

ACTION PLAN PRODUCED BY PARTICIPANTS

**The 5th Conference of Vice-Chancellors, Provosts and Deans
of Science, Engineering and Technology
(COVIDSET 2013)**

***Enhancing capacity in Science, Engineering and Technology
in response to emerging industrial and socio-economic
needs of Africa: the role of Universities and Research
Institutions***

**Gaborone, Botswana
6-7 November 2013**



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List of Abbreviations

ANSTI	African Network of Science and Technological Institutions
AfDB	African Development Bank
COVIDSET 2005	First African Regional Conference of Vice Chancellors, Provosts and Deans of Science, Engineering and Technology
COVIDSET 2007	Second African Regional Conference of Vice Chancellors, Provosts and Deans of Science, Engineering and Technology
COVIDSET 2009	Third African Regional Conference of Vice Chancellors, Provosts and Deans of Science, Engineering and Technology
COVIDSET 2011	Fourth African Regional Conference of Vice Chancellors, Provosts and Deans of Science, Engineering and Technology
COVIDSET 2013	Fifth African Regional Conference of Vice Chancellors, Provosts and Deans of Science, Engineering and Technology
EAC	East African Community
PPP	Public Private Partnerships
PG/T	Postgraduate Training
SADC	South African Development Co-operation
ECOWAS	Economic Community Of West African States
ICT	Information Communication and Technology
NEPAD	New Partnership for African Development
R&D	Research and Development
R&Dep	Research and Deployment
S&T	Science and Technology
STI	Science Technology and Innovation
SET	Science, Engineering and Technology
SETI	Science, Engineering, Technology and Innovation
SETR	Science, Engineering, Technology and Research
SSA	Sub-Saharan Africa
STEM	Science, Technology, Engineering and Mathematics
UNESCO	United Nations Educational Scientific and Cultural Organisation
UPE	Universal Primary Education
IP	Intellectual Property
MDGs	Millennium Development Goals
GDP	Gross Domestic Product

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ANSTI dedicates this COVIDSET2013 to all those who have worked so hard to establish this as Africa's biannual conference of high level university decision makers especially Professor Joseph G. M. Massaquoi, former Director of UNESCO-Regional Office for Science and Technology in Africa (UNESCO-ROSTA), Nairobi, Kenya and Coordinator of ANSTI for over 14 years. His legacy will continue to live on even when he is no more.

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Preface

This is the report of the fifth in the series of the bi-annual African Regional Conference of Vice Chancellors and Deans of Science, Engineering and Technology (COVIDSET2013) being organised by the African Network of Scientific and Technological Institutions (ANSTI) in conjunction with the United Nations Educational, Scientific and Cultural Organisation (UNESCO) the German Academic Exchange Service (DAAD) and the University of Botswana. The Conference is affirming UNESCO/ANSTI's commitment to make this forum for Africa's leaders responsible for university training, research and innovation and policy makers an important platform for exchange, debate of ideas, capacity building and design of concrete actions to improve the impact of high-level training, research and innovation on Africa's sustainable development and socio-economic transformation.

The theme of COVIDSET2013 follows the logic of previous ones in strengthening teaching and research and in preparedness for post millennium development goals, dubbed Post 2015 Development Agenda. The theme for COVIDSET 2013 is 'Enhancing Capacity in Science, Technology and Innovation in Response to Emerging Industrial and Socio-economic needs in Africa: The Role of Universities and Research Institutes'.

The role of universities in the generation of knowledge for driving the socio-economic development of Africa is more urgent now than ever before. Economies of sub-Saharan African countries are growing at a very fast rate (World Bank Africa Pulse, 2012).

Discoveries of new oil, gas, and minerals in the last ten years are bringing the prospects of large revenue for newly resource-rich countries. At the same time, Climate change with its adverse effects on basic needs of health and nutrition, food security, energy access and efficiency, water availability and environmental sustainability; youth unemployment, sprawling urban development and global fragile economy pose threats to Africa's economic resilience if appropriate measures are not taken to curb them. Africa must harness the opportunities that these challenges bring and be ready for this new economic resurgence. The call for economic, social and environmental resilience building was reiterated at the UNESCO/AfDB/AUC/UNECA 1st African Forum on STI for Youth employment, Human capital Development, and Inclusive Growth culminated in a Ministerial Declaration by African Ministers of Education, Science and Technology and Finance in April, 2013 in Nairobi, Kenya (<http://www.adeanet.org/STIforum/en/content/nairobi-ministerialdeclaration>).

The new world economic paradigm shift presents Africa with new challenges and opportunities which necessitates the strengthening of Africa's human and institutional capacities in teaching, research and training in science, technology and innovation so as to influence human capital, youth employment, industrial and socio-economic development and inclusive growth. The expected outcome of COVIDSET 2013 calls for astute innovative measures in harnessing science, technology and innovation in response to these emerging

socio-economic, industrial and environmental needs of the continent. Universities and research institutions have an enormous responsibility in driving this process.

