Revitalizing Science and Technology Training Institutions in Africa

The Way Forward

Action Plan Produced by participants at

The First African Conference of Vice-Chancellors, Provosts and Deans of Science, Engineering and Technology (COVIDSET 2005)

Accra • Ghana • 15-17 November 2005

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Abbreviations

ANSTI	African Network of Scientific and Technological Institutions
COVIDSET 2005	First African Regional Conference of Vice Chancellors, Provosts and Deans of Science, Engineering and Technology
ICT	Information Communication and Technology
NEPAD	New Partnership for African Development
R&D	Research and Development
S&T	Science and Technology
UNESCO	United Nations Educational Scientific and Cultural Organisation

Acknowledgements

Preface

This report summarizes the outcome of the conference on the state of science and technology training institutions which was held in Accra Ghana 15-17 November 2005.

Participants at the conference were from leaders of institutions responsible for teaching and/or research in the region. These included Vice-Chancellors, Deans of Faculties and heads of academic departments in African universities. Over two hundred (200) university leaders participated in this forum. There were also participants from among the donor community and agencies involved in Higher Education and the promotion of Science and Technology in Africa.

The participants deliberated on many issues and developed proposals for the resolution of the problems and strategies to make the Science and technology institutions more relevant to national development objectives. An action plan was developed for the revitalization of African Science and Technology training Institutions. This report gives the outcome of the conference. It gives an account of the problems affecting science and technology training institutions and proposes the strategies and actions to overcome them.

The range of problems is very wide and hence many actions were proposed. However, in the last chapter of this report only a few of these have been identified as priority areas requiring regional cooperation. I hope all Institutions in the region and donors to higher education in Africa will find the document useful.

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Introduction

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 resources are required to operate and maintain industries, build infrastructures, increase agricultural productivity and provide other valuable services.

The role of science and technology in general and research and training institutions in particular is now widely recognized in the region. In the recent African Ministerial Conference on Science organized by NEPAD, the Ministers recognised that "Science and Technology will play an important role in Africa's efforts to eradicate poverty, achieve food security, and fight diseases such as Malaria, tuberculosis and HIV/AIDS, reverse environmental degradation and increase the pace of industrialization".

In order to apply S&T we need good training and research institutions which can produce the knowledge and manpower to address the various problems of national development. This was also recognised by African ministers at the NEPAD meeting who adopted a workplan which included the establishment of network of centres of excellence. The latter would involve networking of existing and/or new R&D institutions and strengthening them to grow into centres of excellence.

Unfortunately in the past two decades there was a marked reduction in the financial support for higher education everywhere in the region. This has led to a situation where some institutions are no longer able to provide quality internationally-acceptable university education. The problem is particularly severe for science-related courses. Hence science and technology institutions cannot be immediately expected to play a major role in the development process without some vital re-invigoration.

Because of the decline of the past two decades, it was considered that the starting point towards the involvement of science and technology training institutions in the resolution of national problems would be the examination of their current state. In this connection the UNESCO Regional office of Science and Technology in Africa, working through its project, the African Network of Scientific and Technological Institutions (ANSTI) convened an African Conference of Deans of Fac-

ulties of Science, Engineering and Technology and Vice-Chancellors to deliberate on the state of S&T training and research institutions and the role they can play in the socio-economic development of the region.

The conference was held in Accra, Ghana from 15-17 November 2005.

The conference provided a forum for the discussion of the state and the problems of S&T training and research institutions in Africa with a view of facilitating their strengthening and their participation in the resolution of major socio-economic problems of the region.

The conference addressed the following themes:

• Research and teaching resources available in scientific training institutions in Africa.
• The role of Science and Technology training institutions in the fight against poverty
• Science and Technology training institutions and the fight against HIV/AIDS and other infectious diseases.
• University-Industry partnership for economic development.

Through the discussion of the problems related to the above-mentioned themes, the proceedings of the conference, in effect, became a needs assessment for the revitalization of African science and technology training institutions. This assessment helped define the priority areas for intervention. An action plan was developed to address the various problems identified.

This report gives a brief description of the problems highlighted by conference participants and the activities proposed to remedy them. The report is divided into three parts. In the first part all the problems identified are listed in groups corresponding to the different sub-themes of the conference. In the second part a list of actions and their objectives are presented. And finally ten (10) priority actions for regional cooperation have been presented in the last part of the report.

The report also carries an annex which presents a matrix of the action plan.

2.0: The Problems Identified

Several problems were identified by the university leaders gathered in Accra. These problems fall into two broad categories. In the first are those relating to their ability to train and undertake research. In the second category is the obstacle of making them more relevant to the pressing problems of the region: HIV/ AIDS and Poverty. In this section we highlight the problems in various categories and sub-categories.

2.1 State of teaching resources and innovative teaching and management techniques

The problems facing teaching and management of science and engineering courses can be grouped under the following: availability and quality of staff; problems relating to students; poor laboratory facilities; non-availability of learning materials; poor ICT facilities; low funding and others of a general nature. Below some of the issues raised in the conference are highlighted.

Staff

There are two fundamental staff problems that adversely affect teaching in many institutions. These are: Shortage of staff as exemplified by the high level of vacant posts in many institutions and inadequate numbers of Lecturers with PhD. These two fundamental problems are caused by underlying issues which include the inability to recruit and retain staff, the brain drain to developed countries and the low turnover of postgraduate education in science. These problems are not mutually exclusive. The low level of postgraduate education is as a result of shortage of staff especially those with doctorate degrees. Similarly the brain drain may contribute to the inability to recruit and retain staff.

Several strategies were proposed to handle these problems. They include strengthening local training at postgraduate level, attracting and using scientists in the Diaspora and providing more incentives for staff of universities.

Students

Student-related problems include overcrowded facilities/classes and low quality of students entering science and engineering courses. These problems are

caused by the increase in enrollment and the decline in the number of school leavers with good tuition in mathematics and science.

The proposed strategies include the provision and management of lecture theatres that can accommodate large classes, the use of ICT to provide tuition online through university intranet and private sector participation in the provision of university hostels. With regard to the weak background of students entering universities, an appropriate strategy would be for the institutions to organize bridging programs for weak students and also propose to government to make mathematics and science compulsory in secondary schools.

