



# 2012 ATPS ANNUAL CONFERENCE & WORKSHOPS

HOSTED AT THE NEW AFRICAN UNION  
COMMISSION CONFERENCE CENTRE  
19-22 NOVEMBER | ADDIS ABABA, ETHIOPIA



## Emerging Paradigms, Technologies & Innovations for Sustainable Development: **Global Imperatives and African Realities**



### **PROGRAMME & BOOK OF ABSTRACTS**

In collaboration with:

JOHN TEMPLETON  
FOUNDATION

European Academies  
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Science Advisory Council



With support from





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EMERGING PARADIGMS, TECHNOLOGIES  
AND INNOVATIONS FOR SUSTAINABLE DEVELOPMENT:  
**GLOBAL IMPERATIVES & AFRICAN REALITIES**



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## 1.0 PREAMBLE

The quadruple challenges of imploding economies, deepening and widening poverty, climate change, and disappearing environmental assets (natural resources and biodiversity) around the world necessitate a careful rethinking of knowledge platforms and development pathways at global, continental and national scales. With the recent global financial crisis and deepening social and environmental crisis in the past decade, science experts and policymakers alike are united in the search for alternative development paradigms. Major global policy support institutions such as the World Bank (WB), the United Nations (UN), Organization for Economic Cooperation and Development (OECD) amongst others, now sing the same song: "there is need for new paradigms and pathways for economic growth that is inclusive of social and environmental sustainability". A recent report launched by the World Bank (2012) aptly concludes that, "inclusive green growth is necessary, efficient and affordable,...., the search for solutions needs to shift from the search for more financial resources, to "getting smart". In the same vein, the recent Global Green Growth Summit held in South Korea, re-echoed the collective voice of global leaders that "technological innovations will be central to the creation of a new and more sustainable development paradigm". Many global assessments and reports now converge in the conclusion that having the right kind of science, technologies and innovations is at the heart of sustainable development (UNESCO, 2010, UNEP 2011, UNDP 2012, UNCTAD 2012, World Bank 2012). Be it the first and second carbon intensive industrial revolutions which are now foundering or the third industrial revolution which is now evolving under different nomenclatures (Green Economy, Green Growth, Inclusive Growth, Climate Resilient Economy, Low Carbon Economy, etc.), STI has remained the constant driver of productivity and efficiency gains in economic development history.

In June 2012, World Leaders, the Academia, the Private Sector Actors and the Civil Society convened in Rio De Janeiro, Brazil under the auspices of the United Nations Conference on Sustainable Development. Reconnaissance surveys in Africa suggested that 20 years after the first Rio conference, stakeholders' expected more proactive and practical actions in addressing poverty, hunger, energy access, energy security, efficient and sustainable resource use and ecosystem management, improved agricultural value chain management, etc. The general feeling amongst policymakers and policy analysts consulted was that the global governance architectures be it in the socio-political, economic or environmental realms still leaves Africa disadvantaged in many ways. This is largely due to lack of political will to implement negotiated agreements and international commitments; global mechanisms and institutions that favour binomial relationships between the global north and the global south with knowledge, technologies and innovations predominantly flowing from the former to the latter; and general inequities in the distribution of skills and capacities for innovation and wealth creation. The Ministers of African States have therefore aptly noted that the critical foundation for sustainable development must include more inclusive global governance; strong and responsive pro-poor institutions for wealth creation, social equity and equality; poverty eradication and environmental sustainability, as well as sustained progress in the achievement of internationally agreed commitments including the Millennium Development Goals (MDGs). They called on Rio+20 to reinvigorate political will and international commitment to implementing the goals and ideals of sustainable development and urge developed countries to proactively fulfill previous commitments and pledges to help Africa's efforts to achieve sustainable development.

The optimism that the Rio+20 conference outcomes was expected to deliver greater global commitment to sustainable development and encourage countries of the global north to step up development assistance to African countries was well placed. However, a pragmatic assessment of global development trends and resource potentials suggest Africa is on the move (UNDP 2012), and the technical resource and productivity potentials for green growth is substantial. Huge opportunities therefore exist for home grown development on the continent, but the STI capacities of the African countries to effectively participate in harnessing these

comparative advantages remain dismal (Urama et al., 2010). Though Africa's scientific capacities and Gross Domestic Products (GDP) growth have improved during the past decade, technological and innovation capacities remain low and the requisite institutional and governance infrastructures are only just emerging (Urama et al., 2010; UNESCO 2010, UNDP 2012). Whereas there are pockets of success in application of STI including the mobile telephony and telecommunications, among other factors, which contributed to the sustained economic growth in the continent during the past decade, the continent generally lags behind in skills and competencies required to fully reap the benefits afforded by STI for its development. This can be attributed to many factors, but key amongst these are the lack of skills and capacities in the area of STI to guide and foster an African development agenda, inadequate implementation of STI policies and programmes, and limited political commitment.

It is expected that as the world "gets smarter", transitions away from hydro-carbonated industries and natural resource intensive economies will be imperative. Continued reliance on cheap exports of primary resources will not only be environmentally unsustainable and economically inefficient, but also socially unacceptable. Building STI capacities, knowledge systems and structures, knowledge circulation and networks, and effective valorization of STI knowledge will therefore be the bedrock for sustainability of nations in the coming decades!

Africa cannot afford to remain reclusive of the emerging global realities and social, economic and environmental challenges of climate change, biodiversity loss, deepening water stress, energy price hikes, etc.; neither should she remain a global consumer of knowledge, technologies and innovations in the new global economy, the architecture of which is emerging today. The first Africa Forum on STI hosted by the Republic of Kenya from 1-3 April 2012 and co-organized by African Development Bank (AfDB), African Union Commission (AUC), United Nations Economic Commission for Africa (UNECA), United Nations Educational, Scientific, and Cultural Organization (UNESCO) and Association for the Development of Education in Africa (ADEA), called for African countries to, among other things, design STI policies and programs to implement strategies to support inclusive growth, employment opportunities, and sustainable development in Africa.

The international conference and workshops convened by the African Technology Policy Studies (ATPS) and its partners will reflect on a post-Rio+20 futures for Africa. To make good global commitments to sustainable development in Africa, we believe that African countries would need strategic transformative reforms in its knowledge structures (from mono-disciplinary certificate education to trans-disciplinary systems studies, entrepreneurship and innovation capacity development); institutions and governance structures (from neo-colonial knowledge dependence to governance structures that are fully embedded in Africa's socio-political, economic and cultural realities); Agricultural systems research and policy (from focus on incremental productivity enhancing measures to value chain approaches and technologies that may enhance quantum leaps in value addition including on-farm factor productivity improvements, enhanced shelf life and market value of agricultural products); knowledge circulation and networks (to enhance intra-African knowledge flows and networks), and development pathways to enhance transitions towards poverty reduction and wealth creation for inclusive green growth and development on the continent.

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*1. The important role for science, technology and innovation in fostering socio-economic development has been recognized by African Heads of States in their various declarations including the Lagos Plan of Action, the African Union/New Partnership for Africa's Development (AU/NEPAD) Consolidated Plan of Action and policies of the Regional Economic Communities (RECs) and Member States. However, like most policies, implementation has been constrained by a number of factors.*

## Conference Sub-themes and Call for Papers

Five inter-related priority subthemes have been identified through a participatory stakeholder consultation exercise which commenced at the ATPS Annual General Meeting in November 2011 (for details see [http://www.atpsnet.org/media\\_centre/news/article.php?article=109](http://www.atpsnet.org/media_centre/news/article.php?article=109)), and culminated in an expert consultative workshop held in Naivasha, Kenya in May 2012 (for details see [http://www.atpsnet.org/media\\_centre/news/article.php?article=110](http://www.atpsnet.org/media_centre/news/article.php?article=110)). Through the consultative process, leading experts from Africa, Europe, North America, the Caribbean and small Island states, Asia, and Australasia suggested the focus on the following sub-themes:

### **Sub-theme I: Transitions to Low Carbon Development Pathways: Implications for Sustainable Development in Africa**

Papers under this subtheme should cover broad range of issues on the role of STI in transitions to more inclusive green growth, green economies and low carbon development pathways in Africa. A number of alternative paradigms are emerging including the Green Economy, Green Growth, Low Carbon Development, Inclusive Growth, etc.

The sub-theme explores country experiences, policy questions and options for a sustainable structural transformation in African economies that will protect Africa's natural capital while growing her economies. These will include but not limited to, renewable energy options for energy access and energy security, greening industries, and green growth; institutional arrangements to support such transitions including global financing mechanisms, climate/green change technology transfer mechanisms, trade rules, regionalisation and internationalisation of STI, extension services, etc. It seeks information to establish baselines, understand current and future barriers, potentials/opportunities; and provide policy actions and measures required to achieve more inclusive growth and sustainable development in Africa.