The conference was officially opened by Botswana's Assistant Minister of Education and Skills Development, Honourable Patrick Masimolole. In this remarks, the Minister underscored the need to consider multi-lateral and bi-lateral cooperation in the development of critical trans-boundary resources, for instance: shared water resources found in the Great Lakes of East Africa, the Nile, Niger, Volta, mighty Congo, Zambezi, Limpopo, Senqu-Orange and the Okavango River basins. Mutually beneficial agreements need to be reached as nations gravitate to peaceful co-existence and economic development. Networks, especially those promoting south-south partnerships among African universities need to be encouraged and sustained, said the Minister. This address indeed set the tone for very lively discussions especially on the issues of biodiversity and sustainable development.

On his part the Vice Chancellor of the University of Botswana averred that sustainable development requires effective and efficient partnerships for the creation and transfer of knowledge between universities, communities, governments and industry. He said that we need to invest strategically in developing the human resource capital, skills, expertise and infrastructure required for relevant research, innovation, engagement with and service to our communities.

Sixty scientific papers were presented either at plenary or at the parallel technical sessions. Over 150 participants shared their experiences and audits of achievements, shortcomings and evidence-based proposals. It is our sincere hope that this report will be useful to policy makers and managers at institutional, national, regional and international donor agencies as we address the pertinent issues that affect SET education in Africa.

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1. Introduction

1.1 SET and Development

The weakness in the technological capability of African countries is one of the factors affecting their ability to harness their abundant natural resources for socio-economic development. Science and Technology human resource are required to operate and maintain industries, build infrastructures, increase agricultural productivity and provide other valuable services. It is further argued that Science, Engineering and Technology (SET) can unlock the great potential of Africa and overcome these challenges. In order to apply SET to solve these problems, we need to develop appropriate frameworks and strategies for attracting highly trained scientists who will not only share their outputs, experiences and best practice but also convert their research into products to address the situation.

The role of science and technology in general and research and training institutions in particular is now widely recognized in the region. Although many high-level forums such as the African Union's Congress of African Scientists and Policy-makers (CASP) and the 2007 African Union Summit of Heads of States and Governments have acknowledged the low level of funding for SET activities, we must develop strategies that will provide the necessary training to produce the knowledge and manpower required to address these developmental and socio-economic challenges. Besides the African Union efforts, other initiatives such as those contained in the Millennium Development Goals (MDGs) and the World Summit on Sustainable Development (WSSD), have outlined targets that will re-position Africa on the right path towards attainment of these goals.

1.2 Role of ANSTI in COVIDSET

The African Network of Scientific and Technological Institutions (ANSTI) plays a major role in revitalising SET for sustainable development in Africa. In collaboration with Kwame Nkrumah University of Science and Technology in Accra, Ghana and the UNESCO Regional Office for Science and Technology in Africa, ANSTI organised the first regional conference of Vice-Chancellors, Deans of Science, Engineering and Technology (COVIDSET) in 2005. In 2007 a similar forum was hosted by Tshwane University of Science and Technology in Pretoria South Africa. The third conference was held in 2009 in Kampala, Uganda and was hosted by Makerere University. The first conference was based on an audit of the State of Science and Technology training institutions in Africa while Science and Engineering Education for sustainable development formed the theme of the second conference. The aim of COVIDSET 2009 was to look at the issue of Science and Technology Research and its deployment to serve society. Following naturally to these themes is the issue of harnessing the innovation for sustainable development based on the experiences and best practice. Hence therefore the theme for COVIDSET 2011 was 'Harnessing Africa's SETI for sustainable

development: Role of Universities' while in 2013 the theme was Enhancing capacity in science, technology and engineering in response to emerging industrial and socio-economic needs of Africa.

1.3 Conference Subthemes and Key issues

The conference was organised around four sub-themes namely; making education, science, technology and engineering training work for Africa's sustainable development; innovative use of science and engineering in enhanced research infrastructure, climate change mitigation and adaptation; Sustainable environmental and ocean management; access to water, efficient energy, food security and healthcare delivery; third, creating an effective synergy between science, engineering and innovation, youth employment, entrepreneurship development and inclusive growth; and fourth, science technology and innovation policies for sustainable development of Africa.

Sub-theme one was on Education, Science, Engineering and Technology training and Sustainable development. This theme considered diverse issues ranging from threats to the deep ocean biodiversity to gender issues in research and curricula. The theme also discussed culture considerations in curriculum development, funding for research in private universities, the role of networking and collaboration in research excellence, sustainability of rural livelihoods in the face of climate variability and change and last but not least revitalizing postgraduate Engineering Programmes in African Universities for research capacity building.

Theme two was on Climate Change and Sustainable Environment. The subtheme discussed several issues that elicited interesting debate. Challenges of food production in a world of changing climate and equitable utilization of shared water resources were discussed and actions were proposed to deal with the challenges. Also discussed was the role of national as well as regional organisations that are spearheading climate change research and related priorities. Controversial issues of adaptation versus mitigation against climate change and variability for sustainable development formed part of the deliberations.