Laboratory

The participants at the conference stressed that one of the biggest problems facing the teaching of science and engineering courses is the inadequacy of the laboratories. There are two aspects of the problem. First, the equipment are old and obsolete. The second problem is the inability to maintain specialized equipment which shortens the life of expensive equipment and further lowers stock of equipment.

As a strategy, universities were urged to establish common facilities for the sharing of the use of expensive equipment within the institution and
as well across the country. Regional centers of excellence for equipment and online maintenance assistance should also be established

Text books

The high cost of textbooks coupled with the declining level of income of most parents in the region has made access to standard textbooks and other learning materials very difficult. Participants stressed that access to text books or alternative learning materials is necessary if the quality of teaching is to improve. In this connection a recommended strategy was to promote e-learning and the local production of multi-media learning materials. It was thought that once the institution has acquired the ICT infrastructure the cost of e-learning materials will be cheaper than that of a standard text book

ICT facilities

There are two major problems associated with the deployment of ICT facilities in most universities. First the facilities are inadequate. The computers are few and the internet connections are slow and unreliable. Furthermore, most institutions are unable to sustain the facilities once they are in place. Linked to the first problem is the high cost of the bandwidth which makes it difficult to invest in high bandwidth to improve the connection speed.

Universities were urged to develop an ICT strategic plan and ensure that the director of ICT facilities is part of the institutions management team. With regard to the high bandwidth cost, strategies would include efficient management of bandwidth and regional collaboration in negotiations with the bandwidth providers.

Funding

The underlining problem affecting all the other constraints mentioned above, is the lack of adequate funding and investment in science and technology. If institutions were adequately funded the problems discussed above would be fewer. Therefore, a major assignment of university leaders in the region is to lobby governments to make Science and Technology a priority. They should develop innovative means of generating funds from tuition, research and the community services they provide.

Others

Other problems mentioned included those related to the assurance of quality and the absence of Scientists and Engineers in decision making positions at the national level. The latter problem affects the ability of scientific institutions to benefit from government support.

2.2   Access, gender and other equity issues

The equity issues in science and engineering education are at three levels. First there is the issue of access. Then after entering the institutions, there is the problem related to the ability of marginalized groups to participate in the proceedings of the courses. Finally, and partly arising from the second problem, is the institution's inability to retain the women and other disadvantaged groups in the science and engineering programmes.

Access

One of the equity problems faced in many institutions in the region is the low level of admission to science education for girls and other disadvantaged groups. There are many reasons for this, one of which is poor teaching at the secondary and primary schools, which are usually biased against women. Another is the poor facilities in rural secondary schools.

The proposed strategy for resolving these problems include support for specific programmes that will improve the entry-level grades of women and other disadvantaged groups.

Participation

Another equity problem is that of poor participation in science programmes by girls and students from less privileged groups. In most universities where women are a minority in the science classes it is observed that they do not participate very well. Universities were urged to create an enabling environment to give confidence to women students in science and engineering classes so that they can also participate fully.

Retention

The retention rate is higher for men than for women in the science and engineering courses. This is an equity issue and should be corrected.

2.3 State of research facilities in African universities

The participants at the conference examined the factors that influence the quality of research. These included: The state of the ICT facilities; the human resource capacity; the library facilities; the availability of laboratory equipment and the research support staff.

ICT facilities

The following were identified as weaknesses relating to ICT facilities which adversely affect the use of the technology for research purposes: poor infrastructure; few computers (a low ratio of computers to staff/ research students); and the high cost of connectivity which makes high-speed internet service unavailable. Furthermore, staff are unable to access journals online in order to update the knowledge on recent developments in their fields of research.

The problems of ICT facilities require strong institutional policy as well as a regional approach for joint negotiations on the cost of bandwidth. With respect to the access to journals online the problem is two fold, the internet connectivity and the cost of the journals. Universities with internet facilities should look for freely available e-journals.

Human Resource Capacity Building

There are two human resource problems affecting research in the region's universities. First is the inadequate quality of human resource to undertake research. This arises from the fact that very few staff have PhDs and/or research experience. The second problem is the lack of time to do research due to large teaching loads from high student to staff ratios in S&T institutions. Another related problem is the poor networking amongst S&T institutions and lack of communication among scientists in the region. It is thought that with good networking some of the human resource problems could be overcome.

As a strategy to overcome these problems universities should recruit and use the services of teaching assistants. Furthermore, regional networks of scientists should be strengthened.

Library facilities

The library facilities in most universities are inadequate. Some have very few current journals and there are whole disciplines without any current journal. This problem can only be solved through increased funding for libraries. As a temporary measure access to e-journals will ameliorate the problem.

Laboratory Equipment

Laboratory facilities are crucial for scientific research. A major problem in the region is that after years of neglect most laboratories are poorly equipped. They have only obsolete and non-functional equipment and lack any sophisticated equipment such as NMR. Furthermore, the laboratories lack the capacity to service and maintain sophisticated scientific equipment.

The participants suggested that a short-term strategy would be to use the internet to improve access to laboratories (I-Labs). Furthermore, a strategy of pooling together resources within the university, across departments and also within the region could help to overcome the problem. In connection with the latter, exchange research visits could form part of this strategy

Teaching and research support

Another problem is related to the available support staff for research work. In addition to technicians required to undertake maintenance and repair of equipment, there is a lack of staff to prepare experiments. Adequate attention should be given to the training of laboratory technicians in order to improve the research capacity.

2.4 The role of science and technology institutions in sustainable development and the fight against poverty

It is important that African institutions develop strategies/ actions in order for them to be relevant and useful to the resolution of socio-economic problems of the region, especially the extreme poverty. In this connection, participants identified several constraints that affect the participation of science and technology research and training institutions in the fight against poverty. These can be categorized into three groups: lack of relevance of curricula and quality of training; weak level of research and absence of entrepreneurship development programmes.

