

Concept Note on the Sub-Theme 3

Lifelong Acquisition of Scientific and Technological Knowledge and Skills for the Sustainable Development of Africa in the Context of Globalization

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1. Introduction:

This sub-theme attempts to identify ways and means of building and strengthening Africa's capacity to generate, acquire, adopt and utilize scientific and technological knowledge and skills to confront the myriad and diverse challenges of sustainable development in the context of global integration. The assumption of the sub-theme is that- Africa's development has to be fully anchored in the development and utilization of high level knowledge and skills for its people to effectively deal-with day to day challenges of development and gainful engagement at global level.

The purpose of this concept paper is thus to initiate and guide discourses and sharing of experiences of reforms, processes and innovations valuable to the development and utilization of African scientific and technological capacities.

The concept paper starts with a brief discussion of the context of African development in terms of challenges and opportunities, defines the key concepts utilized in the sub-theme, before divulging into some critical issues to be addressed. The preparatory process is then indicated, before concluding observations.

2. Background and Context: Challenges and Opportunities in Africa:

This year a number of African countries celebrate fifty years of political independence, joining others who have already done so. Hence the preparation of the proposed Triennale is at a threshold when a persistent question is being raised as to whether Africa will break out of malaise of the past to realize its potential, as countries in Asia and Latin America have done. The issue is whether, the 21st century hyped as a "time for Africa" will bring the desired reawakening of the continent. The development of scientific and technological capacity and of education as a whole is thus part and parcel of the critical assessment.

The legacy of the last five decades of independence has left the continent still mired in challenges, and many unfulfilled promises. First, most African states face the challenge of legitimacy and credible democratic governance based on rule of law, and effective and efficient institutions. The capacity of most African states to articulate policies and strategies for reforms and to implement them is often lacking. A number of countries on the continent are currently termed fragile or failed states, meaning they have limited capacity to drive their development agenda, let alone scientific and technological innovations. In some of the countries, governance institutions are so fragile that democratization and implementation of socio-economic reforms are stymied, thereby breeding instability and violations of human rights. Consequently, effectiveness of state and governance institutions in most countries, and

particularly those emerging from or are in conflicts, is highly compromised. The status of essential institutions and infrastructure, in some of these countries, are too dilapidated to provide quality services needed for any serious scientific and technological work. Rehabilitation and reconstruction are thus a priority, before contemplating building new initiatives. Reforms of education and training institutions are central to the process of rehabilitation and reconstruction.

Second, the continent still faces the challenge of economic marginalization in terms of contribution and benefits from global trade. Africa's share of global trade is still marginal, being about 3 percent (ADB, 2009). Most countries continue to be predominantly producers of raw materials: agricultural and mineral commodities and oil. There have been no significant movements towards value-addition to primary products since independence. The private sector, which in countries of other regions is a key driver of economic development, is relatively small, in exception of South Africa. Consequently, the state remains the major economic player. The continent compares very poorly with Asia in attracting foreign direct investments (FDI). In 2005, for instance, Africa inflow of FDI was 2.2 percent compared to 17.2 percent for Asia (UNCTAD, 2007).

Third, a high proportion of African population is youthful. In 2007, the 15-34 age-group was 34.9 percent (UN, 2007). Taken together with those below 15, it is clear that high levels of investment in education, training, improvement of health services and employment generation are required. With high rates of youth unemployment, millions of young people are underemployed in petty trade, engaged in less productive activities, or idle. This population is also vulnerable to diseases such as HIV/AIDS, Malaria and Tuberculosis (TB). In conflict situations, they easily become either the victims or perpetrators of violence.

Fourthly, regional integration is a major challenge to improving trade, attracting investments, and harnessing Africa's potential in agriculture, water, energy, minerals and oil. Development of regional institutions and infrastructure would bring economies of scale and unleash major economic benefits. The revival of existing regional economic entities (COMESA, EAC, ECOWAS, IGAD, SADC, etc) is encouraging, but a great deal of work is needed to bring about desired benefits of integration.