On the question of climate change and variability that is affecting livelihoods in Africa due to crop failure and adverse conditions, the conference posed the question on whether Africans should give up mitigation and adopt adaptation. The conference conjectured that Africans

should dwell more on climate change adaptation rather than mitigation since adaptation will lead to mitigation effects.

Sub-theme three was based on Synergy between Science, Engineering and Innovation. Water Management in developing countries, international networks for transfer of Knowledge for students, inadequate research instruments and setting aside mobility funds to support research findings distribution were the key issues discussed under this theme.

Sub-theme four was on STI Policies for Sustainable Development. The conference noted that African countries are seeking ways to revive economic growth and expand their role in the global economy, but their efforts are hampered by poor infrastructure. The growing interest in investing in Africa's infrastructure therefore provides an opportunity for the continent to strengthen its engineering capabilities. The conference further opined that it is only a robust indigenous capacity that can guarantee sustainable development in Africa. The session, after exhaustive deliberations, made recommendations touching on capacity building, university – industry collaboration for improved quality and standards, retention of Engineers and curriculum enrichment among other key issues.

1.4 Structure of the Report

This action plan report is divided into three parts. The first Chapter gives the introduction to the COVIDSET series and in particular the 2013 COVIDSET theme and sub-themes. Chapter two discusses the problems identified within the context of the four sub-themes and the proposed actions and their objectives. Chapter three outlines key priority issues that will require international or regional effort and action. A conclusion is given at the end of the report.

2.0 The Problems Identified, Lessons Learnt and Proposed Actions

SET&I training and sustainable development; innovative use of S&E for solving socio-ecological and environmental challenges in Africa; synergy between SET&I, youth employment and entrepreneurship development and SE&I policies for sustainable development were the key issues discussed in the fifth COVIDSET. However, a number of other issues have persisted throughout all the COVIDSETS. Underfunding, inadequate facilities such as laboratories, library and ICT services and out dated curricula are some of the common problems that have been highlighted in all the four previous conference themes.

The problems identified by the conference are grouped into the four themes. Each problem is briefly described followed by opportunities identified to help mitigate the problem, the lessons learnt and shared by participants and proposed actions going forward. The action matrix given at the end of this report provides a comprehensive coverage of the objectives with each action.

2.1 Making Education, Science, Technology and Engineering Training Work for Africa's Sustainable Development: the Role of Universities

This subtheme considered diverse issues ranging from threats to the deep ocean biodiversity to gender issues in research and curricula. The theme also discussed culture considerations in curriculum development, funding for research in private universities, the role of networking and collaboration in research excellence, sustainability of rural livelihoods in the face of climate variability and change. Proposals on how to revitalize postgraduate Engineering Programmes in African Universities for research capacity building formed a major part of these discussions as well.

2.1.1 Threats to the Deep Ocean Biodiversity

The human footprint in the deep ocean has become an issue of concern that is disrupting the biodiversity. The extraction of oil and gas and concomitant problems associated with spilling and leakages is a major threat. Again, the mining of conventional and rare earth minerals have the consequences of disturbing the habitat and releasing of unwanted chemicals.

LESSONS LEARNT / OPPORTUNITY

Deep Ocean harbors high rather than low species biodiversity. There is therefore an urgent need to prevent loss of this biodiversity and avert catastrophes. We need to maintain the integrity of marine ecosystems and exploit resources in a sustainable manner. Governments and regulatory agencies must work with scientists and stakeholders to apply key principles

of sustainable development. According to UNEP, it means considering the needs of both present and future generations, demonstrating a willingness to place limits on use and exploitation of natural resources, allocating both rights and obligations equitably, and integrating environmental, social and economic viewpoints in defining sustainable development.

The precautionary principle and ecosystem-based management are two ideas widely embraced in coastal zone management. They potentially have a strong role to play in the stewardship of deep margins. Defining ecosystems, their vulnerable components, cross-system interactions and their dynamics will allow us to identify uncertainties and manage at the ecosystem level. Increased stakeholder participation in this management, acknowledgement that stakeholder access carries significant responsibilities for sustainable and fair use, transparent decision making and accountability must be a high priorities.

ACTIONS:

To address the above challenges, a proposed solution will entail, among others, the following actions:

- Working together as regional African countries to review the current tools, guidelines and legislation on environmental management for impact assessment and monitoring
- Working together with oil, gas and mining companies to develop capacity and infrastructure

2.1.2 Gender Dimension in Research and Curricula

Factors that prevent female academic staff members to realise their career aspirations as well as research and publication potential were outlined. Existing gender discrepancies arise from barriers created at the institutional level. Lack of encouragement for women to engage in research and publications was cited as an example. Society at large plays a role in creating and reinforcing gender divisions that shape institutional culture, which in turn influence the creation of career aspirations of both sexes.