Relevance and Quality of Training

Some institutions in the Africa region are still running courses patterned on those from other more developed regions. This approach enables them to meet international standards. However, they are unable to meet the demands for the type of training required for the local market. The challenge is to provide training that is internationally acceptable and locally relevant. Thus, institutions are unable to play important roles in poverty eradication because the academic programmes are inappropriate and the students are not sufficiently exposed to practical experience. The latter is due to the weak industrial base of most countries in the region.

Weak level of research

One of the important roles that science and technology institutions can play in the fight against poverty is undertaking research whose results will improve economic activity in the region. Unfortunately, this is constrained by factors such as lack of research funding, weak research institutions and inappropriate research agenda

Entrepreneurship Development

Unemployment is one of the causes of poverty. It will be useful for the purpose of enterprise development and job creation if graduates of African institutions were empowered with entrepreneurial skills. Unfortunately, most institutions in the region do not have programmes for entrepreneurial skill development.

2.5 Tertiary institution -industry partnership

The partnership between higher education institutions and industry is a useful strategy for the application of science and technology for development. Since knowledge is generated in higher education institutions and utilized by industry for the provision of services and products it is only logical that the two institutions link up in order to promote development. However, in Africa this useful strategy is constrained by many factors including absence of the enabling environment, the weak industrial base and lack of knowledge of the dynamics of university-industry partnership.

The dynamics of University-Industry Partnership

It was confirmed by participants that in most institutions there is an absence of clear characterization of the dynamics of the Tertiary institution-Industry interaction. This was considered to be a constraint in view of the fact that one needs to understand the process before one could intervene to strengthen it.

The enabling Environment

The absence of an enabling policy environment was also considered to be a constraint. Universities lack the institutional framework (e.g. a liaison office) to facilitate the partnership.

Weak industrial base

There are reduced opportunities for partnership due to inadequate numbers of viable local industries in most African Countries. The fewer the industries available to engage in the partnership the weaker the partnership.

Resource Limitation

Resource limitation is also a constraint. Resources are required at individual, departmental and institutional level. The resource constraints include: Limited human resource capacity of industry (Lack of technical staff for interpretation and transformation of research results); Inadequate funding of University–Industry linkage programmes. The latter will require a strategy to broaden the partnership to include Government.

Protection against piracy

Several researchers are unwilling to release their research results to industry (or in the public domain) for fear loss of control. Similarly, industries are protective

of trade secrets against loss to competitors etc. This can only be addressed by strengthening the intellectual property rights through proper legal framework.

2.6 Higher education and HIV/AIDS prevention and control

The following constraints were considered to affect the ability for scientific institutions to play a more active role in the problem of HIV/AIDS.

Shortage of specialized personnel on HIV/AIDS within higher education institutions.

There is therefore need for capacity building at the level of the individual and the institution.

Resistance to behavioral and attitudinal change and Dealing with sexually active groups

There has to be education on ways of preventing and controlling the spread of HIV/AIDS.

Inadequate funding of HIV/AIDS programmes.

Universities should develop several strategies for advocacy and fund-raising.

Limited access to health services.

Improved linkage with health professionals in and outside the institutions will be a useful strategy to overcome this constraint

Low awareness of HIV/AIDS as a threat.

Universities should mainstream or integrate HIV/AIDS issues into curricula of higher Education Institutions.

3.0: Proposed actions and their objectives

In this section we summarize the proposed actions and present a list of them and the objective(s) of each of them. Details of these actions are also presented in the matrix of the action plan. The list is long because we wanted to cover all possible actions in order to address the wide range of problems that exist in the institutions (see Section 2.0). However, it should be added that not all actions proposed here would apply to every institution. In fact an institution may find fewer than ten (10) actions that may interest it. Therefore, it is important to examine each action and see whether it fits into the institution's priority. The list should be looked upon as a resource for actions to address problems where they exist and the prioritization is entirely left to the individual agencies and institutions. Further, the actions recommended are directed at various players including the faculties, the universities, the government and international agencies.

For international organizations involved in regional activities the next section in this book will highlight the priority actions that can be implemented at that level.

3.1 State of teaching resources and innovative teaching and management techniques

Staff

The following four (4) actions are required to improve staff situation in the Institutions:

ACTION: *Local Universities should attract and train more PhD candidates into S&T courses.* The objective of this action is to improve staff quality by ensuring that more staff have PhDs. Local training is cheaper and carries less risk of brain drain.

ACTION: *Universities should review remuneration packages to provide incentives to staff.* The objective is to retain highly qualified staff and reduce the number of vacant posts.

ACTION: *Staff exchange programmes. Visiting professors from the Diaspora.*
The objective is to provide short-term relief to continue to maintain standards while universities embark on staff development programmes.

ACTION: *Provide Professors with teaching assistants with Masters Degrees.*
This action will free professors to enable them concentrate on training at the post-graduate level.

Students

The following actions were proposed for dealing with the problems arising from increase in student population.

ACTION: *Deploy ICTs for teaching and learning in science and engineering. Train staff on the e-content development and use of ICT for learning/teaching.*
The objective is to train large number of students at different locations at different times

ACTION: *Build large lecture theaters.*
The objective is to reduce overcrowding in lecture rooms.

ACTION: *University administration to use private sector to build more student hostels.*
This action will enable other players to provide hostel accommodation for students and thereby reduce congestion.

ACTION: *University leaders establish a lobby group to support compulsory math and science in secondary school.*
This will increase the number of students with qualification to enter science and engineering schools.

ACTION: P*re-entry science training program.*
To reduce drop-out rate from university science programmes

ACTION: *Train more graduate teachers for teaching of basic sciences in schools*
This will ensure that entrants to universities have good background in Science.

Laboratory

The actions proposed to address the numerous problems mentioned earlier, include:

ACTION: *Universities to prepare business plans to enable them seek grants and loans from the private and public sectors.*
The objective is to equip the laboratory by securing funding from private sources for investment in equipment.

ACTION: *Search for partner universities and develop networks for maintenance of scientific equipment.*
Improved maintenance will increase the stock of laboratory equipment.

Text books

ACTION: *Train staff to develop e-content.*
The objective is to build the capacity of staff to develop content for use of ICT in learning and teaching. This will make learning material available at low cost.