### **Sub-theme II: Governance of Science, Technologies and Innovation including Genetics for Farming, Biotechnologies, Nanotechnologies and Indigenous Knowledge Systems**

The subtheme explores broad issues on the governance of STI for food security and sustainable development with a special focus on biotechnologies, genetics for farming, nano-technologies and indigenous knowledge system for improved productivity and value addition in agriculture, health delivery, water management, etc. These technologies and innovations present opportunities for addressing many of Africa's development challenges including food and energy insecurity, poor access to quality drinking water and sanitation, and increasing disease burden. Likewise, papers under this subtheme should explore based on empirical evidences the many controversies that trail the development of some of these technologies in Africa and across the globe.

The sub-theme aims to provide critical assessments of country case studies to establish baseline knowledge of the current potentials, barriers and opportunities in the development, deployment and diffusion of these technologies in Africa as well as explore policy options for optimising the potentials and minimising the risks associated with these technologies.

### **Sub-theme III: Institutional Structures and Social Innovations for Sustainable Development in Africa:**

The subtheme explores the institutional and social structures needed to deliver on sustainable structural transformations toward inclusive growth in Africa. This includes the new forms of public policies shaped by new models of innovation that enhances resource efficiency, resource productivity, greening economies, greening industries, and decoupling economic growth from social and environmental impacts, among others. The subtheme also explores

The implications of emerging global changes, global recession, and the shift in global partnerships, etc., for African development and the role of STI. Other areas considered under this subtheme include; privatisation and commercialization of enterprises, innovation incubation, entrepreneurship and public-private partnerships (PPP) in the new global economy.

#### **Sub-theme IV: Youth and Gender Empowerment for Sustainable Development in Africa**

The sub-theme will explore regional and global experiences on youth development and engagement in science, technology and innovations, which will serve as a knowledge asset for both practitioners and policy makers to foster activities on youth development, empowerment and leadership in Africa. The potentials and challenges of youth and gender engagement/empowerment for African sustainable development through STI are also covered under this subtheme.

#### **Sub-theme V: Mainstreaming Trans-disciplinarity in STI in Higher Education**

The subtheme hopes to explore the concept of trans-disciplinarity in higher education with respect to its application to science, technology and innovation for African sustainable development. This includes new pedagogies, models, curricula, incentive structures, policies and reforms on teaching, learning, research and community service required for a sustainable higher education and development in Africa.

## 2.0 CONFERENCE OBJECTIVES

The overall purpose of the conference is to critically examine the current conditions, barriers and opportunities in the above thematic areas and provide policy options for transitions to more inclusive sustainable development in Africa.

## 3.0 EXPECTED OUTPUTS

1. Published conference proceedings;
2. A book volume with selected conference papers showcasing success stories, barriers and opportunities for transitions to low carbon development pathways in Africa; and
3. A communiqué summarizing key conference recommendations for African policy-makers and development partners

## 4.0 EXPECTED OUTCOMES

1. African policymakers, science experts, private sector actors and civil society appraised of the pros and cons of alternative development pathways and policy choices including actions and inactions; and
2. Strengthened networks amongst STI actors in Africa.



## 5.0. CONFERENCE METHODOLOGY

The conference will use various methods to ensure effective participation by all stakeholders:

### **Day 1: 19<sup>th</sup> November 2012: Facilitated Plenary Session**

This will involve commissioned keynote papers from selected renowned researchers, policymakers and practitioners in the different thematic areas. The keynote papers will draw on existing evidences to frame the dialogues around each thematic area. Two keynote papers will be commissioned for each theme, one from a developed country perspective and another from the African perspective to ensure a balanced discourse of the subjects. These sessions will be coordinated by professional facilitators to ensure proper and effective stakeholder engagement.

### **Day 2: 20<sup>th</sup> November 2012: Parallel Sessions**

The one-day parallel sessions will deliberate on each subtheme to have a focused exhaustive dialogue on the subject areas. This will include parallel presentations of shortlisted papers expected to be received in response to the call for papers focusing on regional and country case studies, projects, experiences, etc. The sessions will explore the reasons for success and failure in the different contexts and draw conclusions and lessons for sustainability.

### **Day 3: 21<sup>st</sup> November 2012: Plenary Closing Session**

This session will be dedicated to feedback generated from the parallel sessions to collectively identify strategic priority response policies, measures and options for Africa in the new global economy. The recommendations will be documented in a Communiqué that will be widely disseminated to the relevant stakeholders within the government, private sector, academia, and civil society actors in Africa and in the development partner countries in Europe, North & South America, Asia and Australasia.

## 6.0 FULL CONFERENCE AGENDA

### DAY 1 – MONDAY, 19 NOVEMBER 2012

Time	Topic/Presentations	Facilitators:	
08.30 - 09.00am	Registration & Accreditation	1) Mr. Murimi Muriuki, ATPS 2) Ms. Sarah Wakasa, ATPS 3) Mr. Nelson Akenga, ATPS	
<b>Plenary Session 1: Opening Session</b> <b>Rapporteur: Dr. Nicholas Ozor, Senior Research Officer, ATPS</b>			
Time	Topic/Presentation	Presenters	Session Chair
09.00 - 09.05 am	Welcoming Remarks by the ATPS Ethiopia Chapter	Mr. Wondwossen Belete National Coordinator ATPS-Ethiopia	Dr. Mohamed Khalil Timamy Head, Environment Division Department of Rural Economy and Agriculture, AUC, Ethiopia
09: 05 – 09:15 am	Welcoming Remarks by the AUC	H.E. Professor Jean-Pierre Ezin Commissioner for Human Resources, Science & Technology, AUC, Ethiopia	
09:15 – 09:25 am	Welcoming Remarks by the ATPS Secretariat/ Objectives of Conference	Prof. Kevin C. Urama Executive Director, ATPS	
09:25 – 09:35 am	Welcoming Remarks by the Chair of ATPS Board	Prof. Shaukat A. Abdulrazak Executive Secretary, National Council for S&T, Republic of Kenya / Chair, ATPS Board	
09:35 – 09:40 am	Remarks by a Representative of ATPS Consortium of Development Partners	Dutch Ministry of Foreign Affairs/Rockefeller Foundation/ Open Society Foundation/ Nigerian Ministry of S&T, etc.,	
10:00 – 10:20 am	Opening Keynote Address: <b>Emerging Paradigms, Technologies and Innovations for Sustainable Development: Global Imperatives and African Realities</b>	His Excellency Mr. Dessie Dalike, Honourable Minister for Science and Technology Ethiopia	
10:20 – 10:40am	Emerging Paradigms, Technologies and Innovations for Sustainable Development in East African Countries	Prof. Margaret Kamar Hon. Minister for Higher Education, Science & Technology, Republic of Kenya	
10:40 – 11:00 am	Emerging Paradigms, Technologies and Innovations for Sustainable Development: in West African Countries	Hon. Prof. Ita Okon Bassey Ewa, Hon. Minister for S&T Ministry of S&T Federal Republic of Nigeria	
11.00 - 11.15am	PHOTO SESSION & TEA/COFFEE & HEALTH BREAK		

**PLENARY SESSION 2: KEYNOTE PAPERS**  
**Rapporteur: Dr. Nicholas Ozor, Senior Research Officer, ATPS**

	Keynote Presentations	Presenters	Session Chair
11:15- 11:35 am	Green Growth and Poverty Reduction: Framing the Issues for Developing Countries	Mr. Angel Gurría Secretary General, OECD, Represented by Mr. Serge Tomasi Deputy Director of the Development Co- operation Directorate, OECD, France	Prof. Turner Isoun, Former Minister for S&T, Fed. Republic of Nigeria & Vice Chair, ATPS Board
11:35 - 11:55 am	Energy Transitions, Innovations & Development: Global Imperatives and African realities	Professor Lynn K. Mytelka Professorial Fellow UNU-MERIT (Maastricht) Distinguished Research Professor Carleton University (Ottawa)	
11:55 – 12:15 pm	Social Innovations & Sustainable Development in the Global South: - implications for achieving sustainable development goals in the global south	Prof. Caroline Wagner Milton Wolf Chair in International Affairs, Ohio University, USA	
12:15 – 12:35 pm	Institutional Structures, Policies & Macro Economic Environment in African Countries: implications for Social Innovations and business competitiveness	Professor Eric Eboh Policy & Institutions Economist, University of Nigeria, Nsukka / President, Agricultural Policy Research Network (APRNet), Nigeria	
12:35 – 01:00 pm	Q&A Facilitated Discussion Session		
01.00 - 02.00pm	Lunch Break		