OPPORTUNITY:

Measures that will contribute towards gender equality should be put in place. It is also recognised that major funding agencies are demand gender inclusion in research content, in equal opportunity for all and in dissemination of findings. For example the European Union has committed to support gender equality in Africa by actively promoting the role of women in science and a target of 40% women's participation at all levels has been set in Rwanda. It is now common to see more and more journals (with high impact factors) demanding that papers should include the gender and sex dimensions

LESSONS LEARNT:

Practices engrained in institutional culture play a big role in the creation of different educational achievements and career aspirations of men and women. We also recognise that only people can make organisational change happen; policies that consist of a set of guidelines and organisational culture and various functions are strongly influenced by the way things have always been done. For instance the society is still patriarchal and this is reinforced at institutional level.

ACTION:

- There is need to streamline gender in research opportunities, hiring of staff into administrative positions of the university as well as capacity building and training.
- There is need to create a more inclusive atmosphere that does not jeopardise academic quality in terms of selection criteria and affirmative action.
- For a successful transformation both men and women, in senior and junior ranks, must be ready and committed to bringing forth change.

2.1.2 Culture Considerations in Curriculum Development

Participants noted that sometimes cultural issues are not adequately considered while developing curricula.

ACTION:

Universities should work with governments in drawing science policy that recognizes cultural issues and orientations.

2.1.3 Funding for Research in Private Universities

Members decried declining status of research in some Universities in the region. Low funding, heavy workload, inadequate capacity in conducting research and apathy among lecturers were identified as key challenges bedeviling research efforts in these Universities.

OPPORTUNITY:

There is need to take advantage of existing opportunities to secure increased funding and capacity to carry out research.

LESSONS LEARNT:

Both the University administration and individual lecturers should consider research a core business in the university.

ACTION:

Individual lecturers must take the initiative in engaging in research for sustainable development.

2.1.4 Role of networking and collaboration in research excellence

The conference noted that Africa lags behind the developed countries in terms of research and innovation. The current status of research and the root causes of underdevelopment of science and technology in Africa were examined. Members noted that over the years it has become apparent that impediments to scientific development in Africa can be resolved, to a fair extent, by networking and mutual sharing of facilities and skills among the countries of Africa and beyond.

OPPORTUNITY:

Scientists in African countries should be encouraged to engage in international and National collaboration

LESSONS LEARNT:

Better scientific future for Africa can be achieved through efficient educational strategies based on cultural practices and indigenous knowledge which incorporates networking and adequate funding.

ACTION:

In order to alleviate the challenges of implementing some of the suggested solutions, there is need for Universities to work with governments in developing science policies.

2.1.5 Sustainability of Rural Livelihoods in the Face of Climate Variability and Change

Climate change and environmental degradation are affecting livelihood diversification and sustainability especially in the rural areas. The challenges faced by rural communities attempting to adapt to climate variability and change include: water scarcity, poor infrastructure and marketing services, lack of institutional support, and inadequate information and knowledge on rural livelihoods and their sustainability.

LESSONS LEARNT / OPPORTUNITY:

In situations where agriculture is the mainstay for rural livelihood, there is need to lay emphasis on flood recession cultivation, wild fruits gathering, drought tolerant crop and animal production, changing farm calendar and livelihood diversification.

ACTION:

There is need to increase grassroots participation in tackling climate change phenomenon at local level by raising awareness of climate change and adaptation strategies. The school

curricula right from primary level all through to secondary should contain content that covers climate change, variability, adaptability and mitigation

2.1.6 Revitalizing Postgraduate Engineering Programmes in African Universities for research capacity building

Development of African economy requires capacity building in research. There are no vibrant graduate Engineering programs in a number of African universities due to an over-emphasis on undergraduate training. Problems affecting graduate engineering programs include inadequate funding and poor resource/infrastructural base, inadequate supervision, lack of access to relevant scientific publications due to high subscription rates, poor quality of attention due to large numbers of students, low degree completion rates and long completion times among others. Human and institutional capacity are also lacking in several African Universities. This must be addressed in order to increase quality research in our institutions.

OPPORTUNITY:

- Universities should enhance participation and partnership in research affairs by appointing adjunct staff from industry.
- Africa is at the threshold of developing a critical mass in new growth areas such as oil and gas.

LESSONS LEARNT:

- Students and researchers should enhance quality of scholarship and research in order for their work to be published in high impact journals.
- Development of human capital in a necessary condition for achieving sustainable development in Africa.
- Postgraduate students constitute the pool from which the next generation of academics will be drawn from.

ACTION:

- Governments and Universities should enhance financial support to students carrying out research.
- African Institutions need to incentivize students/researchers to publish their research findings in high-impact journals.

2.1.7 Enhancing and Strengthening Regional Scientific Bodies

It is evident that strategies to enhance economic development stress the importance of science and technology. However, inadequate resources continue to hamper efforts being made. Evidence has shown that pooling resources together will alleviate this challenge. For instance, the Western Indian Ocean Regional Initiative in Marine Science and Education (WIORISE) Network was formed to address coastal erosion, coral reef bleaching and disease, use of explosives and seine nets in fishing and increased numbers of fouling organisms. The network has allowed the pooling of resources of individual countries, especially of skilled human capital. The network has catalyzed and stimulated scientific and educational development in the region.. Member countries of WIO are Madagascar, Tanzania, Mauritius, Kenya, South Africa and Mozambique. The set-up

LESSONS LEARNT/ OPPORTUNITY:

- Collaboration can lead to high quality scientific research outputs that in turn will lead to products that improve quality of life.
- Sharing of highly trained human resource, facilities, technology transfer and faculty mobility can be achieved through regional organizations and networks.