ACTION: *Strengthen ICT infrastructure.*
The objective is to build the physical structure to use ICT in teaching and learning.

ICT facilities

ACTIONS: *Establish an ICT Unit; Train technical staff; Universities to provide Budget for ICT; establish workshop for equipment maintenance and participate in Regional training activities.*
The objective of this cluster of actions is to facilitate adequate utilization of ICT in both teaching and research.

ACTIONS: *Monitoring and management of available resources; Optimization of the use of the available resources; regional collaboration in negotiations for cost of bandwidths.*
The objective is secure, affordable, adequate and well managed bandwidth.

Funding

ACTIONS: P*roduce Good business plans; Make equipment replacement plans with adequate budgets; Create centers to generate incomes.*
The objective of all the actions is to secure additional funds for training and research activities.

Others
ACTION: *Universities to establish an internal accreditation system; Form partnership with accredited institutions.*
This will assure quality and relevance of the training programmes.

ACTION: *Organize conferences and invite MPs.*
The objective is to influence policy relating to science and Technology institutions.

3.2   Access, gender and other equity issues

Access

To improve access by disadvantage groups to Science and Engineering Institutions, the following actions were proposed.

ACTION: *Lower entry points to the specific programmes (e.g. Engineering in KNUST); Increase entry age limit for women wishing to pursue postgraduate courses; Scholarships for female students and the less privileged group.*
The objective of these actions is to make it easier for disadvantage groups to qualify for space in Science and Technology Institutions and thereby increase there enrolment.

ACTIONS: *Science camps for girls; Bridging programmes in science courses for girls and students from less endowed schools; Field visits and attachment of secondary schools girls to University Science and Engineering Faculties; Role models for ladies and the disabled. (Example a lecturer at Nairobi University who is blind)*
These actions will ensure that women and other disadvantaged groups are well prepared for university entrance examinations.

ACTIONS: *In-service training courses for science teachers (e.g. Kenyatta University), Universities should get involved in policy issues regarding the teaching of science at the primary and secondary levels.*
The objective is to train teachers in Science and Mathematics with a view of enhancing the quality of teaching these subjects in secondary schools.

Participation

ACTIONS: *Affirmative action for equal participation in all science and mathematics programmes (e.g. KNUST); increased mentoring of female students and others from less privileged societies.*
The objective is to ensure that women and other disadvantaged groups participate in S&T programmes/ activities in universities.

Retention

ACTIONS: *Change in teachers and lecturers attitudes (and comments) to girls pursuing science degree programme; Provision of child care facilities for young mothers wishing to pursue postgraduate studies. (University of Ilorin); Access and special facilities for the physically challenged (Blind facilities at Kenyatta University, Kenya, Deaf and Dumb at Jos, Nigeria).*

These actions will provide facilities that would assist in the retention of more women in Science and Mathematics courses.

3.3   State of research facilities in African universities

ICT facilities

ACTION: *(See actions proposed in 3.1.5)*

ACTION: *Networking with researchers of similar interest around the world.*
The objective is to make researchers aware (at low cost) the advances in their area of specialization.

ACTION: *University senates/ council to develop cost recovery plans for ICT investments.*
The funds could be used for the purchase of more ICT hardware.

Human Resource Capacity Building

ACTION: *Provision of support for Postgraduate training fellowship, associate ships and training programmes.*
These will facilitate access to training institutions and contribute to the human resource capacity building.

ACTION: *Adopt training grade on the academic staff which will be reserved for the recruitment of bright young graduates.*
This will relieve staff of the teaching load to enable them do some research work.

ACTIONS: *Creation of centres of leadership and excellence; Networking with and mobilization of African experts in the Diaspora; Develop databases on scientists in the Diaspora.*
The objective is to pool together the resources available for research in the region.

Library facilities

ACTION: *Establishment of On-line services in University libraries; Provision of Access to e journals (e.g. explore WHO free e-journals).*
These actions will provide access to the scientific knowledge available globally.

Laboratory Equipment

ACTIONS: *Establish an i-laboratory concept involving many Universities; Establishment of a centralised analytical laboratory in each institution to cater for research; Establish a virtual laboratory concept through networking; Develop technical cooperation with international collaborators to help equip labs; Contribute to overheads of Universities from project grants for facility maintenance.*

The above set of actions is intended to facilitate the use of ICT to overcome the lack of laboratory equipement.

ACTION: *Ghana's model of two and a half percent of VAT towards education must be adopted by all in order to invest in scientific equipment for teaching and research.*
This is an action for fund raising.

Teaching and research support

ACTION: *Development of regional common facilities for intra and inter countries for the promotion of a culture of maintenance; Regional training workshops for repair and maintenance of scientific equipment.*
The objective of these actions is to improve the quality, quantity and access to specialist teaching and research facilities.

3.4 The role of science and technology institutions in sustainable development and the fight against poverty

Relevance and Quality of Training

ACTION: *Continual review of curricula to include community attachments; Revision of syllabuses to make them more relevant.*
The objective is to build appropriate programme and curricula to make graduates marketable and to increase their chances on the job market. It will also facilitate the development of curricula that directly addresses the needs of the communities.

Weak level of research

ACTION: *Adoption of a multidisciplinary participatory research approach.*
This action will popularize research activities and thereby increase the level of interest and support for research.

ACTION: *Adoption of a demand-driven research approach; Develop research agendas which aim at addressing community needs; Diversification of the sources of research funding;*

• To play an advocacy role and
• To foster university

The objective is to make research relevant to national needs.

Entrepreneurship Development

ACTION: *Build capacity in entrepreneurship development to enable youth to engage in small-scale businesses; commercialize research findings; Establish technology development and transfer units in universities.*
The objective is to equip graduates with skills for self-employment.