Fifth, the transformation of conflicts within African countries, peace building and reconstruction, are also challenges that Africa must face squarely and urgently to develop and retain the requisite human resources for sustainable development.

Finally, the ongoing environmental degradation and climate change pose threats of food security, water supply, and ecological systems that are a persistent challenge. Sustainable development is therefore not just an option for Africa but a scientific and technological imperative. The continent also faces the challenges of implementing international commitments such as Millennium Development Goals (MDGs), trade and climate change protocols.

These, among other challenges facing Africa, need to be anchored within a framework of effective institutions (state, private sector and civil society etc) that articulate and implement requisite development policies. The development of appropriate education and training programmes at all levels is central to building that capacity. Quality and diversified tertiary education and training strongly oriented towards the acquisition of knowledge, reinforcement of critical skills and competences for utilization of scientific and technological know-how is

indispensable. This is a prerequisite for repositioning and favorable integration of Africa into the global knowledge economy.

Sub-Theme in the History of the 2008 Biennale

The 2008 ADEA Biennale underlined need for a paradigm shift in structure and substance education systems in African countries given the challenges posed by national and global socio-economic environment. The need for holistic, integrated and diverse structures was emphasized as means of catering for all learners taking different educational pathways to acquisition of knowledge and skills. The paradigm shift will recognize the diversity of tertiary education and training institutions, ownership and partnerships as well as content of course offerings. Implied in the shift is the need to make education at this level complementary to other levels in terms of acquisition of critical skills for continuous learning to enhance scientific and technological competences needed in globalizing Africa. This sub-theme continues the discourses initiated during the 2008 Biennale in terms of quality and relevant training of knowledge workers for sustainable development.

In this context, the content of tertiary education and leadership of institutions thereof assume an increasing importance. The thrust of the sub-theme as the title implies, is acquisition and utilization of scientific and technological skills to usher Africa into global knowledge economy.

3. Challenges of Development of Tertiary Education in Africa:

The fact that higher education institutions in developed and emerging economies play a critical role in the development of global knowledge and technological advancement, has not escaped attention of Africa. That these institutions have also built close linkages with industry for utilization of new knowledge and innovations in the productive sectors and services of the economy is a feat to be emulated.

The development of knowledge economies has also fueled unprecedented growth of higher education, notable especially in Asian and Middle Eastern countries. The leading universities in USA and Europe are also extending their reach in other regions through cross-border campuses and distance education through Information and Communication Technologies (ICT). In this situation, competition for students, staff and resources has become global and consequently very intense. International mobility of students has not only become a common phenomenon, but also big business. Australia, India and Malaysia have become major destinations of African students, thereby becoming serious competitors to USA, Canada, UK and other European countries (N.V.Varghese, 2008). Student mobility within Africa is also a feature of tertiary education, South Africa, Nigeria and Uganda being the main destinations.

The development of higher education in Africa has registered impressive growth in the last two decades. The number of institutions has increased and the existing ones expanded. Student enrollments have sky-rocketed, constraining available infrastructure, resources and staff. The dominant role public universities played in the initial decades of independence, has been breached with entry of private universities and colleges into the arena. With this expansion, issues of access and equity, financing, relevance of curriculum offerings, quality of education provided and decline of research capacity and output have come up.

Commercialization and “vocalization” of university education has become a common practice in determining of courses offered, and in attracting the students (Mahmood, Mamdani, 2007). The idea of entrepreneurial universities has emerged as an extension on the idea of a “development” university that shaped major programmes and human resource output immediately after independence.

In addition, the supply of a highly skilled labor force with tertiary qualifications to meet the rising demand of the labor market is weak in the continent. The new graduates are also ill-prepared to contribute to the competitiveness of their respective countries through knowledge absorption and innovation.

