered people or built effective collaborations and partnerships that have achieved greater impact, especially at national, regional and continental levels.

In addition to the above points, the following observations were made:

i. The need to scale up access to programmes aimed at prevention of the proliferation of new infections and reduction of child marriages;
ii. Investment in locally adaptable technologies such as the Blair toilet.
iii. Strengthening of community engagement through effective local leadership
iv. Development of sound STI Policy and implementation strategies
v. Redefining of Higher education institutions curricula, putting an emphasis on an education system that produces goods and services.
vi. Recognition of youths as the new game-changers in Africa's quest for development
vii. Strengthening of research institutions and universities by providing cutting-edge laboratory equipment for research.

To accelerate progress towards 'Leave no one behind" target by 2030 requires a strong political commitment to adopt and monitor regional benchmarks on key indicators, from which countries will establish appropriate intermediate benchmarks to tighten the follow-up and reviews of achievements.

Education – Girl and Gender Equality

i. Governments should recruit more female STEM teachers to become role models in schools.
ii. Increase domestic, inclusive and gender responsive education financing systems. This has to be supported with robust systems to promote transparency and accountability as well as internal efficiencies in the use of resources.
iii. Need to strengthen community and parents' engagement on the importance of educating girls.
iv. Need to gather and disaggregate data across non-traditional issues such as gender and conflict, gender and refugees etc.

Education- Refugees and IDPs

i. Governments should open up their national education systems to include refugees.
ii. Increase domestic resource mobilization & international community support to governments that accept refugees so that they can strengthen their public education

systems & deliver free education to refugees & IDPs.

iii. Explore the possibility of ICTs to support access to quality education by refugees & IDPs.
iv. Provide capacity support to teachers & psycho-social support in areas where people have suffered traumatic experiences.
v. Improve data collection for all categories of children affected by conflict (refugees, returnees & IDPs) to ensure they are not left behind in terms of schooling.

Education-Rural Population

i. Strengthening data collection mechanism to produce more disaggregated indicators to capture equity in all aspects
ii. Having a transparent system in education financing with the inclusion of rural communities in the management & governance of education
iii. Addressing social barriers to education in the rural areas
iv. Strengthen functional literacy on FGM, child marriage, GBV etc.
v. Provision of social services such as energy, infrastructure, water, entrepreneurship development to promote job creation, school feeding programs, retention of teachers and minimize rural-urban migration
vi. Government to work on better allocation of teachers to the rural areas by providing incentives such as hardship allowance, etc.

Session on Prosperity

Emphasis was made on the need to expand connectivity in Africa and to modernise and industrialise Africa. It is was noted that most of the key institutions needed to industrialize and modernise, such as small and business development agencies, entrepreneurship development and promotion entities, industrial research institutes and academia are either inadequately equipped or underdeveloped. One way is to ensure that entrepreneurship and innovation are part of African universities system. Efforts to resuscitate some of the key agencies needed to industrialize successfully should be ramped up. It was emphasised that prosperity cannot be achieved if Africa does not build businesses that are competitive, create jobs and wealth. Member states were challenged to map their needs that require urgent technological solutions and create data repositories to ensure they own and preserve their knowledge for future generations. To ensure no one is left behind, STI solutions must take into account the needs of the marginalised.

Session on Planet

The session reflected on huge challenges being faced by the continent in water, energy and food security, in the context of climate change-induced extreme events and advocated for new approaches in order to build a resilient and sustainable 'new' water-energy-food nexus in the continent. A global transformation towards 'New Water', 'New Food', and 'New Energy', will lead the way towards a sustainable future.

The forum highlighted that Africa lags significantly behind in energy access, yet it is also blessed with high levels of solar radiation. By embracing renewable energy the continent could skip the unsustainable Carbon-dependent economy stage, which the developed world needs to tackle.

Africa is at the front line of the adverse impacts of climate change. Climate change-induced extreme events such as droughts and floods have resulted in unprecedented hardship, loss of billions of dollars in damages, and increasing

threats to water and food security in the region. In response to these extreme events, necessary science-driven mitigation and adaption strategies should be put in place in order to address the above challenges. The forum highlighted the importance of identifying pathways to integrate the science-based understanding of climate impacts on water security into mitigation and adaptation policies in the wake of increasing frequencies of these climate change induced extreme weather events in the region. There is a need to provide capacity building to relevant stakeholders in the long term to support post-disaster and resilience-building activities.