3.5 Tertiary institution -industry partnership

The dynamics of University-Industry Partnership

ACTION: *Build cause and effect models of tertiary institution-industry interactions learning from existing models; Organize together with stake holders, workshops, documentation and outreach programs for awareness creation and marketing of strengths and opportunities.*
The objective is to develop capacity of scientists and engineers to explain, predict and manage the relationship between industry and Research and Development

The enabling Environment

ACTIONS: *Capacity building for S&T policy makers involving parliamentarians etc.; Proactive involvement of tertiary institutions in S&T policy formulation and implementation; Review existing tools and instrument of S&T policy at national and regional levels.*
These actions will together ensure that Science and Technology policy includes University partnership as strategy for technological capacity building.

Weak industrial base

ACTION: *Set up innovation/incubation centers, parks etc. giving training, credit and marketing support to S&T graduate entrepreneurs.*
This will contribute to the establishment of new knowledge based firms.

Resource Limitation

ACTION: *Sharing of human resources and infrastructural resources by means of centres of excellence, exchange programmes and industrial relations at faculty, university, national, regional or international levels.*
The objective is to reduce cost, unnecessary duplication and increase synergy among institutions between institutions and industry.

ACTION: *Encouragement of government and stakeholders to get involved in the financial and policy support of R&D relevant to University- Industry collaboration.*
This will ensure adequate and sustainable funding of the University-Industry Linkages and projects.

Protection against piracy

ACTION: *Signing of Memorandum of Understanding for every kind of University–Industry–Government or other linkages.*
This will protect both parties in the partnership from unethical behavior.

3.6 Higher education and HIV/AIDS prevention and control

Shortage of specialized personnel on HIV/AIDS within higher education institutions

ACTIONS: *Training of staff to gain knowledge and skill in issues relating to HIV/AIDS; Study visits for staff; Workshops and Seminars; Institutional training on issues of HIV/ AIDS; Invitation of professional body to give periodic workshops for staff to upgrade knowledge on HIV/AIDS.*
These actions will promote human resource capacity building for teaching and training on HIV / AIDS.

ACTIONS: *Equipping of libraries; Providing research materials; Workshops and Seminars; Linkage with other Universities and other institutions with expertise to train staff on HIV/AIDS.*
The objective is to promote Institutional capacity building.

Resistance to behavioral and attitudinal change and dealing with sexually active groups

ACTION: *Formation of AIDS groups/ committees; Seminars and workshops; Counseling services; Peer education; Education on the use of condoms; Partnership with NGOs and other institutions in awareness creation.*
Modify behavior and attitudes in higher education institutions.

Inadequate funding of HIV/AIDS programmes

ACTIONS: *Request Universities, the Government, international organizations, NGOs responsible for HIV/AIDS to increase the amount and support for HIV/AIDS issues; Development of HIV/AIDS policy in the Institutions; Collaborate with NGOs and other institutions in HIV/AIDS programmes.*
The objective of the proposed actions is to increase funding for HIV / AIDS activities.

Limited access to health services

ACTION: Include health personnel in HIV / AIDS committees and programmes
This will improve access to medical care.

Low awareness of HIV/AIDS as a threat

ACTION: *Design programs for all students; Incorporate HIV/AIDS issues into common courses taken by all students e.g. Biology or Entrepreneurship courses; Distance learning courses on HIV/AIDS; Have a compulsory course on HIV/AIDS.*
This is to ensure knowledge acquisition and exposure of every student to the issues of HIV / AIDS.

4.0: Nine (9) priority actions for regional cooperation for the revitalization of science and technology training institutions

Most of the above mentioned actions are intended for the attention of national institutions and governments. However, there are a few which are specifically for the intervention of international organizations which seek to promote regional cooperation for revitalizing African Science and Technology Training Institutions. Below we highlight such activities which are drawn from the list that was presented from the preceding section.

General

(1) *Regional exchange of information on good practices.*
This action will use various media for information exchange: electronic; printed material and forum where strategic issues and experiences are discussed. Through this action university leaders responsible for Science and Technology training will be aware of tried and tested actions for the resolution of various problems in the region. This will enable them avoid making the same mistakes.

Staff Problems

(2) *The main action will be the institution of staff exchange programmes and the use of visiting professors from the Diaspora.*
The objective is to provide short-term relief to continue to maintain standards while universities embark on staff development programmes.

Large Student Population

(3) *The disproportionate increase in student population requires the deployment of ICTs for teaching and learning in science and engineering. Regional action will involve the training of staff on e-content development and use of ICT for learning/teaching.* The objective is to train large number of students at different locations at different times.

Laboratory

(4) *Regional online maintenance assistance and centre of excellence for equipment maintenance; search for partner universities and develop networks for maintenance of scientific equipment; Establish an i-laboratory concept involving many Universities.* Improved maintenance will increase the stock of laboratory equipment.

Improving the availability of Text books

(5) *The regional action will include regional training workshops to train staff to develop e-content.*
The objective is to build the capacity of staff to develop content for use of ICT in learning and teaching. This will make learning material available at low cost.

Strengthening ICT facilities

(6) ACTIONS: *Monitoring and management of available resources; Optimization of the use of the available resources; regional collaboration in negotiations for cost of bandwidths.*
The objective is secure, affordable, adequate and well managed bandwidth.

Human and physical resource for research

(7) *The required regional actions are the creation of centres of leadership and excellence and promoting Networking with and mobilization of African experts in the Diaspora. The latter will require development of databases on scientists in the Diaspora.*
The objective is to pool together the resources available for research in the region.

Library facilities

(8) *Regional action will include the arrangements to provide access to e-journals.*
These actions will provide access to the scientific knowledge available globally.

Shortage of specialized personnel on HIV/AIDS within higher education institutions

(9) *Regional workshops for the training of staff to gain knowledge and skill in issues relating to HIV/AIDS; Study visits for staff; Workshops and Seminars; Institutional training on issues of HIV/AIDS; Invitation of professional body to give periodic workshops for staff to upgrade knowledge on HIV/AIDS.*

These actions will promote capacity building for teaching and training on HIV / AIDS.

Annex I
OUTLINE OF THE ACTION PLAN

Sub-Theme I: State of teaching resources and innovative teaching and management techniques

Several problems were identified in the categories of Staff, Students, Infrastructure (ICT, Laboratory facilities) and Textbooks.

