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الرابطة لأجل تطوير التربية في إفريقيا  
Association for the Development of Education in Africa  
Association pour le développement de l'éducation en Afrique  
Associação para o Desenvolvimento da Educação em África

**Triennale on Education and Training in Africa  
(Ouagadougou, Burkina Faso, February 12-17, 2012)**

**Promoting critical knowledge, skills and qualifications for  
sustainable development in Africa: How to design and  
implement an effective response  
through education and training systems**

### **Sub-theme 3**

**Lifelong acquisition of scientific and technological  
knowledge and skills for Africa's sustainable  
development in a globalized world**

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## **Synthesis Paper- Sub-Theme 3 Executive Summary**

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**Working Document**

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**DOC 0.1.3**

# 1. EXECUTIVE SUMMARY

## Introduction

1. Sub-Theme3 synthesis paper brings out salient points that need attention of policymakers, educators, scientists, economic actors, development partners and civil society to build and intensify utilization of scientific and technological capacities for sustainable socio-economic development in Africa.

2. The paper is informed by a number of contributions from country teams, development agencies and private sector, the Association for Development of Education in Africa (ADEA) Working Group on Higher Education, regional organizations and individual consultants. The contributions were supplemented by a literature review of reports by the African Union (AU)/New Partnership for Africa's Development (NEPAD), the World Bank, United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Economic Commission for Africa (UNECA) and the African Development Bank (AfDB). Studies by regional research networks and researchers were also utilized.

3. Africa is richly endowed with abundant natural resources, diversity of cultures and indigenous knowledge, and a population which is predominantly youthful. Nevertheless, it faces the challenges of poverty, food security, health and climate change. This synthesis discusses how Africa can utilize its natural and human resources to fundamentally transform socio-economic status of its people. The envisaged transformation would be anchored on acquisition and utilization of scientific and technological knowledge and skills to add-value to natural resources, and tap the energy and talents of the people, especially the youth. This would facilitate the continent to be competitive and secure its rightful share of the global market and opportunities.

4. The synthesis paper has identified eight key issues critical to the process of acquisition and utilization of scientific and technological capacity for innovation and sustainable development in Africa for discussion at the 2012 Triennale.

## Articulation of Science and Technology Policies and Programs in Africa

5. The analysis starts with issues of articulation of policies and programs pertaining to the development of scientific and technological capacity and institutions in Africa. The paper has analyzed how policies and programs are articulated at continental, regional, national and institutional levels. The analysis has focused closely at the AU/NEPAD policy document entitled *AU/NEPAD, Africa's Science and Technology Consolidated Plan of Action (CPA) (November 2005)*. In addition to the policies and programs articulated at the continental level, the paper has shown how these have been cascaded by Regional Economic Communities (ECOWAS, EAC, COMESA and SADC) and at national and institutional levels.

6. A major issue identified as a constraint to the realization of science and technology in Africa is lack of effective mechanisms for implementation, monitoring and evaluation. The CPA has also initiated an ASTII process for this purpose.

7. The analysis has concluded by identifying action points to strengthen implementation of the agreed agenda in science and technology. Building national capacities in African countries was identified as a critical need for implementation of the agreed commitments at various levels.

## Foundations of Lifelong Learning of Science and Technology

8. The ability to continue to learn as the world changes, knowledge increases and technologies become more sophisticated is very critical for survival and sustainable development. The analysis has

identified three critical areas to lifelong learning namely: i) appreciation and incorporation of indigenous knowledge in the learning process; ii) quality teaching and learning of science and technology in schools; and iii) investing in quality teacher education especially in science and mathematics. The paper argues that integrating indigenous knowledge within the education system coupled with quality teaching and learning of science and technology in the early stages of basic education is crucial to success in acquisition, adoption of scientific and technological knowledge at other levels of education and training, and in the society.

9. Tertiary education bears the major responsibility for pre-service training of teachers for basic and technical education. While recruitment into teacher education and formation of teachers is major constraint in provision of quality education at all levels, research to guide policy and interventions is lacking. Hence increased attention to research on status of science education at all levels: content, pedagogy and practice is required.

10. Quality of science education in Africa will ultimately depend on the quality of those recruited for teacher education, quality of in-service training and professional development provided especially for mathematics and science teachers, and in sufficient numbers to meet current and future demand for the rapidly changing enrollments at all levels of the education system. The paper has argued that the strategies proposed are critical to establishing a firm foundation for lifelong learning of mathematics and sciences among African learners.