Session on Peace

In order to promote peace, there is a need to engage youth in STI especially by investing in Technical, Vocational and Entrepreneurship Education and Training to address rampant unemployment that threatens peace in Africa. Digital communication has resulted in misinformation and disinformation – both of which challenge peaceful co-existence. Developments in emerging technologies should go hand in hand with the development of policies and guidelines to mitigate the negative effects of advanced technologies. Appropriately applied and developed, advanced technologies can help provide solutions to food insecurities, climate change, healthcare and stronger and just institutions, among others, which in turn minimize conflicts and promote peaceful existence.

Session on Partnership

The continent requires more effort in strengthening collaborations and partnerships at a continental and regional level to support regional networks and capacity building initiatives. Initiatives that enable individuals and institutions to share research infrastructure, access resources and networks beyond their borders, and team up with others working on similar challenges could strengthen partnerships. Such arrangements could ensure more efficient utilisation of resources for greater impacts. Good examples such as the Biosciences Innovations Network for Eastern African Development (BioInnovate Africa) and Southern African Network for Biosciences (SANBio) were highlighted as cases that could be replicated in other sectors and scaled up. In both cases, research entities and businesses from a minimum of three countries are needed per project supported by the Networks, and they share expertise and infrastructure for education, training, research, innovation and entrepreneurship promotion. Institutions such as the UN Technology Bank for Least Development Countries, UNESCO, other agencies and entities could adopt similar models in their work.

Open Science

Open science is a game-changer in our quest to develop evident-based policies and offer opportunities for building a vibrant scientific community, improve inclusiveness, create jobs and encourage dissemination of scientific findings. This notwithstanding, the concept needs a clear definition and standards; the enabling policies and institutions and the investments in infrastructure to support it.

There is a need to build human capital in Africa in order to add value to data to drive innovation and support job creation. We need to have fair and reasonable conditions to data sharing, increase motivation and be more opened to the attributions to scientific information especially in institutions where rewards are based on publications. Moreover, it will be prudent to conduct cost and benefit analysis of open science to accentuate

implications on the relevance to science, technology and innovation in the African context.

Conclusions

Science, Technology and Innovation are central to the successful implementation of the SDGs and the AU Agenda 2063. These Agendas call for transformational change in many sectors such as health, energy, climate change, food security, mobility and transportation, ICTs, water, sustainable cities, and others. A complicating factor is that all these transformations need to be made almost simultaneously, adding further to the complexities in dealing with them. To manage these complexities our science has to be smarter. It calls for a strong positioning of science as foundations for the successful implementation of the SDGs. It calls for strong science to inform policy and for strong policies for science. It calls for a catalytic role of STI to help leapfrog sustainable development in Africa.

In order to respond to the UN Decade for Action, tangible STI deliverables that have an impact on society should be measured and evaluated regularly. The newly launched STI Advisory Committee should assist member states to develop and implement STI policy in order to deliver a transformed and prosperous Africa through the 2030 Agenda and Agenda 2063.

Recommendations

i. Build capacity in the basic sciences and engineering guided by national heritage, priorities and comparative geographical advantages in order for Africa to take full advantage of the opportunities offered by emerging technologies,
ii. Significantly scale up investments in R&D, universities and research centres;
iii. Align the critical skills at country level to effectively respond to a future that is increasingly driven by STI.
iv. Establish innovation hubs, incubators and common equipment centres that serve both industry and academia
v. Develop a strategy that co-implements the Fourth Industrial Revolutions while taking advantage of established technologies in order to catchup and meet the aspirations of of the 2030 Agenda and Agenda 2063
vi. Strengthen collaborations and partnerships at a continental and regional level by supporting regional networks and capacity building initiatives
vii. Draw lessons from the experiences of other regions to make significant inclusive and sustainable development gains ;
viii. Adopt and promote renewable energy technologies in order mitigate the impact climate change, create jobs and promote wellbeing.;
ix. Redesign the curricula of higher education, by putting an emphasis on an education system that produces goods and services.