ACTION:

- Countries and universities are encouraged to form and strengthen scientific and technological research networks and collaborations.
- Existing regional networks and universities should be at the forefront in providing timely evidence-based advise to governments on climate change adaptive strategies.

2.2 Innovative use of S&E in: Enhanced Research Infrastructure, Climate Change Mitigation and Adaptation; Sustainable Environmental and Ocean Management; Access to water, Efficient energy, Food security and Healthcare delivery

This subtheme discussed several issues that elicited interesting debate. Challenges of food production in a world of changing climate and equitable utilization of shared water resources were discussed and actions were proposed to deal with the challenges. Also discussed was the role of national as well as regional organisations that are spearheading climate change research and related priorities. Controversial issues of adaptation versus mitigation against climate change and variability for sustainable development formed part of the deliberations.

2.2.1 Challenges of food Production in a World of Changing Climate

Erratic rainfall is a factor that has caused declining production of some staple food crops and hence causing continuous increase in the prices of these commodities.

OPPORTUNITY:

Bean production was cited as an example in a study carried out in Nyanza province in Kenya. It was noted that beans provide a cheap source of proteins; and also fixates nitrogen in the soils for increased fertility for other crops.

LESSONS LEARNT:

For optimal production, there is the need for better meteorological data for accurate prediction of rain patterns

Need for farmers to spread risk to achieve better harvest by planting at different sections of the farm with the seed at different times of the year.

ACTION

Breeding of better bean varieties that will match the type of ecological conditions

More involvement of extension workers to work closely with local farmers and advise them.

2.2.2 Equitable utilization of shared water resources

Water is life. Efforts to preserve it must be made at all levels. The conference noted that equitable and beneficial utilization of shared water resources should be urgently addressed. The Mara Basin in Kenya which extends to Serengeti, in Tanzania was given as one such basin that needs urgent attention. The conference further noted that institutions lack the ability to carry out roles of managing such basins.

OPPORTUNITY:

Establishment of mechanisms and institutions to manage utilization of water resources in the shared river basins using international legal frameworks.

LESSONS LEARNT:

There are factors mitigating against equitable distribution of water resources in some of the cross-boundary basins in the region. The pursuit of national self-interest and sovereignty that is exercised by the respective states, coupled with the extractive effort on the non-state actors are the typical challenges.

PROPOSED ACTION:

- Need for the respective countries to sign international law/agreement on the protocols on the management of the basins.

- Need to capacitate the institutions on the management of the basins.

2.2.3 The role of National Adaptation Programmes of Action (NAPA) on Prioritization of climate change needs on economic sectors for Least Developed Nations (LDCs)

A critical analyses of prioritization of climate change needs on economic sectors on the basis of United Nations Framework Convention on Climate Change (UNFCCC) for the 15 least developed nations (LDCs) in Eastern and Southern Africa, including Lesotho, Malawi, Burundi, Mozambique, etc. (NAPA Commission) was discussed. The study also looked into the value of the Human Development Index (HDI) as a proxy for climate change vulnerability. The LDC criteria are poverty, human resource and economy. The LDCs are the countries that exhibit the lowest indicators of economic development.

CHALLENGES:

- Weak linkages between the NAPA process and the national development plans of LDCs
- Inappropriate national institution drivers of the NAPA process.
- Low prioritization of important sectors, such as gender, health and population growth (demography)

OPPORTUNITIES:

NAPA affords LDCs to identify areas of urgent and immediate needs, that is, areas of comparative prioritization of immediate and urgent needs for targeted funding before it becomes too expensive. It emphasizes capacity building through multi- disciplinary approach at national and sub- national level.

LESSONS LEARNT:

Many LDCs at regional level still have some common prioritization areas for the climate change adaptation model but still prioritize separately

PROPOSED ACTION:

It is proposed that LDCs that have common project prioritization should have a regional approach in prioritizing urgent and immediate climate change needs as they will benefit by taking trans-boundary/regional approach. This will promote regional synergy.

2.2.4 Adapting vs. Mitigation against Climate Change and Variability for Sustainable Development

Climate change and variability is affecting livelihoods in Africa due to crop failure and adverse conditions.

OPPORTUNITY:

Africans should dwell more on climate change adaptation rather than mitigation since adaptation will lead to mitigation effects

LESSONS LEARNT:

- There is need to draw a clear line between Climate Change (CC) and climate Variability (CV) since each require different intervention approaches
- Climate Change research should be multi-disciplinary
- Preservation of seed varieties in banks must be mandatory as species/varieties are improved for climate change adaptation.
- In carrying out CC adaptation research, the issue of technology affordability should be paramount.