**PLENARY SESSION 3: KEYNOTE PAPERS**  
**Rapporteur: Dr. Mark McHenry, Murdoch University, Western Australia**

	Keynote Paper Presentations	Proposed Presenters	Session Chair
02:00 – 02:30 pm	Achieving Food Security and Sustainability for 9 Billion	Professor Chris Leaver Emeritus professor of Plant Science, fellow of St. John's College, Oxford University, UK	Sir, Brian Heap (ATPS Board Member) President, European Academies Science Advisory Council
02:30 – 02:50 pm	Is Genetic Modification to Answer to Africa's food insecurity? Lessons from India	Dr. Anupam Varma, Adjunct Professor, Indian Agricultural Research Institute, India	
02:50 – 03:10 pm	Nanotechnologies and Implications for Achieving Sustainable Development Goals in Africa	Prof. Emmanuel Ezugwu, Provost, Air Force institute of Technology, AFIT, Kaduna, Nigeria.	
03:10 – 03:30 pm	Building the critical mass in STI capacity in response to the emerging needs of Africa	Dr Peggy Oti-Boateng Senior Programme Specialist for Science and Technology - UNESCO, Nairobi Office & Coordinator, African Network of Scientific and Technological Institutions (ANSTI)	
03:30 – 04.00 pm	Facilitated Discussion Session		
04.00 - 04.15 pm	TEA/COFFEE & HEALTH BREAK		

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**GLOBAL IMPERATIVES & AFRICAN REALITIES**

04.15 - 04.30pm	A Strategic Approach to Strengthening the African Higher Education and Research Space (AHERS) Through Institutional National Regional and Continental Collaboration	Ms. Alice Lamptey Senior Program Specialist, PMU –PAU, AUC Ethiopia	Prof. Mark Swilling ATPS-South Africa National Chapter Coordinator Sustainability Institute, University of Stellenbosch, South Africa
04:30 – 04:45 pm	African Science and the Science of Sustainability in the 21 <sup>st</sup> century? Perspectives from the African Academy of Sciences	Dr. Benjamin Apraku Gyampoh Programme Officer Africa Academy of Sciences (AAS), Kenya	
04:45 – 05:00 pm	Gender equity and youth empowerment in Africa: implications for achieving Sustainable Development Goals in Africa.	Prof. Agnes Mwang'ombe Principal, College of Agriculture and Veterinary Medicine, University of Nairobi, Kenya & Prof. Obioma Nwaorgu, Global Health Awareness research Foundation, USA	
05.00 - 05.50pm	Facilitated Participatory Dialogue		
05:50 – 06:10 pm	Launch of ATPS-Australia Chapter		Prof. David Doepel Africa Research Group, Murdoch University, Perth, Western Australia
<b>END OF DAY 1</b>			
07:00 – 09:30 pm	High Level Strategic Planning Dinner hosted for ATPS Development Partners and Key Stakeholders (By Invitation Only)		

**DAY 2 - TUESDAY, 20 NOVEMBER 2012**

PARALLEL SESSIONS (D2:P1 – P4)

See Annex 1 – 4 for specific break-out rooms for the parallel sessions: P1 – P4

Time	Topic/ Presentations	Topic/ Presentations	Session Chair/Lead Discussants
09:00 – 11:00 am	Parallel Session (D2-P1): Sub-Theme I Transitions to Low Carbon Development Pathways: Implication Sustainable Development in Africa	All delegates that submitted papers under this subtheme (see Annex 1 for full program and venue)	Chair: Prof. Lynn Mytelka, Professorial Fellow UNU-MERIT (Maastricht) Distinguished Research Professor, Carleton University (Ottawa)  Rapporteur: Dr. Mark McHenry, Murdoch University, Western Australia
09:00 – 11:00 am	Parallel Session (D2-P2): Sub-Theme II  Governance of Science, Technologies and Innovation including Genetics for Farming, Biotechnologies, Nanotechnologies and Indigenous Knowledge Systems	All delegates that submitted papers under this subtheme (see Annex 2 for full program and venue)	Prof. Sir Brian Heap Member, ATPS Board; EASAC; The Royal Society of London & Honorary Fellow, St. Edmunds College  Rapporteur: Dr. Nicholas Ozor, Senior Research Officer, ATPS
09:00 – 11:00 am	Parallel Session (D2-P3): Sub-Theme III  Institutional Structures and Social Innovations for Sustainable Development in Africa	All delegates that submitted papers under this subtheme (Annex 3 for full program and venue)	Chair: Prof. Indira Nath (ATPS Board Member) Institute of Pathology (ICMR), India  Rapporteur: Mr. Ernest Acheampong, Research Officer, ATPS
09:00 – 11:00 am	Parallel Session (D2-P4): Sub-themes IV and V  Sub-Theme IV - Youth and Gender Empowerment for Sustainable Development in Africa  Sub-Theme V - Mainstreaming Trans-disciplinarity in STI in Higher Education	All delegates that submitted papers under this subtheme (Annex 4 for full program and venue)	Chairs: Mr. Tennyson Magombo, (Out-going Chair, AYFST), Executive Director, Arise and Shine International, Malawi  Rapporteur: Dr. Edith Gathoni, Post-Doctoral Research Officer, ATPS
11:00 – 11:30 am	TEA/COFFEE & HEALTH BREAK		
11:30 – 01:00 pm	PARALLEL SESSIONS (D2:P1 – P4) CONTINUE (cf : Annexes 1 - 4 for time allocations and respective venue)		
01:00 – 02:00 pm	LUNCH		
02:00 – 03:30 pm	PARALLEL SESSIONS (D2:P1 – P4) CONTINUE (cf : Annexes 1 - 4 for time allocations and respective venue)		
03:30 – 04:00 pm	TEA/COFFEE & HEALTH BREAK		
04:00 – 05:00 pm	PARALLEL SESSIONS (D2:P1 – P4) CONTINUE (cf : Annexes 1 - 4 for time allocations and respective venue)		
06:00 – 09:00 pm	Conference Group Dinner hosted by ATPS (Details TBC)		

END OF DAY TWO

**DAY 3 - WEDNESDAY, 21 NOVEMBER 2012**

**PLENARY SESSION – International Roundtable, Recommendations and Conclusions**  
**Rapporteurs: TBC**

Time	Topic/ Presentations	Proposed Presenters	Session Chair/Lead Discussants
08:30 – 09:30 am	Recap from the Parallel Sessions	<p>Dr. Mark McHenry, Murdoch University, Western Australia (D2:P1) – Low Carbon Development Pathways: Implications for Sustainable Development in Africa</p> <p>Dr. Nicholas Ozor, Senior Research Officer, ATPS (D2: P2) – Governance of STI- Genetics for Farming, Biotechnologies, Nanotechnologies and Indigenous Knowledge Systems</p> <p>Mr. Ernest Acheampong, Research Officer, ATPS (D2:P3) – Institutional Structures and Social Innovations for Sustainable Development in Africa</p> <p>Dr. Edith Gathoni, Post Doc. Research Officer, ATPS (D2:P4 - Sub-theme IV) - Youth &amp; Gender Empowerment for Sustainable Development in Africa; and (D2:P4 - Sub-theme V) - Trans-disciplinarity in Higher Education</p>	<p>Dr Peggy Oti-Boateng</p> <p>Senior Programme Specialist for Science and Technology</p> <p>UNESCO, Nairobi Office and</p> <p>Coordinator, African Network of Scientific and Technological Institutions (ANSTI)</p> <p>Nairobi, Kenya</p>