### **Preparing African Youth for Science and Technology Endeavors**

11. By any definition, youth constitute a large proportion of the population of Sub-Saharan Africa. In 2010 the total Africa population was estimated at 867 million and youth age 0-14 constituted 43.2 per cent, while those aged 15-34 were 34.9 per cent. Those above 35 were 22 per cent. However according to the United Nations Population Fund 2011 report, Africa population surpassed a billion people in 2009 and is projected to increase to two billion in the next 35 years (2044). This population will however remain relatively young, as fertility in most African countries is unlikely to change dramatically in the next three decades. According to Michelle Gavin, 2007 “Africa is currently in the midst of what demographers call “a youth bulge,” indicating a significant increase of young people in the structure of the population. The impact of this youthful population on the current and future developments in Africa is worthy a close analysis.

12. Investing in “youth bulge” to acquire scientific and technological knowledge and skills through quality education at all levels, provision of healthcare and democratic space through visionary leadership, offers a great opportunity for Africa to turn its rich natural resources into a firm foundation for economic growth, entrepreneurship, employment creation, competitiveness and sustainable development.

13. The national governments should establish mechanisms and institutions for promoting innovations among youth. Articulation and implementation of comprehensive and inclusive policies and mechanisms to build scientific, technological and entrepreneurial capacities of youth for socio-economic transformation of Africa societies should be policy imperative. National governments and other stakeholders should also widen opportunities for young scientists to access research funds and fellowships for further studies to improve their capacities for research and innovation.

14. Ignoring the youth potential is to deny Africa its most precious resource for sustainable development.

### **Tertiary Institutions: Research, Innovations and Linkages**

15. Tertiary education is highly valued in Africa. The proportion of household income and national budgets allocated to tertiary is indicative of the high demand and value placed on access to tertiary education. The almost insatiable demand for tertiary education is fueled by the increasing number of

secondary school graduates and adults interested in improving their qualifications and skills. However, despite the rapid expansion of tertiary education institutions in the last two decades and increased resources, Africa remains the only region in the world with the lowest proportion of higher education cohort accessing tertiary education. In 2011, only 6 percent of appropriate age cohort was able to access higher education. Tertiary institutions are critical to socio-economic development in Africa as they represent a concentration of resources and talents (staff and students). In many African countries they are an integral part of the national research and innovation system.

16. The synthesis paper has discussed at the length the role of tertiary education in transmission of scientific and technological knowledge, research and innovations. A number of issues have been explored under this rubric: i) the nature and implications of the expansion of tertiary education; ii) the quality of education provided thereof and strengthening of QA especially in scientific and technological education; iii) the role of centers of excellence in building the necessary capacity for teaching and undertaking relevant research and iv) university- industry linkages.

17. The growth of tertiary institutions in the last two decades has been remarkable. While private universities continue to increase at a higher rate than the public ones, student enrolments in private institutions remain low. Hence public universities remain dominant in terms of diversity of academic programmes, public funding, research infrastructure and overall quality of staff and student body.

18. Given the limited resources allocate to higher education and R&D, issues of transparency, efficiency, accountability, and effectiveness in utilization of the available funds in expansion of tertiary institutions and in the improvement of research and innovation processes should be given more attention than hitherto.

19. On the whole the expansion higher education particularly in sub-Saharan Africa has not given appropriate weight to science, technology, research and innovation. Consequently there is an urgent need to reorient African universities and other tertiary institutions towards science and technology to bring out the much needed balance between social sciences and science-based courses and professions.

20. There is no question that Africa needs differentiated universities, training colleges, research institutes, polytechnics and other tertiary institutions to meet its scientific and technological advancement and other developmental needs. A balanced development of tertiary education to meet diversity of needs of national economies is therefore necessary. A policy rethink on the current approaches to increasing places in higher education is urgently needed.

21. A continuing challenge is not only to improve overall quality of education and professional training in African universities but also to create Centers of Excellence in post-graduate training, post-doctoral exposure and research and development. Efforts geared towards this are notable at national, regional and international levels. The establishment of African Institute of Science and Technology and the proposed Pan-African University are initiatives intended to harness Africa's talent in a collaborative manner by utilizing limited resources effectively through concentrated endeavor in critical and strategic fields of development.

22. Under university –industrial linkages, two papers were prepared focusing on this critical concern in development discourses. Both have given examples of university and productive sectors linkages, and analyzed various dimensions of the emerging relationships. A number of action points have been identified. University –industry linkages need to be re-defined to bring it closer to the African socio-economic reality, especially the fast growing small and medium enterprises in the informal sector. Universities need also to articulate policies and rules to guide and govern the relationships between them and the productive sectors. The relevance, focus and quality of research and innovation capacity need to be strengthened to meet the expectations of the productive sectors.