ACTION:

- ANSTI/UNESCO should liaise with the African Development Bank to institute Centres of Excellence for Climate Change Research programs in African universities
- Spreading of Risk model should be implemented and recommended to stakeholders (e.g. early, middle and late planting should be adopted)
- Capacity building for Climate Change research and training should be enhanced.
- Indigenous knowledge should be applied in CC adaptation research/pathway is charted.
- Climate Change impact data should be generated via research to aid research direction.
- Farmers should be introduced to crops that can adapt to changing temperature and rainfall.

2.2.5 Water Management

Water management in developing countries is poor. Efforts to manage water sources and catchment areas must be made at all levels. The conference noted lack of existing methods and initiatives to help in water management.

OPPORTUNITY:

Resources that enable researchers to log in and share/ discuss joint water research projects in agricultural modelling, water and urban sanitation, aquatic systems and micro pollution, water protection and water in the global world are now widely available.

LESSONS LEARNT:

Multifaceted consultations and discussions will help convince governments of the importance of effective water management.

ACTION:

- Need for capacity building to deal with the technical and logistics issues involved
- Need to develop mechanisms that will convince governments of the importance of effective management

2.3 Creating Synergy between SEI, Youth employment, Entrepreneurship development and Inclusive growth

Science tells us the reasons behind what is happening and engineering picks it up and designs products as solutions to address problems. Science and Engineering is important for the development of the continent and all stakeholders must get involved in building capacity for sustainable development. Africa must unite to solve its problems and do what is necessary for its development and not what people want to do. Policies should therefore be put in place to direct human resource development towards engineering and science. It is therefore imperative that African leaders should challenge African Scientists and Engineers to deliver solutions and innovative programs to address societal challenges that bedevil the continent.

Several proposals were identified as discussed in this theme.

2.3.1 International networks for transfer of Knowledge for students

The role of networking in addressing research capacity difficulties, including knowledge transfer challenges has not been recognised. From the published research in 2002 to 2011, only 31 African Scientists are among 5000 most highly cited world scientists. Twenty five (25) of these are from South Africa while 3 are from Kenya and 1 each from Senegal, Tanzania and Uganda. Their research areas include pharmacology, plant and animal science, environment and ecology, chemistry and Medicine.

Some of the reasons responsible low research output is lack of collaboration and networking among researchers. The high cost of research that is beyond the means of a single lab or sometimes even a single country is the more reason why collaboration is critical. Networking is an essential tool for solving continental problems through sharing of resources, enhancing the quality and quantity of research and fostering quality knowledge

transfer among students. There is increased number of citations received by publications coming out from network groups rather than individual researchers. Moreover, access to network resources leads to improved staff retention, and increased number and quality of students.

OPPORTUNITIES:

Better scientific future for Africa can be achieved through efficient educational strategies based on cultural practices and indigenous knowledge which incorporates networking and adequate funding.

LESSONS LEARNT:

Members noted that over the years it has become apparent that impediments to scientific development in Africa can be resolved, to a fair extent, by networking and mutual sharing of facilities and skills among the countries of Africa and beyond.

ACTION:

- Establish guest teams that will work closely with the local groups in the developing countries
- Organise short term visits and attachments to developed or well equipped labs
- Organise workshops for students and young researchers

2.3.2 Student Attachment in industry

Industries have an obligation to ensure that students are exposed to industry training. However it's difficult for students to get placement due to lack of appropriate policy guidelines to govern the process.

OPPORTUNITY:

Industries should recruit students for attachment as part of their contribution towards developing the manpower that they need.

LESSONS LEARNT:

Attachment offers an important aspect in skills and curriculum enrichment. Companies may offer scholarships to top students but there is no remuneration payable.

ACTIONS:

Based on mutual research interest between industry and academia, academic staff should help students find attachment

2.3.3 Inadequate Research instruments

Research instruments are quite expensive and beyond the reach of some of the universities in the region.

OPPORTUNITY:

There is need to create networks that will facilitate sharing of these equipment. Suggested names such as NUSESA – National Users of Equipment in East and Southern Africa; SEANAC – Southern and Eastern Africa Network of Analytical Instruments

LESSONS LEARNT:

- Development of a database for all analytical and scientific instruments at university level to support sharing as far as possible. For example the University of Johannesburg, University of Botswana, University of Stellenbosch have central databases.
- National Research Funds such as in RSA provides equipment and mobility support for researchers

ACTION:

- Create national research centres
- Create support funds such as the National Research Fund in RSA which provides equipment and mobility support for researchers

2.3.4 Mobility Funds

It's increasingly difficult to share research instruments located in other universities.

OPPORTUNITY:

In order to support sharing of research instruments located in other universities, there is need to create a central mobility fund for this purpose to help scientists travel to other universities to use the resources there.

LESSONS LEARNT:

Ownership of capital investments of such shared facilities needs to be clearly defined.

ACTIONS:

For UNESCO/ANSTI:

- To assist member institutions to implement networks for transfer of Knowledge for students
- To assist young researchers get attachment in developed labs

For Member institutions and countries:

- Establish National Research Funds to support research and research equipment sharing
- Make education more relevant and inclusive. Include Result-based learning approaches to delivery of education programs.