09.30 - 10.45am	<p>International Roundtable and Recommendations on Emerging Paradigms, Technologies and Innovations for Sustainable Development: Global Imperatives and African Realities (Panellists to make about 4-minute remarks on take home messages and strategic actions for Africa)</p> <p><b>Panellists:</b></p> <ol style="list-style-type: none"> <li>1) <b>H.E. Professor Jean-Pierre Ezin</b> (AUC), Commissioner for Human Resources, Science &amp; Technology, AUC,</li> <li>2) <b>Prof. Shaukat A. Abdulrazak</b>, Executive Secretary, National Council for S&amp;T, Republic of Kenya / Chair, ATPS Board</li> <li>3) <b>Prof. Osita Ogbu</b>, Former Economic Advisor to the President of the Federal Republic of Nigeria/ Executive Director, African Development Solutions International (ADSI), Nigeria</li> <li>4) <b>H. E. Mr. Dessie Dalike</b>, Hon. Minister for Science and Technology, Federal Republic of Ethiopia</li> <li>5) <b>Hon. Prof. Margaret Kamar</b> Hon. Minister for Higher Education, Science and Technology, Republic of Kenya</li> <li>6) <b>Hon. Prof. Ita Okon Bassey Ewa</b>, Hon. Minsiter for Science and Technology, Federal Republic of Nigeria</li> <li>7) <b>Prof. Lynn K. Mytelka</b> Professorial Fellow, UNU-MERIT, Maastricht and Distinguished Research Professor, Charlton University, Ottawa, Canada</li> <li>8) <b>Prof. Caroline Wagner</b> Associate Professor, John Glenn School of Public Affairs, Ohio University, USA</li> <li>9) <b>Prof. Chris Leaver</b> Oxford University, UK</li> <li>10) <b>Dr. Peggy Oti-Boateng</b> Senior Program Specialist S&amp;T Coordinator, ANSTI-UNESCO, Kenya</li> <li>11) <b>Dr. Benjamin Apraku</b> Gyampoh Programme Officer, Africa Academy of Sciences (AAS), Kenya</li> <li>12) <b>Dr. Mohamed Khalil Timamy</b>, Head, Environment Division Department of Rural Economy and Agriculture, AUC</li> <li>13) <b>Prof. Turner Isoun</b>, Former Minsiter for S&amp;T, Fed. Republic of Nigeria / Deputy Chair ATPS Board</li> <li>14) <b>Dr Agnes Soucat</b> Director, Human Development OSHD, AfDB</li> <li>15) <b>Dr. Boukary Savadogo</b>, Higher Education Division, AfDB</li> <li>16) <b>Mr. Ahlin Byll-Cataria</b>, Executive Secretary, ADEA-AfDB</li> <li>17) <b>Dr. A. I. Mayaki, Executive Secretary</b>, NEPAD</li> </ol>	<p>Chair: Dr. Mahama Ouedraogo,          Head of Division, Science and Technology-AUC          Addis Ababa, Ethiopia</p>
10:45 – 11:00 am	Tea/Coffee/ Health break	
11.30. - 12.30pm	<p>Recommendations and way forward - A Communiqué to be produced recommendations from the parallel group discussions and recommendations from the international roundtable</p>	<p>Facilitator: Dr. Nicholas Ozor, Senior Research Officer, ATPS</p>
12:30 – 01:00 pm	<p>Conclusion and closing remarks</p>	<p>Prof. Kevin Urama,          Executive Director, ATPS          Prof. Shaukat A. Abdulrazak, Chair - ATPS Board</p>
01:00 – 02:00 pm	LUNCH	
02:00 – 05:00 pm	<p>Plenary Session:          ATPS Annual General Meeting          (For registered members only)</p>	<p>Prof. Shaukat A. Abdulrazak, Chair ATPS Board</p>
END OF DAY THREE		
CONFERENCE DELEGATES DEPART		

**DAY 4 - THURSDAY, 22 NOVEMBER 2012**

**ATPS BUSINESS – ATPS MANAGEMENT AND BOARD MEETINGS  
 VENUE: DREAMLINER HOTEL, ADDIS ABABA, ETHIOPIA**

<b>Time</b>	<b>Topic/Presentations</b>	<b>Participants</b>	<b>Session Chair</b>
09:00 – 13:00 pm	ATPS National Chapter Coordinator's and Secretariat Staff Meeting & Training on Transformational Leadership	<ul style="list-style-type: none"> <li>• ATPS Board Members</li> <li>• ATPS Regional Council Members</li> <li>• ATPS National Chapter Coordinators</li> <li>• ATPS Secretariat Management Committee Members</li> <li>• AWFST Executives</li> <li>• AYFST Executives</li> </ul>	Chair: Prof. Shaukat A. Abdulrazak  Facilitators: Prof. Vincent Anigbogu DG, Institute for National Transformation USA  Prof. Chris Garforth Professor of Agric. Extension and Rural Development, School of Agriculture, Policy and Development, University of Reading, UK
11:00 – 11:30 a.m.	TEA/COFFEE & HEALTH BREAK		
01:00 – 02:00 p.m.	LUNCH		
02:00 – 06:30 p.m.	22 <sup>nd</sup> ATPS Board Meeting	ATPS Board Members only	Prof. Shaukat A. Abdulrazak, Chair, ATPS Board
03:30 – 04:00 pm	TEA/COFFEE & HEALTH BREAK		





# ANNEXES

## ANNEX 1:

### PROGRAMME FOR PARALLEL SESSION 1 (COVERING SUB-THEME I) - (D2-P1)

<b>Tuesday, 20<sup>TH</sup> November 2012</b>			
<b>D2-P1: (SUB-THEME I) TRANSITIONS TO LOW CARBON DEVELOPMENT PATHWAYS: IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT IN AFRICA</b>			
<b>Rapporteurs: Dr. Mark McHenry, Murdoch University, Western Australia</b>			
<b>Time</b>	<b>Topic/Presentations</b>	<b>Presenter</b>	<b>Session Chair</b>
08:30 – 09:00am	Registration		
09:00 – 09:25am	Pro-poor, low carbon development: Improving low carbon energy access and development benefits in LDCs	<b>Dr. Robert Byrne</b> Research Fellow, SPRU (Science & Technology Policy Research) and STEPS Centre, University of Sussex, UK	<b>Professor Lynn Mytelka</b> Professorial Fellow, UNU-MERIT, Maastricht and Distinguished Research Professor, Carleton University, Ottawa, Canada
09:25 – 09:50 am	Low Carbon Growth Pathways for Africa: The case of geothermal energy potential	<b>Dr. Mohamed Khalil Timamy</b> Head, Environment Division Department of Rural Economy and Agriculture, AUC, Ethiopia	
09:50 – 10:15am	Inclusive Green Growth, Renewable Energy Potentials and the Mitigation of Climate Change Impacts- Implications for SDGs in Africa	<b>Dr. Fatima Denton</b> Director, African Climate Policy Centre (ACPC)- United Nations Economic Commission for Africa (UNECA), Addis Ababa, Ethiopia	
10:15 – 10:50am	Facilitated Discussion		
<b>10:50 – 11:10am</b>	<b>TEA/COFFEE &amp; HEALTH BREAK</b>		

11:10 – 11:25am	Financing Access to Sustainable Energy for the Poor in Nigeria: The Public Finance Option	<b>Mr. Chidiebere Ibe</b> Institute for Public Policy Analysis and Management, Abuja, Nigeria	
11:25 – 11:40am	Transition to Low Carbon Pathways for Sustainable Agricultural Systems in Nigeria	<b>Prof. Francis E. Bisong</b> Professor, Department of Geography & Environmental Science, University of Calabar Nigeria	
11:40 – 11:55am	Transitions to Low Carbon Development Pathways: Implications for Sustainable Development in Africa	<b>Prof. Mark Swilling</b> Sustainability Institute, Stellenbosch University South Africa	<b>Prof. Francis M. Mutua</b> University of Nairobi Coordinator Stochastic Modeling Component FRIEND Nile Project, University of Nairobi, Kenya
11.55- 12.10pm	Artisanal Rastrineobola argenta light fishing on Lake Victoria, Kenya: traditional kerosene lamps and PV-battery modern lighting systems, markets, and improving safety and supply security	<b>Prof. David Doepel</b> Africa Research Group, Murdoch University, Perth, Western Australia	
12.10 - 12.25 pm	Climate Change Mitigation and Trade Competitiveness: An Assessment of the Clean Development Mechanism in East Africa	<b>Jill Juma</b> SEATINI, Kenya and Trade Policy Expert, Kenya	
12.25 - 01.00 pm	Facilitated Q&A Discussio		
01.00pm - 02.00pm	LUNCH		
02:00 – 02:15pm	Pathways to Low Carbon Development: Alternative Energy Sources for Africa	<b>Babettie A. Juwayeyi</b> Bunda College of Agriculture, Malawi	
02:15 – 02:30pm	Microalgae cultivation and its use in the production of biofuel and agricultural inputs in Lesotho	<b>Sissay B.Mekbib</b> National University of Lesotho, Roma, Lesotho	
02:30 – 02:45pm	Chrome-Aluminide Protective Coatings for Thermal Power Generations	<b>J.K.Kiplagat</b> Ministry of Industrialization Kenya	
02:45 – 03:00pm	Emission Trading System as a policy tool for Low carbon development pathway	<b>Billy Katontoka</b> Africa Carbon Credit Exchange, Zambia	
03:00 – 03:15pm	Trends and Potentials of Renewable Energy Development in Ethiopia	<b>Shirega Minuye</b> Ethiopia	