The changing higher education landscape in Africa is attributed, to a large extent, to the emerging realization of the benefits that can accrue to the continent through enhanced global competitiveness and participation in the knowledge economy. At national level the change is driven by demand for improved qualifications by individuals to compete for promotion and the limited jobs in the labor market. In addition, there is a felt need to redirect education and training of youth and adults towards acquiring scientific and technological knowledge and skills necessary for unlocking Africa’s economic potential and to reap benefits of integration into the global economy (World Bank, 2003 and 2008; PHEA, 2008).

For African countries to develop and improve tertiary education institutions to produce highly qualified and competent human resources, generate knowledge and innovations, each country need to come up with strategies of tapping this potential for economic and sustainable development. The importance of transformation of tertiary institutions cannot be over emphasized.

Knowledge and Skills for Sustainable Development in Africa

The world has entered into an epoch where knowledge has become a key driver of economic growth, technological advancement and sustainable development. Research has therefore assumed greater importance in the process of wealth creation. Investment in research capacity, institutions and programs has become vital in maintaining global competitiveness and innovation in the market place. Countries that are dominant in the global economy (USA, UK, Japan and now China) are therefore investing heavily in research capacity and infrastructure for creation of new knowledge and technologies. Research universities and institutes in these countries have become the epicenters of not only generation of new knowledge and innovations, but also rolling out new products and new processes in the global market.

Leading research universities in China, India, Singapore and South Korea have moved into this direction. In this way, the emerging economies intend to enhance their competitiveness and strengthen their stake in the global knowledge economy. As economies move into this direction climate change and sustainable development have come into the fore.

Africa is endowed with vast natural resources, mineral wealth and agricultural capacity, yet little profits have been gained from their exploitation. In addition, most of its products have lost market value in an increasing technological market as a result of limited value- addition. Science and technology is perceived as the key driver for socio-economic development as well societal transformation.

Sub-Saharan Africa is characterized by low investments in Research and Development (R&D) this being less than 0.5 percent in 2007 (UIS.2009). The average expenditure on R&D as proportion of GDP for OECD was 2.6 per cent in 2009. On the other hand, the proportion of GDP allocated to Africa averages about 0.3 percent. The leading African countries in terms of R&D intensity are: South Africa, Tunisia, Morocco, Egypt and Sudan. Other countries in Eastern, Central and Western regions of Africa are displaying keen interest in scientific, technological and innovation by factoring increased funds for R&D into their budgets.

Most of the funds for R&D in Africa come from government (UIS.2009). In other countries public and private partnership is the norm. This is the case in emerging economies which are investing increasing proportions of their GDPs in generating new knowledge and innovations. For instance, (South Korea (3.5%), Singapore (2.6%), China (1.5%), Brazil (1.0), Malaysia (0.8) and India (0.6) (UIS.2009). The knowledge generated thereof is intended to fuel long term economic and technological development. These countries are also investing heavily in the development of higher education and opening up opportunities for an increasing proportion (about 50 percent) of the postsecondary populations to access tertiary education.

In Africa only about 5.0 percent of university age cohort is accessing higher education. And those who are enrolled are all in humanities and social sciences. The proportion enrolled in science-based faculties and professions remain low. While science and technology development has received increased attention in policy statements in Africa, there are no notable changes in R&D investments. This explains, to a large extent, the limited scientific and technological contributions by African scientists, engineers and researchers in leading scientific and technological journals. Dilapidated infrastructure, lack of resources and poor reward systems are common features, leading to brain drain of the few graduating from local institutions. Consultancies have often shaped how research is undertaken in Africa. Most of African researchers are engaged in consultancies as a means to supplement their meager income.

In China, India and S. Korea, on the other hand, the trend is being reversed. Highly trained scientific personnel are attracted back to their countries of origin through improved research opportunities and other incentives. In Africa, it is very hard to sustain and fully engage the existing scientific and technological communities by provision of satisfactory infrastructure and attractive incentives.