Problem Identified	Strategy to Address the Problem	Proposed Action	Specific Objective of the Actions	Expected Outcomes
Staff				
Inadequate number of Lecturers with PhD	Localization of the training process for PhD	Local Universities to targett attract more PhD candidates into S&T courses	To increase quality of lecturers	All academic staff have PhDs
Inability to recruit and retain qualified staff	Incentives	Universities to review remuneration packages to provide incentives to staff	To retain high caliber staff	High quality academic staff
Brain drain and brain waste	• Incentives to attract S&T professionals in the Diaspora • Create centres of excellence to attract drained brains	Staff exchange programmes. Visiting professors from the Diaspora.	To provide short-term relief on teaching loads	Improved ability to produce high quality graduates Short-term increase in the staff strength
Low turnover of postgraduate education in Science and Technology	• Mentoring • Accelerate the process by providing more opportunities for the students to acquire experience	Provide Professors with teaching assistants with Masters Degrees	To train large numbers of PhD students for recruitment to academic staff	Long-term increase in staff strength
Students				
Overcrowded Classes due to increasing enrolment	• Use of ICT • Provision & Management of large capacity lecture theatres	• Deploy ICTs for teaching and learning in science and engineering. Train staff on the e-content development and use of ICT for learning/teaching • Build large lecture theaters	• To reduce overcrowding • To train large numbers of students at different locations and different times	Lecture rooms will be decongested

Problem Identified	Strategy to Address the Problem	Proposed Action	Specific Objective of the Actions	Expected Outcomes
Students cont				
Distracting living conditions for students	Private sector participation in the provision of student hostels	University administration to use private sector to build more student hostels	To provide reasonable and abundant accommodation for students	Increase in Student accommodation
Decline in the number of school leavers in Mathematics and Science	Make Mathematics and Science compulsory in secondary schools	University leaders establish a lobby group to support compulsory math and science in secondary school	To increase the number of students with the necessary qualifications to do science and engineering in universities	Increased intake in science and technology Institutions
Low quality of students for admission	• Bridging program • Long term quality improvement measures at the lower level	• Pre-entry science training program • Train more graduate teachers for science education in schools	To reduce drop-out from University	High rate of graduation from University science programmes
Laboratory				
Inadequate Laboratories	Search for funding from public and private institutions	Universities to prepare business plans to enable them seek grants and loans from the private and public sectors	Secure funding for labs	Well equipped labs
• Inability to acquire and maintain specialized Lab equipment • Obsolete equipment	Establish centres of excellence for equipment maintenance and on-line assistance	Search for partner universities and develop networks for maintenance of scientific equipment	To increase the stock of laboratory equipment	Improved availability of Specialized equipment for S&T

Problem Identified	Strategy to Address the Problem	Proposed Action	Specific Objective of the Actions	Expected Outcomes
Text books				
Inadequate supply of Text Books and Journals	• Promote e-learning • Promote local production of Textbooks	• Train staff to develop e-content • Strengthen ICT infrastructure	• To build the physical and human resource capacity for use of ICT in learning and teaching • To build capacity of staff to produce books locally and therefore reduce cost	Staff can develop e-contentgood ICT Infrastructure
ICT facilities				
Inadequate Deployment of ICTs facilities	• ICT Strategic Plan Document • High level placement of ICT Director as member of executive	• Establish an ICT Unit • Train technical staff • Universities to provide Budget for ICT • Establish workshop for equipment maintenance • Regional training	Adequate utilization of ICTs	Quality teaching and learning
High cost of Bandwidth	• Efficient Bandwidth Management • Regional collaboration such as ANSTI	• Monitoring and management of available resources • Optimization of the use of the available resources	Secure affordable, adequate & well managed bandwidth	Adequate bandwidth
Funding				
Inadequate funding, Inadequate Investment in Science and Technology	• Lobby Government to make S&T a priority • Generate funds internally e.g. through fees • Fund raising initiatives	• Produce Good business plans • Make equipment replacement plans with adequate budgets • Create centers to generate income	• Secure adequate funds	Funds for S&T programs

Problem Identified	Strategy to Address the Problem	Proposed Action	Specific Objective of the Actions	Expected Outcomes
Others				
Quality Assessment	Establish institutions for quality assurance	• Internal accreditation system • Partner with accredited institutions	To ensure quality of degrees	
Limited number of scientists and engineers in decision making	Invite the politicians to scientific conferences	Organize conferences and invite MPs	To influence policy	Attention to S&T

Sub-theme 2: Access, gender and other equity issues

Three major problems were identified: Access of girls to Science and Technology training Institutions; participation and retention in universities.

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Access				
1. Low level of admission to science education for girls and other disadvantaged groups.	Identify and remove impediments to girls' access to science and engineering courses	• Lower entry points to the specific programmes (e.g. engineering in KNUST). • Increase entry age limit for women wishing to pursue postgraduate courses. • Scholarships for female students and the less privileged.		Increase in enrollment of women
	Support Programmes to improve the entry level grades of women and other disadvantage groups	• Science camps for girls • Bridging programmes in science courses for girls and students from less endowed schools • Field visits and attachment of secondary schools girls to University Science and Engineering Faculties. • Role models for ladies and the disabled. (Example a lecturer at Nairobi University who is blind)		Increased access for girls and other disadvantaged groups to science programmes

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Access				
2.Poor teaching at the secondary and primary schools, etc.	Training for teachers of science and mathematics in secondary schools	• In-service training courses for science teachers (e.g. Kenyatta University) • Universities should get involved in policy issues regarding the teaching of science at the primary and JSS levels	To train teachers in science and mathematics	Better teaching of science and mathematicsat the primary and JSS levels
Participation				
3.Poor participation of girls and students from less privileged groups	Create an enabling environment for women to study sciences and Mathematics	• Affirmative action for equal participation in all science and mathematics programmes (e.g. KNUST) • Increased mentoring of female students and others from less privileged societies	To ensure that women and other disadvantaged student groups participate in S&T programmes\ activities in Universities	Improved participation of females in science and mathematics
Retention				
4.Low rate of retention of women in the science courses	Take affirmative actions for retention of women in Science and Technology courses. (Women should be supported and provided with an enabling environment)	• Change in teachers and lecturers attitudes (and comments) to girls pursuing science degree programme • Provision of child care facilities for young mothers wishing to pursue post- graduate studies. (University of Ilorin). • Access and special facilities for the physically challenged (Blind facilities at Kenyatta University, Kenya, Deaf and Dumb at Jos, Nigeria)	To provide facilities that would assist in retaining more women in science and mathematics	More women retained in mathematics and science