03:15 – 03:30pm	Contribution of animal agriculture to greenhouse gases production in Swaziland; implications for	Dlamini, A.M. & <b>Dube, M. A</b> University of Swaziland
03:30 – 03:45pm	Empowering the Health of Rural Farmers in Africa through Telemedicine: Challenges and Prospects	<b>Zelalem W. Mengistu</b> Ethiopia
03:45 – 04:00pm	Facilitated Q & A Discussion	
<b>04:00 – 04:20pm</b>	<b>TEA/COFFEE &amp; HEALTH BREAK</b>	
04.20 - 05.00 pm	<b>Plenary Panel Discussion:</b>  <i>Do Renewable Energy Options provide a Sustainable Development pathway for Africa? - Insights from the IPCC Sustainable &amp; Renewable Energy Report, 2011, and the Global Energy Assessment, 2011</i>  <b><u>Panellists:</u></b> 1) <b>Prof. Lynn Mytelka</b> , UNU-MERIT, Maastricht and Charlton University, Ottawa, Canada 2) <b>Prof. Mark Swilling</b> , Stellenbosch University, South Africa 3) <b>Dr. Billy Katontoka</b> , Africa Carbon Credit Exchange, Zambia 4) <b>Dr. Rob Byrne</b> , University of Sussex, UK 5) <b>Prof. Turner Isoun</b> , Former Minister for S&T, Fed. Republic of Nigeria & Vice Chair, ATPS Board 6) <b>Prof. Francis Mutua</b> , University of Nairobi, Kenya 7) <b>Dr. Fatima Denton</b> , ACPC, Ethiopia 8) <b>Mr. Serge Tomasi</b> , OECD, Paris, France	

## ANNEX 2:

### PROGRAMME FOR PARALLEL SESSION 2 (COVERING SUB-THEME II) - (D2-P2)

Tuesday, 20<sup>TH</sup> November 2012

**D2-P2: (SUB-THEME II) GOVERNANCE OF SCIENCE, TECHNOLOGIES AND INNOVATION INCLUDING GENETICS FOR FARMING, BIOTECHNOLOGIES, NANOTECHNOLOGIES AND INDIGENOUS KNOWLEDGE SYSTEMS**

*Rapporteur: Dr. Nicholas Ozor, Senior Research Officer, ATPS*

Time	Topic/Presentations	Presenter	Session Chair
08:30 – 09:00am	Registration		
09:00 – 09:20am	Welcome and introduction to project	<b>Prof. Volker ter Meulen</b> President of the German Academy of Sciences Leopoldina, Member of the EASAC Council. Email: Volker.terMeulen@mail.uni-wuerzburg.de	
09:20 – 09:40am	Genetics for Farming and Food Security in Africa: Lessons from Nigeria	<b>Prof. M. I. Uguru</b> Dept. of Crop Science University of Nigeria Nsukka Nigeria	<b>Prof. Sir Brian Heap</b> Member, ATPS Board European Academies Science Advisory Council, The Royal Society of London SW1Y 5AG, and Honorary Fellow, St Edmund's College
09:40 – 10:00am	Current Situation on GM research and innovation in Ghana and the region (opportunities and challenges)	<b>Professor Walter Alhassan</b> Forum for Agricultural Research in Africa (FARA), Ghana	
10:00 – 10:20am	Current Situation on GM research and innovation in Uganda	<b>Dr. Andrew Kiggundu</b> Kawanda Agriculture Research Institute (KARI) Uganda	
10:20 – 10:40am	Water Efficient Maize for Africa (WEMA) Project and focus on implications for African science of the liability clause in biosafety	<b>Dr Roshan Abdallah (Mrs)</b> Tanzania Tropical Pesticides Research Institute (TPRI) in Arusha, Tanzania	
10:40 – 11:00am	Virus Resistant Cassava (VICRA) project and issues arising	<b>Dr. Douglas W. Miano</b> VIRCA - Kenya Agricultural Research Institute (KARI) Biotechnology Centre Kenya	
11:00 – 11:30am	Facilitated Q&A discussion		
<b>11:30 – 11:50AM</b>	<b>COFFEE/TEA/HEALTH BREAK</b>		

11:50 – 12:10am	Nanotechnology: Key to meeting the Millennium Development Goals	<b>J.K.Kiplagat</b> Ministry of Industrialization Kenya	<b>Dr. David Bennett</b> Project Co-Leader Biosciences for Farming in Africa
12:10 – 12:30pm	Studies on Nano biotechnology Control of Agricultural Pests and Pathogens for Food Security and Safety	<b>B. Chinenye Aruah</b> National Biotechnology Development Agency, Nigeria	
<b>12.30 - 1.00 pm</b>	Facilitated Q&A discussion		
<b>01:00 – 02:00pm</b>	<b>LUNCH</b>		
02:00 – 02:15pm	Practical Application of Modern Biotechnology Tools to Musa Breeding in Nigeria: Potentials for Increased Production	Oselebe, H.O., Obi, I.U. and Uguru, M.I. University of Nigeria, Nsukka Nigeria	Dr. Anupam Varma Indian Agriculture Research Institute, India
02:15 – 02:30pm	Animal Genetic Resources, Intellectual Property Rights and Traditional Knowledge: Quo Vadis?	<b>Eliamani Laltaika</b> Tanzania Intellectual Property Rights Network (TIP-Net) Tanzania	
02:30 - 03:00pm	Facilitated Discussion		
03:00 – 04:00pm	Two Break out groups to discuss questions circulated to all academies and chapters beforehand: <i>(i) The current situation in using biotechnology in agriculture</i> <i>(ii) Looking to the future</i>		EASAC Working Group Members
<b>04.00 – 04.15pm</b>	<b>TEA/COFFEE &amp; HEALTH BREAK</b>		
04.15 - 5.15 pm	Report back (10 minutes each) from chairs of Break out groups (EASAC Working Group Members with assistance from Claudia Canales and Robin Fears)  Panel and General Discussion and concluding remarks  <b><u>Panelists:</u></b> <b>Prof. Volker ter Meulen</b> <b>Prof. Emmanuel O. Ezugwu, AFIT, Nigeria</b> <b>Dr. Anupam Varma, India</b> <b>Dr. David Doepel, Australia</b> <b>Prof. M. I. Uguru, Nigeria</b> <b>Prof. Norah Olembo, Kenya</b>		<b>Professor Chris Leaver (UK)</b> Emeritus Professor of Plant Sciences, University of Oxford. Senior Scientific Adviser Biosciences for Farming in Africa, John Templeton Foundation
05:15 – 06:00pm	Launch of booklet on Regulation of GM Technology	<b>Dr. Jan-Hendrik Groenewald</b> Executive Manager Biosafety South Africa	<b>Prof Roseanne Diab</b> Executive Officer Academy of Science of South Africa (ASSAf)

## ANNEX 3:

### PROGRAMME FOR PARALLEL SESSION 3 (COVERING SUB-THEME III) - (D2-P3)

<b>Tuesday, 20<sup>TH</sup> November 2012</b>			
<b>D2-P1: (SUB-THEME I) TRANSITIONS TO LOW CARBON DEVELOPMENT PATHWAYS: IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT IN AFRICA</b>			
<b>Rapporteurs: Dr. Mark McHenry, Murdoch University, Western Australia</b>			
<b>Time</b>	<b>Topic/Presentations</b>	<b>Presenter</b>	<b>Session Chair</b>
08:30 – 09:00am	Registration		
09:00 – 09:10 am	Welcome and introduction to project on <b>Understanding and Fostering Social Innovation in Africa</b>	<b>Ernest Acheampong</b> ATPS	
09:10– 09:30 am	Building National Systems of Innovation for Sustainable Development in Africa: Experiences from the Fed. Republic of Nigeria	<b>Mrs R. S. Jimetta</b> Permanent Secretary, Ministry of S&T, Fed. Rep. Of Nigeria	<b>Prof. Indira Nath</b> (ATPS Board Member) Institute of Pathology (ICMR), India
09:30 – 09:50am	Social Innovations, Inclusive Green Growth and Sustainable Development : Global Imperatives and African realities	<b>Prof. Kevin Urama</b> Executive Director, ATPS/ <b>Mr. Ernest Acheampong,</b> Research Officer, ATPS	
09:50 – 10:10am	The Land Potential Knowledge System (LandPKS) Increasing Land Productivity and Resilience	<b>Dr. Jeffrey Herrick</b> United States Department of Agriculture, New Mexico, USA	
10.10 - 10.30am	Facilitated Discussion		
<b>10.30 - 10.50am</b>	<b>TEA/COFFEE &amp; HEALTH BREAK</b>		
<b>10:50 – 11:10am</b>	Economic Growth's Secret Weapon: Entrepreneurship & Innovation	<b>Mr. Denis C. Fourie</b> Chairman, The Lobbyist Group, South Africa	<b>Prof. S. Chidebelu</b> Department of Agricultural Economics University of Nigeria
11:10 – 11:30am	Social Innovations: Lessons from the mPedigree Technology	<b>Mr. Bright B. Simons</b> Director of Development Research and the Coordinator of the mPedigree Network IMANI Center for Policy Education, Ghana	
11:30 – 11:50am	Social Innovations and Economic Growth: Experiences of the Global Knowledge Initiative (GKI)	<b>Mr. Andrew Gerard</b> Program Officer The Global Knowledge Initiative, USA	