2.4. STI policies for Sustainable Development of Africa

African countries are seeking ways to revive economic growth and expand their role in the global economy, but their efforts are hampered by poor infrastructure. The growing interest in investing in Africa's infrastructure therefore provides an opportunity for the continent to strengthen its engineering capabilities. It is only a robust indigenous capacity that can guarantee sustainable development in Africa. In view of this the conference deliberated may issues in this respect and identified several challenges and proposed actions to deal with them.

2.4.1 Inadequate capacity building initiatives

Infrastructure projects in Africa should be used to train and develop a robust indigenous capacity. Through the many infrastructure projects that are being initiated, Africa has a huge potential in tapping into the international capacity that is readily available through knowledge transfer programs inbuilt into contracts.

There is potential for developing new STI skills in line with developing new services especially in the ICT sector. Governments form an essential part of the national systems of innovation that commit budgets for R&D infrastructure and entrepreneurship development to create opportunities for STI sectoral growth. Therefore Africa needs to align its STI capacity building policies to suit the continent's need for skills towards industry growth and socio-economic benefits.

OPPORTUNITY:

Projects such as Highways, Hydro Power projects, Transportation, Water and Sanitation should be used to train indigenous engineers.

LESSONS LEARNT:

Proper Engineering training requires adequate level of investment. Governments should therefore ensure that suitable levels of investment are made in engineering training.

ACTION:

There should be a deliberate government policy to ensure active participation of indigenous engineers even if the foreign companies are bringing in their funds.

2.4.2 University – Industry Collaboration for improved quality

There should be high level collaboration between the Universities and Industry to support student internship and inject required input into the curricula.

OPPORTUNITY:

Synergy between academia and the industry will bring about intended results quicker. University-industry collaboration provides an opportunity to enhance relevance and quality of University education

ACTION:

Engineering practice and teaching: Attach young staff to consulting firms to ensure that they fully appreciate the practical aspects of the profession.
Ensure that curricula has input from industry.

2.4.3 Standards

Only certified engineers are allowed to practice the profession to check quackery and collapse of engineering infrastructure.

OPPORTUNITY:

Engineering Regulatory Bodies across the continent need to be strengthened

LESSONS LEARNT:

Government should ensure the establishment and proper operation of Regulatory Councils.

ACTION:

ANSTI should be encouraged to coordinate engineering education in African Universities. In this regard ANSTI should coordinate structured discussion to on viability and possibilities of establishing a uniform accreditation programme.

2.4.4 Retention / Ring fencing of Engineers

Retention of qualified and experienced engineers into the profession is difficult.

LESSONS LEARNT:

To be able to train and retain engineers, there should be a special salary scale for engineers.

ACTION:

There should be professional training after graduation from the universities. Both the government and private sector need to provide this training.

2.4.5 Curriculum Enrichment

OPPORTUNITY:

Universities and academic staff should take advantage of the resources that are increasingly available freely.

LESSONS LEARNT:

Student engineering groups and activities in collaborations with local and global professional engineering societies should be encouraged. This will facilitate a richer practice based approach and additional extra curricula activities.

ACTION:

Governments to put in place and enforce policies for Industry to partner with Universities to revise Engineering Curricula and to get these industries to take part in Professional training of graduate Engineers for at least three years after graduation.

2.4.6 Biomedical Engineering Training

OPPORTUNITY:

To facilitate improved and enhanced training of Biomedical engineering, UNECA supported the development of a generic Biomedical Engineering (BME) Curriculum.

ACTION:

It is recommended that African Universities should be encouraged to domesticate the BME Curriculum and be supported with Capacity building for BME delivery.

2.4.7 Institutional Management

Technical departments/ministries are managed by non-professionals and in some cases politicians.

LESSONS LEARNT:

Technical government departments should be headed by competent and experienced Professionals who understand the BUSINESS of what they are responsible for.

ACTION:

Governments should nurture the career paths of professionals in order to allow them to reach the highest level of management.

2.4.8 Accreditation

Members noted that cross border movement of professionals, including engineers, is not a challenge as at now. However, from experiences elsewhere such as in Europe, the conference noted that it's becoming a best practice to consider having a continental accreditation programme for efficiency and cross border engagements purposes.

CHALLENGE:

A common accreditation mechanism for African universities' engineering programs does not exist. The challenge therefore is to consider developing cross-border or continental Credit Transfer mechanisms to support more efficient Cross border movement.

OPPORTUNITY:

There is need to set up accreditation criteria for African universities' engineering programs to ease cross border movements.

LESSONS LEARNT:

Professionals from several African countries do not have difficulties registering and working in other countries.

ACTION:

ANSTI to facilitate a regional discussion on possibilities of Africa having a uniform accreditation body for engineering programs.

2.4.9 Research Funding

It's difficult to secure funding for research. Its even more challenging to get governments to allocate sufficient funds for the same.