Sub-theme 3: State of research facilities in African universities

Problems were identified in five (5) areas: ICT facilities; Human resource capacity building; library facilities; laboratory equipment and research support

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
ICT facilities				
Low investment in ICT infrastructure	• ***(See suggestions for sub-theme 2)***			
High cost of connectivity and high speed bandwidth	• ***(See suggestions for sub-theme 2)***			
Inability to access most journals online to facilitate research	• University libraries to look for freely available on-line journals	Networking with researchers of similar interest around the world	To enable researchers to be aware of recent advances in their areas of specialization	More staff will be up-to-date in their areas of specialization
Low ratio of computers to staff/students	• Increase investment through cost sharing/ recovery	University senates/ council to develop cost recovery plans for ICT investments	To buy more ICT hardware	Access to computers is improved
Human Resource Capacity Building				
Inadequate quality of human resource in S&T institutions to undertake research	Universities to recruit more staff with PhDs and or research experience	Provision of support for Post-graduate training fellowship, associate ships and training programmes	To improve the quality of research staff	Improved quality in the research output

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Human Resource Capacity Building				
Lack of time to do research due to large teaching loads from high student to staff ratios in S&T institutions	Universities should use more research and teaching assistants	Adopt training grade on the academic staff which will be reserved for the recruitment of bright young graduates	Relieve staff of teaching load	More research activities in the institutions
Poor networking amongst S&T institutions and lack of communication among scientists in the region	Develop modalities for networking	• Creation of centres of leadership and excellence • Networking with and mobilization of African experts in the Diaspora • Develop data base on scientists in the Diaspora	To pool together resources at the disposal of the region	Increase in the quality of research
Library facilities				
Low funding for libraries – e.g. lack of relevant journals	• Increased investment in libraries • Improve access to books and journals online	• Establishment of On-line services in University libraries • Provision of Access to e journals (e.g. explore WHO free e-journals)	To provide access to scientific knowledge available globally	Improved quality of library holdings
Laboratory Equipment				
• Poorly equipped teaching Laboratory	• Improve access to modern laboratory facilities using the internet • Need for judicious use of funds for basic equipment	• Establish an i-laboratory concept involving many Universities		

Laboratory Equipment

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
• Limited laboratory facilities–obsolete and non functional equipment • Sophisticated equipment (e.g. NMR) non existent	• Pool together the available resources both within the institution and within the country and region	• Establishment of a centralised analytical laboratory in each institution to cater for research • Establish a virtual laboratory concept through networking • Develop technical cooperation with international collaborators to help equip labs • Contribute to overheads of Universities from project grants for facility maintenance	To use the ICT to overcome the problem of lack of equipment To provide physical access to expensive equipment that cannot be found in every institution/ department	
• Low capacity to service broken down equipment. • Lack of experienced and qualified technical specialists to service and repair machines	Higher education Sector initiative to develop technical specialists	Ghana's model of two and a half percent of VAT towards education must be adopted by all in order to invest in scientific equipment for teaching and research	More effective use of funding for equipment	Improvement in stock of laboratory equipment

Teaching and research support

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
• Poor technical support–low attention given to training of technicians • Poor repair and maintenance culture	• Improve remuneration for technical staff • Improve training of technicians	• Development of regional common facilities for intra and inter countries for the promotion of a culture of maintenance • Regional training workshops for repair and maintenance of scientific equipment	Improve the quality, quantity and access to specialist teaching and research facilities	Enhanced collaboration and access to specialised equipment

Sub-theme 4: The role of science and technology institutions in sustainable development and the fight against poverty

Four major categories of problems were identified: Relevance and quality of training; weak level of research; lack of entrepreneurship development programme; weakness of national academies of science.

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Relevance and quality of Training				
• Lack of practical experience. • Inappropriate academic programmes and curricula	• Increasing the exposure of students to practical work • Restructuring of programmes and curricula to make them multidisciplinary to suit local needs and job market; and to let graduates create wealth	• Continual review of curricula to include community attachments • Revision of syllabuses to make them more relevant• Regional training workshops for repair and maintenance of scientific equipment	• Build appropriate programmes and curricula to make graduates more marketable and to increase their chances on the job market; • Develop curricula that directly address the needs of the communities • Build appropriate programmes and curricula to make graduates more marketable • Build the physical, human and material resource capacity for training at technological universities	• Increase in self-employment and contribution of graduates to community development • Graduates equipped to solve national socio-economic problems

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Weak level of research				
• Lack of research funding • Weak research institutions	• Creation of awareness of importance of research for socio-economic development	• Adoption of a multidisciplinary participatory research approach	To popularize research activities	Increase in level of interest and support for research
Inappropriate research agenda	• Local institutions to play a leadership role in the development of the research agenda	• Adoption of a demand-driven research approach • Develop research agendas which aim at addressing community needs • Diversification of the sources of research funding; • To play an advocacy role • To foster university	To make research relevant to the national needs	
Entrepreneurship Development				
Lack of entrepreneurial knowledge and skills	• Promotion of entrepreneurship development in formal education institutions and the unemployed youth through the open university & distance learning concept • Promotion of business ventures development	• Build capacity in entrepreneurship development to enable youth to engage in small-scale businesses. • commercialize research findings Establish technology development and transfer units in universities	To equip graduands with entrepreneurial skills	• Increased ability of youth to go into self-employment; and also manage their own enterprises. • Graduates and youth can now create jobs rather than being job seekers Graduates equipped with the necessary practical expertise