11:50 – 12:05pm	Constraints and Opportunities of Promoting Public-Private Partnerships in Irrigated Agriculture Financing and Management in Nigeria.	<b>Ebele C. Amaechina,</b> Eboh E. C., & Nwagbo E.C. University of Nigeria Nsukka, Nigeria	<b>Mrs. R. S. Jimeta,</b> Permanent Secretary, Ministry of S&T, Nigeria
12:05 – 12:20pm	Mainstreaming M-Health Innovations With Loosely Coupled Policy Interventions in Africa	<b>Eng. John Okuonzi</b> Kyambogo University, Faculty of Engineering, Uganda	
12:20 – 01:00pm	Facilitated Q&A Discussion		
<b>01:00 – 02:00pm</b>	LUNCH		
02:00 – 02:15pm	Determinants of Micro-Enterprises Growth and Revenue in the Niger Delta, Nigeria: Microfinance the Way Forward	<b>Miebi Theophilus Gbigbi</b> Ministry of Agriculture and Natural Resources, Nigeria & <b>Dr. Anselm A. Enete</b> University of Nigeria	
02:15 – 02:30pm	Mapping Institutional Linkages in Climate Change Adaptation and Mitigation: Implications for Sustainable Food Security and Environmental Quality in Nigeria	<b>Taofeeq Ade Amusa &amp; Dr. Anselm A. Enete</b> Department of Agricultural Economics, University of Nigeria	
02:30 – 02:45pm	Appropriate Innovation Structure for Sustainable Development	<b>Ameha Mulugeta</b> Addis Ababa Institute of Technology, Ethiopia	
02:45 – 03:00pm	Assessment of Innovative Institutional Arrangements: The Case of Integrated Tamale Fruit Company (ITFC) in Ghana	<b>Mr. Francis Kizito Yaw Amevenku</b> CSIR Water Research Institute, Accra, Ghana	
03:00 – 03:15pm	Treatise and Praxis Linking Social Ingenuity and Institutional Innovations in Sustainable Development (SD):A case research in Afar and Boran:	<b>Costantinos BT Costantinos</b> School of Graduate Studies, College of Management, Informatics and Economic Sciences, Addis Ababa University, Ethiopia	
03:15 – 03:30pm	Institutional challenges of current structural changes in West African agriculture : an analysis from the Benin case	<b>Dr. Roch L. Mongbo</b> Abomey-Calavi University Benin	
03:30 – 03:45pm	Enabling Rural Innovations for Sustainable Development in Malawi	<b>Mr. Tennyson Magombo,</b> Executive Director, Arise and Shine International, Malawi Malawi	
03:45 – 04:00pm	The impact of regulation on the adoption and diffusion of Point-of-Sale technology in Nigeria	<b>Ngozi, Ihuoma Ibeji</b> United Kingdom	



04:00 – 04:15pm	Facilitated Q & A Discussion	
04:15– 04:30 pm	<b>TEA/COFFEE &amp; HEALTH BREAK</b>	
04:30 – 05:30pm	Panel Discussion, Summary and concluding remarks	<b>Mr. C. D. Glin</b> Associate Director Rockefeller Foundation, Nairobi, Kenya
	<b><u>Panellists:</u></b>	
	1) <b>Dr. Caroline Wagner</b> , Ohio State University, USA	
	2) <b>Mrs. R. S. Jimeta</b> , FMST, Nigeria	
	3) <b>Prof. Kevin Urama</b> , ATPS , Kenya	
	4) <b>Prof. Eric Eboh</b> , APRNet, Nigeria	
	5) <b>Prof. Sand Chidebelu</b> , UNN, Nigeria	
	6) <b>Dr. Jeff Herrick</b> , USDA, USA	
	7) <b>Mr. Bright Simons</b> , IMANI, Ghana	
	8) <b>Denic C. Fourie</b> , The Lobbyist Group, South Africa	
	9) <b>Ms. Bethlehem Alemu</b> , soleRebels (Bostex PLC), Ethiopia	

## ANNEX 4:

### PROGRAMME FOR PARALLEL SESSION 4 (COVERING SUB-THEME IV & V) - (D2-P4)

**Tuesday, 20<sup>TH</sup> November 2012**

**D2-P4: (SUB-THEME IV) YOUTH AND GENDER EMPOWERMENT FOR SUSTAINABLE DEVELOPMENT IN AFRICA  
 (SUB-THEME V) Mainstreaming Trans-disciplinarity in STI in Higher Education**

*Rapporteurs: Dr. Edith Gathoni, Post-Doctoral Research Officer, ATPS*

Time	Topic/Presentations	Presenter	Session Chair
08:30 – 09:00am	Registration		
09:00 – 09:20am	Youth and Gender Empowerment for Sustainable Development in Africa – The Role of the African Youth Forum for Science and Technology (AYFST)	<b>Mr. Victor Emeka Ngwoke</b> Chair, AYFST, Nigeria & <b>Mr. Abdelaziz Lawani</b> Vice-Chair, AYFST, Benin	
09:20 – 09:35am	<b>Theme IV:</b> Successful Youth Initiatives in Africa: Lessons and Way Forward for Attaining Sustainable Development	<b>Akola Amukhobe</b> <b>Constancia</b> TNS RMS, Nairobi Kenya	<b>Alice Lamptey</b> Senior Programme Specialist, PMU - Pan African University (PAU) AUC, Ethiopia
09:35 – 09:50am	<b>Theme IV:</b> Empowering Women for Sustainable Development through STI: The Key Challenges	<b>Ngozi Uche Onyejeli</b> Scotland, United Kingdom	
09:50 – 10:05am	<b>Theme IV:</b> Innovative and entrepreneur skills for employment. A challenge for the youth in Africa	<b>Luckson Muganyizi Kaino</b> University of South Africa South Africa	
10:05 – 10:20am	<b>Theme IV:</b> Bamboo Bicycle and Car: Green Solution to Nigeria's Transport Problem	<b>Ukoba, O.Kingsley</b> Federal University of Technology Akure, Nigeria	
10:20 – 10:35am	<b>Theme IV:</b> Youth Development, and engagement in science, technology and innovations in Tanzani	<b>Basili S.A, Liheta</b> Moshi, Tanzania	
10:35 – 11:00am	Q&A Facilitated Discussion Session		
11:00 – 11:20am	<b>TEA/COFFEE &amp; HEALTH BREAK</b>		

11:20 – 11:30am	<b>Theme IV:</b> Networking and Empowering Youth in Science, Technology, and Innovation (ST&I): A New Model for Youth Engagement	<b>Kiprono Caleb Metto</b> YADSI, Kenya
11:30 – 11:40am	<b>Theme IV:</b> Science for Women: Supporting Women’s Development and Livelihood Activities Through Science Technology and Innovation	<b>Ezeibe A.B.C</b> University of Nigeria Nsukka, Centre for Entrepreneurship and Development Research (CEDR), Nigeria
11:40 – 11:50am	<b>Theme IV:</b> Youth and ICT for Development: Digital Divide?	<b>Irene Magara</b> Mbarara University of Science and Technology Uganda
11:50 – 12:00 pm	<b>Theme IV:</b> The link between maternal employment and child wellbeing: evidence from West Africa	<b>Ikenwilo Divine</b> United Kingdom
12:00 – 12:10pm	<b>Theme IV:</b> Raphia Palm (Raphia Hookeri) Wine Production: A Goal Mine in Nigeria	<b>Okorji, E. C &amp; Okon, U.</b> University of Nigeria Enugu State Nigeria
12:10 – 12:20pm	<b>Theme IV:</b> Leveraging talent for African development	<b>Velaphi Msimang</b> The Mapungubwe Institute for Strategic Reflection South Africa
12:20 – 12:30pm	<b>Theme IV:</b> Maternal Education and Child Health in Nigeria: Implication for Science Technology and Innovation	<b>Azubike Achike</b> Department of Economics, University of Nigeria, Nsukka, Nigeria
12:30– 01:00pm	Q&A Facilitated Discussion Session	
01:00 – 02:00pm	<b>LUNCH</b>	