4. Key Concepts Utilized in Sub-theme 3:

A number of concepts will be utilized to guide studies which will be undertaken under this sub-theme. Lifelong learning refers to a process whereby a learner acquires skills to learn, analyze, critically evaluate and utilize emerging knowledge and skills. These attributes continue throughout the life of an individual in situations of schooling, working or leisure. Lifelong learning enables the individual to renew his/her knowledge, skills and attitudes in the changing circumstances of life.

This sub-theme takes scientific and technological skills as those that enable a person to acquire knowledge, analyze, adopt and apply it to deal with his or her societal developmental needs. This entails creative divergent and convergent thinking.

Sustainable development implies a process that ensures resources are utilized in a manner that does not destroy or deplete them, but allows for renewal and conservation for future utilization.

A knowledge economy is an economy which is fueled and propelled by knowledge emanating from research, and entails utilization of products and processes emerging from scientific and technological innovations for economic benefits.

5. Main Issues for the Sub-Theme:

In Africa today, there are diverse pathways to acquisition of knowledge and skills. There also diverse locations for carrying out, adoption and utilization of research. As there are many diverse pathways, there also many players in the field. These includes: the state, international and regional organizations, private sector, NGOs, informal sector, communities and individual entrepreneurs. In the government sector, there are also multiple players, embracing various ministries and government agencies. This sub-theme intends thus to capture this diversity and differentiation in acquisition and utilization of scientific and technological knowledge and skills in African societies. However, we must recognize the primary role which tertiary institutions play in the initial and lifelong acquisition of knowledge and skills.

While this sub-theme will endeavor to capture experiences, lessons and innovations emerging from the broad arena of practice and utilization of scientific knowledge in various sectors, we shall pay more attention to tertiary institutions located not only in the ministries responsible of basic education and higher education, but also sectors such as health, agriculture, water and communication. Nevertheless, below we outline some of the challenges related to development of scientific and technological capacity as related to tertiary institutions.

While tertiary institutions and in particular the universities have changed tremendously since independence, there are still many changes to be carried out for these institutions to play their rightful role on national, regional and global levels (Salmi, Jamil, 2009).

First, a balanced and differentiated development of university education and other tertiary institutions is needed. This will bring complementarities in skill development to meet requirements of the economy. It would also open up pathways for recognition and rewarding of skills and competences gained in the informal, non-formal situations and workplaces. Thereby enhance continuing and lifelong education.

Second, they need to cultivate creatively the articulation of quality learner-centered education between of lower levels of education and the tertiary education. And in particular ensure continuity and advancement in preparation of learners at lower levels of education and training for their success in acquiring appropriate skills in tertiary level education and training.

Third, there is need to cultivate solid partnerships between public and private sector in the development of tertiary education. This is critical for mobilizing resources and synergy required for upgrading science education, the quality and relevance of teaching and learning, and in support of research that geared towards generating, dissemination and utilization of new knowledge and innovations for development.

Fourth, there is also need to build critical capacities for leadership and governance in S&T, teaching, research and dissemination of knowledge through increased investment in post-graduate education, and other forms of in-service training and upgrading of critical skills and competences. And at the same time it is imperative to address the current tension between teaching and research requirements in tertiary education.

In addition, there is increasing realization globally of the importance of close cooperation between countries through sharing of resources and technologies, addressing common problems, and facilitating the free movement of people. Increased cooperation through trade and services has resulted in a corresponding need for education systems to be adapted to respond to the demands for trained people with recognized qualifications who are able and ready to move and serve in any part of the world (Sabaya, W: 2004).