### **Exclusion and Inequalities in Access to Science and Technology**

23. The equalities in access to education and subsequently to science and technology related fields tend fall into three broad categories: gender, regional and socio-economic status. Two contributions by FAWE entitled, *Strengthening Gender Research to Improve Girls and Women's Education in Africa* and *FAWE Gender in Higher Education Research Synthesis for ADEA Triennale* have been analyzed to highlight gender inequalities in access to scientific and technological knowledge and skills, under-representation and under- utilization in science and technology in the Africa society.

24. Consequently, women remain an underutilized resource in science, technology and innovation, robbing Africa the potential and talent of women. To improve access and conditions of women in higher education it is important to increase resources for gender mainstreaming and implementation of national policies and international commitments (EFA) and MDGs). The gender inequalities observed in tertiary education and R&D can be traced to the quality science education learning in primary and secondary schools.

25. While gender inequality in access to higher education is a subject to many studies, and policy debates, it should nevertheless be recognized that other forms of inequalities do exist. The most obvious is the increasing marginalization of students from poor households accessing tertiary education. In the first instance, children coming from conditions of poverty, at the initial stages have problems of accessing basic and secondary education, continuing to the other levels, and performing well to be considered for the very competitive access to tertiary education. However access to science related courses and professions is the most constrained. Discourses on social class and marginalized communities access to scientific and technological fields is limited by lack of systematic and reliable data, an issue that researchers and policymakers need to address.

### **ICT for Scientific and Technological Capabilities and Innovations**

26. The rapid growth of ICT in Africa has created enormous opportunities and innovations that have accelerated political and socio-economic development. There is still a major digital divide between Africa and the rest of the world that could continue to widen if Africa does not address the persisting challenges, namely: (i) articulation of ICT policies and strategies (ii) development of ICT infrastructure; and (iii) capacity building.

27. Having quality capacity as well as quantity particularly on ICT is critical to building a creative and innovative knowledge society for sustainable socio-economic development in Africa. Building a scientific capacity requires not only adequate funding and infrastructure but also effective linkages where information and experiences are shared and learned. Governments that have embraced ICT in their economic development plans and vision documents need ICT professionals to oversee implementation of agreed policies and plans. The shortage of professionals is real, and those in place overworked and underpaid.

28. Hence African countries should go beyond articulating policies and investing in ICT infrastructure, to build and strengthen critical mass of professionals to spearhead changes required to realize MDGs, national visions and sustainable development.

### **Galvanizing Public Support for Scientific and Technological Development**

29. Mobilizing public support for scientific and technological development in Africa is an important input in the process of implementation of commitments for Science, Technology and Innovation. Three elements are highlighted here: i) strengthening political will and building ownership of the science and technology agenda and strategies for monitoring and evaluation of implementation; ii) cultivating scientific and technological literacy among politicians and decision makers; and ii)

building creative partnership with media to communicate messages that underpin the contribution of science and technology to sustainable socio-economic development in each country.

### **Strengthening Regional Cooperation and International Engagements**

30. Development of quality institutions for development of science, technology and innovation requires enormous resources (financial, infrastructural and human capital) which can be brought together through regional initiatives. The Lagos Plan of Action, 1980 and AU/NEPAD CPA, 2005, are some of the policy documents that recognize cooperation and collaboration in science and technology as a necessity for Africa's sustainable development and self-reliance. It is also noteworthy that countries which have articulated their national strategies for scientific and technological development have also indicated possible areas for regional cooperation.

31. Tapping the trained and qualified human resources base in Diaspora to support the development of science and technology in Africa is an unexplored opportunity and a challenge that need to be dealt with.

32. The synthesis paper has reaffirmed the value of regional and international cooperation in science and technology to bring out optimal benefits of collective actions to tackle common problems, and to tap the limited financial and human resources for this purpose.

### **Conclusion**

33. In conclusion, the paper emphasized a number of areas where changes are required. These include: teaching and learning of mathematics and sciences at all levels of the education system, building scientific and technological capacity of the youth, revitalizing research and innovative capacities of the universities and linking them to productive sectors of the economy, ensuring inclusion of girls and women and marginalized groups in the development of scientific and technological capacity, building ICT infrastructure and capacity as a platform for change and innovation and strengthening the burgeoning regional cooperation. The paper calls for urgency in implementing science and technology agenda and visions for Africa to realize full benefits of its natural resources and youthful population in economic growth, industrialization, global competitiveness and sustainable development.