02:00 – 02:15pm	<b>Theme V:</b> Science, technology and innovation policy research in Africa's higher education: challenges, prospects and opportunities	<b>Chux Daniels</b> School of Business, Management and Economics The Freeman Centre, University of Sussex, United Kingdom	<b>Prof. Malachy Okwueze,</b> Deputy Vice Chancellor, Administration, University of Nigeria, Nsukka
02:15 – 02:30pm	Theme V: Education Implosion in Africa: Mainstreaming Appropriate Education Technology and Transdisciplinarity as a Way Out	O.C. Eneh Enugu Campus, University of Nigeria Nigeria	
02:30 – 02:45pm	Theme V: Integrating Humanities approaches to shaping African Technological Development: The Case for Indigenous futures component in the Science, Technology and Innovation Agenda in Africa	Oluwafunmilore Adebola Obafemi Awolowo University Nigeria	
02:45 – 03:00pm	Theme V: Information Systems Education in Sub-Saharan Africa: The Case of Kenyan University Business Students Specialization Choice Trends	Prof. Atieno Ndede-Amadi Kenya Country Business Incubator (KEKOB)I Nairobi, Kenya	
03:00 – 03:15pm	Theme V: Mainstreaming Transdisciplinarity in STI in Higher Education	Ibrahim Mohamed Ahmed Industrial Research & Consultancy Centre (IRCC) Sudan	
03:15 – 03:45pm	Q&A Facilitated Discussion Session		
03:45 – 04:00pm	<b>TEA/COFFEE &amp; HEALTH BREAK</b>		
04:00 – 05:00pm	<p>Panel Discussion</p> <p><b>Panellists:</b>  <b>Prof. Malachy Okwueze,</b> Deputy Vice Chancellor, Administration, University of Nigeria, Nsukka  <b>Prof. Anthonia Achike,</b> Depart. of Agricultural Economics, University of Nigeria, Nsukka  <b>Mr. Victor Emeka Ngwoke,</b> Chair, AYFST  Mr. Abdelaziz Lawani, Vice-Chair, AYFST  <b>Prof. Charles Asadu,</b> Head, Department of Soil Science, University of Nigeria, Nsukka  <b>Prof. Atieno Ndede-Amadi,</b> CEO, Kenya Country Business Incubator (KeKoBI), Kenya  <b>Dr. Benjamin Apraku Gyampoh,</b> Programme Officer African Academy of Sciences (AAS), Kenya  <b>Ms. Alice Lamptey,</b> Senior Program Specialist, PMU-Pan African University (PAU), AUC, Ethiopia</p>		<p><b>Dr. Benjamin Apraku Gyampoh,</b> Programme Officer African Academy of Sciences (AAS), Kenya</p>

## ANNEX 5:

### AGENDA FOR THE ATPS 2012 ANNUAL GENERAL MEETING (AGM)

- (1) Minutes of the 2011 Annual General Meeting and matters arising  
The income and expenditure account and balance sheet for the year ended December 31, 2011 (Report of the Auditors)
  
- (3) Reports
  - 3.1 Report from the ATPS Board of Directors
  - 3.2 Reports from ATPS National Chapter Coordinators
  - 3.3 Report on AYFST Program
  - 3.4 Report on AWFST Program
  - 3.5 Reports on other ATPS Programs
  
- (4) Election of Directors in the place of those that retired
  
- (5) Appointment and fixing of the remuneration of the Auditors
  
- (6) Presentation of the ATPS Phase VII Strategic Plan (2013 – 2017)
  
- (7) Any other business which may be properly transacted at an Annual General Meeting



## ANNEX 6:

# ABSTRACTS FROM KEYNOTE PLENARY PRESENTATIONS AND PARALLEL SESSION PRESENTATIONS

## ENERGY TRANSITIONS, INNOVATION AND DEVELOPMENT: GLOBAL IMPERATIVES AND AFRICAN REALITIES

Professor Lynn K. Mytelka  
UNU-MERIT

It is important to acknowledge from the outset that we have yet to begin the process of transition to clean and sustainable energy and transport systems anywhere in the world. But it is time that we consider how to do so and in developing countries, learn how to link this process to innovation and to sustainable and inclusive development. All too often, however, these objectives are considered as either-or options. That need not be the case as will be argued and illustrated in this presentation. Indeed, regarding these as complementary, can be a remarkably stimulating process, but it will require new thinking, the use of new tools and the development of new capacities for making choices about change.

**Keywords: energy transitions, innovation, development**

## INSTITUTIONAL STRUCTURES, POLICIES & MACRO ECONOMIC ENVIRONMENT IN AFRICAN COUNTRIES: IMPLICATIONS FOR SOCIAL INNOVATIONS AND BUSINESS COMPETITIVENESS

Prof. Eric C. Eboh

Economic competitiveness is critical to national and/regional growth potential, wealth creation and sustainable prosperity. In spite of the considerable improvements in macroeconomic and growth performances in the past decade, Africa remains structurally weak, poorly competitive and among the world's poorest and least developed regions. The interplay of better macroeconomic policies, FDI gains, debt relief and favourable commodity prices helped stem the tide of the global economic and financial crisis of 2007-2009. But, growth continues to be stifled by institutional weaknesses, misaligned sector policies coupled with infrastructural shortages, regulatory failures and dysfunctional market mechanisms. While very few African countries (like Mauritius & South Africa) are making steady progress in the middle bracket of the global competitiveness march, most are lagging in distant bottom positions. Tackling the productivity and competitiveness lags of the continent will require getting sector policies right (particularly for agriculture-industry linkages), reining in domestic resource mobilisation and making regional and national institutions work to create the critical investments in technological and social innovations. There is a large scope to strike a deliberate balance between 'state and the market' based upon accountable democratic governance, transparent and efficient public spending and human capacity building for private sector development. There is a compelling case for Africa's paradigm shift in tapping her comparative advantages in agriculture and agro-based industries by effectively deploying regional cooperation/integration, domestic policies and technological, institutional and social innovations. Africa's current circumstances call for a new model of state-market synergy that will have cross-cutting macroeconomic and microeconomic impacts. The synergy will work to promote agriculture-industry linkages, market-oriented value chain development, infrastructure financing, export competitiveness, environmental sustainability and efficient public service delivery.

**Keywords: Social innovation, Global competitiveness, Agriculture industry linkages, State-market synergy, Africa**



## ACHIEVING FOOD SECURITY AND SUSTAINABILITY FOR 9 BILLION

Professor Christopher J. Leaver Cbe Frs  
Emeritus Professor Of Plant Science, University Of Oxford, And  
Professor Sir Brian Heap, Centre For Development Studies, University Of Cambridge

*Old Byzantine Proverb: 'He who has bread may have troubles; He who lacks it has only one'*

During the last 50 years the world population has more than doubled to 7 billion and until recently the relative abundance of food has kept pace, with the poorest benefiting the most, yet more than 1 billion are malnourished and live below the poverty line. This dramatic increase in crop yields was due to a number of innovations: genetics and plant breeding (the so called 'Green Revolution'), mechanisation, irrigation, nitrogen fertilisers, and pesticides. Subsequently the developed world became complacent.

There has however been an environmental cost associated with modern high input agriculture and the world has lost 20% of its topsoil due to erosion, desertification and salinity, 20% of our agricultural land due to overgrazing and the generation of marginal land and 33% of our forests. In addition we now face the challenges of climate change as a result of massive fossil fuel usage resulting in increased greenhouse gases and carbon dioxide levels, decreased water availability, environmental pollution, loss of biodiversity, urbanisation and dietary upgrading (the 'nutritional transition' in China and India), obesity in the developed world and malnutrition and starvation in the developing world.

The major challenge for the future is to feed a predicted world population of 9 billion by 2050, 80% of whom will live in developing and transition countries with the majority living in an urban environment in mega-cities. Each hectare of land in 2050 will need to feed 5 people compared to just 2 people in 1960. To feed this number food production will have to increase by at least 70 percent on essentially the same area of land with less available water. This will require 'sustainable intensification - growing more from less' by using land and resources more efficiently, with the aim of meeting the current needs while improving the ability of future generations to meet their own needs. In addition we must conserve natural resources and preserve ecosystem function while minimizing, adapting to and where possible, reversing the effects of climate change.

Food security and the need for healthy staple food are no longer just the concerns of developing countries and they have become a global issue. Not least in Europe which is a net food importer.

To address these challenges the scientific community and colleagues in associated organizations should be engaged increasingly in strengthening the capacity for research and development and also transferring the results for the benefit of smallholder farmers and their communities in developing countries.

During the last 25 years there has been a revolution in plant science and the skills of the plant breeders have been enhanced by two new technologies, marker assisted plant breeding and genetic modification (GM). These developments have depended on our increasingly detailed understanding of the information content of plant genomes and how cells and organisms function at the molecular, biochemical and physiological level, linked to our ability to use this information to select for, and modify, important agricultural and nutritional traits. We will give examples of how it is being applied in world agriculture now and will be in the future. The application of these technologies must not only be applied to improving food production in major crops of the developed world but also adapted to improving so called, orphan crops in the developing world in general and Africa in particular by public good plant breeding.

As with many new technologies, people are keen to embrace the benefits but are concerned

about the potential risks. In Europe the manner of introduction of these new technologies coupled to a lack of coherent political policy has led to loss of community confidence which has been exploited by global pressure groups and activists for their own political ends. This has resulted in developing countries being denied access to the science where it has the potential to contribute to the improvement of food security and help alleviate poverty. GM crops are not a 'silver bullet' and alone cannot solve the global challenges outlined above. We must evaluate all available technologies and, subject to appropriate and realistic evidence-based, biosafety regulations and in combination with conventional approaches, deploy those which are most effective and sustainable. This will include sustainable farming practices and appropriate use of agrochemical inputs, wherever possible moving from chemical to biological solutions.