Sub-theme 5: Tertiary institution–Industry partnership

Six major areas were identified by participants

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
The dynamics of University-Industry Partnership				
1. Absence of clear characterization of the dynamics of the Tertiary institution-Industry interaction	Scientists and engineers need to develop homegrown methods to work out key drivers and outcomes in respect of Industry –Tertiary institution relationships	• Build cause and effect models of tertiary institution-industry interactions learning from existing models • Organize together with stake holders, workshops, documentation and outreach programs for awareness creation and marketing of strengths and opportunities	Develop capacity of scientists and engineers to explain, predict and manage the local relationship between industry and R & D	• A framework which can guide the analysis and implementations of university– industry relations given certain socio-economic parameters • Increased awareness of strengths and challenges of tertiary institutions and industry • Increased number of joint activities between tertiary institutions and industry
The enabling Environment				
2. Absence of enabling policy environment	Create avenues for improved relationship between tertiary institutions and government	Capacity building for S& T policy makers involving parliamentarians etc.	To secure adequate and sustainable funding of the University-Industry linkages and projects	A change in perceptions so that Govt., industry itself and others become more willing to invest in university – industry linkages
	Create strong advocacy and communication strategies for putting across to policy makers the interests and needs of Science and Technology	• Proactive involvement of tertiary institutions in S& T policy formulation and implementation • Review existing tools and instrument of S&T policy at national and regional levels	To ensure that S & T policy includes University partnership as strategy for technological capacity building	Strengthen U-I partnership through enhanced institutional policy environment

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Weak industrial base				
3. Reduced opportunities for partnership due to inadequate numbers of viable local industries in most African Countries	Initiate self employment and entrepreneurship capacity among students and lecturers	Set up innovation/incubation centers parks etc. giving training, credit, marketing support to S&T graduate entrepreneurs	To contribute to the establishment of new knowledge based firms	• Growing number of knowledge based firms • Less number of local industries folding up
Resource Limitation				
4. Limited capacity in terms of resources and infrastructure at individual, department and institutional level	Foster Intra University, Inter-University intra national, regional, South-South, North South Linkages	Sharing of human resources, infra structural resources by means of centres of excellence, exchange programmes and industrial relations at faculty, university, national, regional or international levels	Reduce cost and unnecessary duplication and increase synergy among institutions and between institutions and industry	Enhanced institutional support for U-I partnership
Limited human resources capacity of industry (Lack of technical staff for interpretation and transformation of research results) Lack of confidence in indigenous professionals	Popularisation of achievements and successes	Universities to regularly organize open days, exhibition to show off their achievements.	To create awareness of the research potential and outputs	Increased awareness of the achievements of local scientists and the role they can play in achieving the Millennium Development Goals (MDGs)

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Resource Limitation				
5.Inadequate funding of University – Industry linkage programmes	Broadened University-Industry-Government - development partner linkages must be accepted as indispensable tool for wealth creation and meeting MDG's etc	Encouragement of government and stakeholders to get involved in the financial and policy support of R&D relevant to University- Industry collaboration	To secure adequate and sustainable funding of the University-Industry linkages and projects	A change in perceptions so that Govt., industry itself and others become more willing to invest in University – Industry linkages
Protection against piracy				
6.Partners fear loss of trade secrets to competitors etc.	Intellectual property rights need to be addressed throughProper legal framework	Signing of Memorandums of Understanding for every kind of University Industry Government or other linkages	To ensure that Legal and ethical issues are not overlooked	• Patent laws and copy right laws formulated and implemented • A greater number of MOU's signed

Sub–theme 6: Higher education and HIV/AIDS prevention and control

Six problem areas were identified

Resource Limitation

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
1. Shortage of specialized personnel on HIV/AIDS within higher education institutions	• Promote capacity building in the area of HIV/AIDS			
	(a) *Capacity building in skills*	• Training of staff to gain knowledge and skill in issues relating to HIV/AIDS • Study visits for staff • Workshops and Seminars • Institutional training on issues of HIV/AIDS • Invitation of professional body to give periodic workshops for staff to upgrade knowledge on HIV/AIDS	• To build the human resource capacity for the teaching and training on HIV/AIDS	• Critical mass of experts in the area of HIV/AIDS
	(b). *Institutional capacity building*	• Equipping of libraries • Providing research materials • Workshops and Seminars • Linkage with other Universities and other institutions with expertise to train staff on HIV/AIDS	• To strengthen institutional capacity	• Existence of strong institutional support and enabling environment

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Resource Limitation				
1. Resistance to behavioral and attitudinal change and dealing with sexually active groups	Promotion and prevention of the spread of HIV/AIDS through education	• Formation of AIDS groups/ committees • Seminars and workshops • Counselling services • Peer education • Education on the use of condoms • Partnership with NGOs and other institutions in awareness creation	Modify behaviour and attitudes in higher education institutions with respect to HIV/AIDS	Modification in behaviour and attitudinal change
2. Inadequate funding of HIV/AIDS programmes	• Intensify advocacy for funding • Generation of funds from alternative sources	• Request Universities, the Government, international organizations, NGOs responsible for HIV/AIDS to increase the amount and support for HIV/AIDS issues • Development of HIV/AIDS policy in the Institutions • Collaborate with NGOs and other institutions in HIV/AIDS programmes	• Increase funding to support HIV/AIDS activities	Adequate funding for HIV/AIDS programmes
3. Limited access to health services	Improve linkage with health professionals	• Include health personnel in HIV/AIDS committees and programmes	• Capacity building for the affected and infected • Improved access to medical services	Improved quality of life for the infected

Problem Identified	Strategy to Address the Problem	Proposed Actions	The Specific Objectives	Expected Outcomes
Resource Limitation				
4. Low awareness of HIV/AIDS as a threat	Promote mainstreaming and integration of HIV/AIDS issues into curricula of higher education institutions	• Design programs for all students • Incorporate HIV/AIDS issues into common courses taken by all students e.g. Biology or Entrepreneurship courses. • Distance learning courses on HIV/AIDS • Have a compulsory course on HIV/AIDS	• To ensure knowledge acquisition and exposure of every student to the issues of HIV/AIDS. • To enable students acquire accurate and adequate knowledge on HIV/AIDS	Effective HIV/AIDS programmes into courses