6. Focus of Studies under Sub-Theme 3:

- i. Articulation of policies, coordination and practices related to science and technology in Africa (allocation of research and development resources, formation and utilization of personnel institutions, etc)
- ii. Lifelong learning of science and technology (status of science education and infrastructure, curriculum, assessment, preparation of science teachers, educating the next generation of scientists and technologists and entrepreneurs in Africa, and formal, non-formal and informal learning (PHEA, 2008) Investing in curriculum reforms especially those relating to teaching and learning of science, mathematics and creativity, and mentoring the next generation of scientists, technologists and entrepreneurs is imperative).
- iii. Preparing youth for lifelong and sustainable engagement in science and technology in national, regional and global context
- iv. What are the critical skills and competences that need to be cultivated at lower levels, for learners to succeed in tertiary education and continue learning beyond graduation in the workplace?
- v. The portrayal of scientific and technological innovations, achievements and process in print and electronic media
- vi. Linkages and synergies of tertiary education with industry in research, dissemination, adoption and utilization of innovative practices in industry and production, channels for updating of knowledge and making curriculum, learning relevant
- vii. The role of tertiary institutions in research and innovations, adoption of science and technology and their impact on gender issues in the development of science and technology in Africa
- viii. Inequalities in access to scientific and technological opportunities (gender, marginalized groups, regions, persons with disabilities)

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- ix. The relevance of ICT in utilization of science and technology for development
 - x. How does higher education meet the diversity of learning needs of African youth and adults (who have experienced formal, informal and non-formal education and training) in the varying political, social and economic circumstances
 - xi. Public, private and community partnership in promoting lifelong acquisition in scientific and technological skills for sustainable development
 - xii. What is working, where and in what fields; best practices in adoption and utilization of scientific and technological skills; and learning from African experiences.
 - xiii. What are the ongoing reforms in tertiary education to bring overboard lifelong learning and acquisition of critical skills and competences in science and technology
 - xiv. Regional cooperation and international engagement in science and technology: role of African centers of excellence
 - xv. Learning from experiences of international players and networks in science and technology development (ADB, AU, UNESCO, World Bank, NEPAD, and AAU, Association for the Advancement of Higher Education and Development (AHEAD), Partnership for Higher Education in Africa (PHEA), Africa Higher Education Collaborative (AHEC), Higher Education Research and Advocacy Network in Africa (HERANA etc).
 - xvi. Learning from experiences in Asia, North America, Europe and Latin America.
 - xvii. How and in what ways are African countries and institutions building and strengthening enabling environments for science and technology to thrive (institutional leadership and governance, renewal of infrastructure, gender issues, brain drain, scientific and technological capacities).

7. Preparatory Process of the Triennale:

The process towards Triennale 2012 is intended to be inclusive and participatory. This sub-theme expects to receive and solicit contributions from government ministries and institutions, international organizations and donor agencies, NGOs, researchers, scientists and innovators. These contributions will be in form of country papers, case studies by agencies and NGOs, background papers and stories from individual innovators and entrepreneurs.

The sub-theme will endeavor to build partnerships that are inclusive and cover the diversity of African regions and institutional experiences. Some of these contributions will be presented at the Triennale and will form the basis of the discourses and sharing thereof.

8. Conclusion:

The future of Africa depends on reclaiming and seizing upon its position in a globalizing world. This entails a successful repositioning of its scientific and technological training and indeed economy in such a way that it does not only become a major player, but also its citizens benefit substantially through productive and creative engagement. It would entail,

thus, repositioning of its intellectual, social and cultural capital in a creative manner to utilize its resources in ways that are beneficial to its people (African Union, 2005 and World Bank, 2008).

For this repositioning to occur, Africa needs to look critically at the processes of acquisition and application of knowledge, skills and competences in sciences and technology by its youth and adults. The imperatives of this need is, therefore, to align its education and training systems from the earliest stages to higher education, into a lifelong process of acquisition of critical scientific and technological skills. While teaching and learning of scientific and technological skills in the first and second cycles of education is fundamental to participation in the global knowledge economy, the development of higher education assumes an increasingly pivotal role.

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