OPPORTUNITY:

Government will give a favourable response if researchers and scientists convert scientific findings and reports into social programs that address societal problems

LESSONS LEARNT:

Even where legal provisions that require a specific percentage of government GDP to be allocated to research exist, implementation of this requirement is not easy.

ACTIONS:

- Request the African Development Fund to establish a Research Development Fund that can be competed for through ANSTI
- Persuade governments to support their obligations of supporting research by engaging with it through inputs into policy

- Train our researchers to compete for money from international sources

3. PRIORITY ISSUES THAT NEED REGIONAL / AFRICAN PARTICIPATION OR INTERVENTION

This chapter outlines five (5) key priority areas which can be implemented at regional or international levels. These action points will guide regional and international governments and donor agencies that are involved in supporting SET and R&D deployment in African institutions of higher learning.

3.1 Enhancing and Strengthening Regional Scientific Bodies

It is evident that strategies to enhance economic development stress the importance of science and technology. However, inadequate resources continue to hamper efforts being made. Evidence has shown that pooling resources together will alleviate this challenge. For instance, the Western Indian Ocean Regional Initiative in Marine Science and Education (WIORISE) Network was formed to address coastal erosion, coral reef bleaching and disease, use of explosives and seine nets in fishing and increased numbers of fouling organisms. The network has allowed the pooling of resources of individual countries, especially of skilled human capital. The network has catalyzed and stimulated scientific and educational development in the region.. Member countries of WIO are Madagascar, Tanzania, Mauritius, Kenya, South Africa and Mozambique. The set-up

LESSONS LEARNT/ OPPORTUNITY:

- Collaboration can lead to high quality scientific research outputs that leads to products that improve quality of life.
- Sharing of human capital, facilities, technology transfer and faculty mobility can be achieved through regional organizations.

ACTION:

The international community to enhance their support to regional organizations and networks such ANSTI and WIORISE in realizing the following medium term plans:

- Enhancing scientific and technological research collaboration in marine science, alternative sources of energy and partnerships at continental level.
- Supporting initiatives by scientists in providing timely evidence-based advise to governments on climate change adaptive strategies such as use of drought resistant crop varieties.

3.2 Adapting vs. Mitigation against Climate Change and Variability for sustainable development

Climate change and variability is affecting livelihoods in Africa due to crop failure and adverse conditions. Africans should dwell more on climate change adaptation rather than mitigation since adaptation will lead to mitigation effects. Lessons Learnt over the years show that there is need to draw a clear line between Climate Change (CC) and climate Variability (CV) since each require different intervention approaches. Climate Change research should be multi-disciplinary.

ACTION:

The conference proposed the following for regional and international intervention:

- ANSTI/UNESCO should liaise with the African Development Bank to institute Centres of Excellence for Climate Change Research programs in African universities
- Spreading of Risk model should be implemented and recommended to stakeholders (For example early, middle and late planting should be adopted)
- Capacity building for Climate Change research and training should be enhanced.
- Indigenous knowledge should be applied in Climate Change adaptation research.
- Climate Change impact data should be generated via research to aid research direction.
- Farmers should be introduced to crops that can adapt to changing temperature and rainfall.

3.3 Mobility Funds

There is need to create a central mobility fund to support young researchers to travel to other universities to use specialised equipment and share experiences.

ACTIONS:

The conference proposed the following action from UNESCO/ANSTI:

- To assist member institutions to implement networks for transfer of Knowledge for students
- To assist young researchers get attachment in developed labs

For Member institutions and countries:

They should establish National Research Funds to support research and research equipment sharing.

3.4 Research Funding

It's difficult to secure funding for research. Its even more challenging to get governments to allocate sufficient funds for the same. Even where legal provisions that require a specific percentage of government GDP to be allocated to research exist, implementation of this requirement is not easy. However it is noted that governments will give favourable responses if researchers and scientists convert scientific findings and reports into social programs that address societal problems.

ACTIONS:

- Request the African Development Fund to establish a Research Development Fund that can be competed for through ANSTI
- Persuade governments to support their obligations of supporting research by engaging with it through inputs into policy
- Train our researchers to compete for money from international sources

3.5 Next step: Monitoring and Evaluation of the COVIDSET series

Members noted that COVIDSET, in its 5th biennial meeting, has matured and should graduate from being a forum of discussion and drawing up of strategies, into a forum where the execution of the strategies are monitored, evaluated and reported. This means that COVIDSET should develop clear plans of action for its strategies with monitoring and evaluation framework with clear targets and performance indicators. Mechanisms for data collection to measure performance and outcomes should also be put in place.

Conclusion

This report has highlighted key issues discussed at the COVIDSET 2013 in Botswana, Gaborone. The report is Action-oriented with a justification on why the actions proposed are valid and relevant. This justification has been drawn from a logical argument by first presenting the issue at hand, analyzing it using the papers and experiences presented by participants and then stating lessons learnt so far. It is hoped that the proposed actions presented in this report will be useful in informing the stakeholders who include University heads, country policy makers, donors and individual researchers and students to find a niche to pitch on.

References

ANSTI, COVIDSET (2013). The book of abstracts and paper presentations. Botswana, Gaborone.