These technologies must not only be applied to improving food production in major world crops but also adapted to improving orphan crops which can address food security and nutrition as well as providing economic benefits to farmers in the developing world. However we must invest now as time is not on our side. Science and its application is not a quick fix and cannot be switched on and off like a tap. While science can provide technological solutions, these have to be implemented in a responsible and fair way for them to have impact. And this is not the job of scientists but of politicians, policy makers, regulators and funding organizations. Now, and in the future, making sure everyone has enough to eat is more than ever about politics, socio-economics, communications and science – it is not just about 'technology-fixes' (see [www.b4fa.org](http://www.b4fa.org))

Doing nothing is not an option!!

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**Keywords: food security, Green revolution, GM crops, Orphan crops, Biosafety**

## IS GENETIC MODIFICATION TO ANSWER TO AFRICA'S FOOD INSECURITY? LESSONS FROM INDIA

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Agriculture has been practiced in India for thousands of years. During the Indus Valley Civilization period (around 3000 BC) Indian dwarf wheat (*Triticum aestivum* sub-species *sphaerococcum*) was grown. Since that period and the time of independence in 1947, India developed capacity to produce about six million ton of wheat annually. It was not sufficient to meet the demand. The country had to resort to large scale importation of wheat. For over a decade the country had a 'ship-to-mouth existence'. Thanks to our visionary political and scientific leadership, agricultural research was given top priority for developing agricultural technologies supported by policies and investments in dams and irrigation, human resource development, improving rural infrastructure and services to transform Indian agriculture. The agricultural transformation in India can be best described in the words of Prime Minister, Manmohan Singh<sup>1</sup>: "The country has achieved a new plateau in food-grain production, exceeding 250 million ton during 2011–2012, an all-time record for the country. The production of grain-legumes, which is the main source of proteins in Indian diet, has touched 18 million ton, crossing the barrier of 15 million ton. The country is producing today more milk, more fruits, more vegetables, more sugarcane, more oilseeds and more cotton than ever before."

Genetics played a key role in transforming Indian Agriculture. Initial gains in improving agricultural production came from increase in area under cultivation and irrigation, but the introduction of High Yielding Varieties Programme (HYVP) in 1966 covering important crops like wheat, rice, maize, sorghum and pearl millet ushered the 'Green Revolution'. Major gains were obtained in the production of wheat and rice. HYVP resulted in increasing production of wheat to nearly 17 million ton in 1968, and there was no looking back, with wheat and rice production touching 86 and 104 million ton, respectively, in 2011. This remarkable achievement could be achieved through judicious integration of genetic improvement of crops by conventional breeding, improved agronomic practices, natural resource management and plant protection practices. India has also developed about 70 GM crops for resistance to biotic and abiotic stresses, and for improved nutritional value of crops. In 2011, India planted more Bt cotton than any other country, covering 10.6 million hectares. Bt cotton helped in increasing cotton production from 13.6 million bales in 2002 to 35.5 million bales in 2011<sup>2</sup>. However, so far, no food GM crop has been commercialized, as the country is actively debating the biosafety issues.

Africa's development challenges related to agriculture and food security are similar to those faced by India. Indian experience of integrated multidisciplinary approach supported by proactive policies and political will can help, not only in achieving sustained higher agricultural productivity but also in transforming the region into the world's bread basket.

**Keywords: Food insecurity, Bio-safety, Genetics, High yielding varieties, India**

## IMPACT OF NANOTECHNOLOGY IN WEALTH CREATION

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Over the last few decades, new technology applications have become very central to the process of socioeconomic development of nations. Among the recent scientific advances, nanotechnology is attracting the attention of many researchers, investors, and marketers for its enormous potential. Basically, nanotechnology is the creation of functional materials, devices and systems through control of matter on the nanometer length scale (1-100 nanometers), and exploitation of novel phenomena and properties (physical, chemical, biological, mechanical, electrical) at that length scale to produce new structures, materials and devices. This technology promises scientific advancement for many sectors such as medicine, consumer products, energy, materials and manufacturing.

Nanotechnology commercialization is expected to become a powerful driver of innovation, job and wealth creation in the global economy in the coming decade. It is estimated that, in 2015, the market in nanotechnology will reach \$1trillion. Nanotech inventions can help fight tropical disease, produce an abundance of food, provide for cleaner water, make the transport of goods easier and cheaper to people in remote areas, and provide clean and cheap energy sources. Consequently, nanotechnology has the potential to dramatically improve the health of citizens and create wealth. Wealth creation involves more than just money: it encompass factors such as enhancement of knowledge, intellectual capital, effective exploitation of resources, preservation of the natural environment, and other factors that may contribute to raising the standard of living and quality of life. This paper therefore aims at examining the impact of nanotechnology in wealth creation.

**Keywords:** *Nanotechnology, Wealth creation, Innovation, intellectual capital*

## BUILDING THE CRITICAL MASS IN SCIENCE, TECHNOLOGY AND INNOVATION (STI) CAPACITY IN RESPONSE TO EMERGING NEEDS OF AFRICA: THE ROLE OF UNESCO

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The world's economies are undergoing a fundamental transformation to knowledge-based industries and the capacity of countries to compete in the global market depends more and more on their ability to innovate harness their human capital and apply the relevant technology for socio-economic development. Africa has an enormous advantage: abundant unexploited natural resources and young population to play an essential role in knowledge-based global economic resurgence, but has not taken advantage of these attributes. The continent is challenged with sprawling urbanisation, adverse climate change effects on water, food security, healthcare, limited access to efficient and clean energy and increased youth population in which many girls are denied access to basic education and unable to realise their full potential. These challenges, however, offer opportunities for industrial and socio-economic development of the continent if countries develop robust STI policies and strategies to take advantage of these problems.

Time is now for Africa to invest in her human capital the youth and ensure gender equity if the continent must be competitive. There is an urgent need to develop the critical mass in science, engineering, technology and innovation in response to emerging industrial and socio-economic needs. These include solutions to basic needs, environmental sustainability and harnessing the potential of the youth by empowering them through education and training, skills development and entrepreneurship. UNESCO in partnership with other development partners will facilitate in repositioning Africa in the global village by supporting capacity building in STI Policy in science and technology to enable Africa to innovatively exploit her natural and human capital for sustainable socio-economic development. African Governments on the other hand must create the platform for implementing appropriate policies to accelerate the process. And African countries need to respond with policies, programmes, institutions and partnerships which maximize the participation of young people and enhance gender equity.

**Keywords:** *Knowledge-based, Human capital, UNESCO, Gender equity, Africa*

## A STRATEGIC APPROACH TO STRENGTHENING THE AFRICAN HIGHER EDUCATION AND RESEARCH SPACE (AHERS) THROUGH INSTITUTIONAL NATIONAL REGIONAL AND CONTINENTAL COLLABORATION

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Strengthening and sustaining the African higher education and research space is a primary goal of the African Union's strategy for harmonization of higher education, as envisaged in the AU's Plan of Action for the Second Decade of Education for Africa (2006-15) which aims to strengthen the capacity of African higher education institutions, through innovative forms of collaboration and improve quality through academic mobility across the continent. In preparation for the UNESCO 2009 World Conference on Higher Education (WCHE+10) a Task Force constituted by UNESCO and ADEA identified several strategic orientations for higher education in Africa, one of which was the creation of an African Higher Education and Research Area (AHERS). The WCHE+10 Communiqué in its section on Higher Education in Africa affirmed the need for Africa to develop and strengthen its higher education and research area through institutional, national, regional and continental collaboration. The Steering Committee of the Working Group on Higher Education (WGHE) of the Association for the Development of Education in Africa (ADEA) consequently commissioned an analytical study to explore the concept in order to propose concrete actions to African higher education stakeholders. The higher education and research space in Africa at present suffers from several challenges including disparate systems inherited from Africa's colonial past (Anglophone, Francophone and Lusophone) with some Arab countries in North Africa having their own specific systems. This situation severely handicaps academic mobility of staff and students, particularly on the continent, notwithstanding the fact that African Heads of State, as far back as 1898, had promulgated the Arusha Convention. It is now more urgent than ever for Africa to take strategic steps to strengthen its higher education and research space. The presentation identifies the key among these strategies including: accelerating the implementation of the Arusha Convention and strategies for harmonization of degree structures to enhance academic mobility particularly within Africa, establishment of an African quality assurance rating mechanism and quality framework, intensifying research and postgraduate training through establishment of regional centres of excellence, more effective use and integration of information and communication technologies, and promoting open and distance education and life-long learning.

**Keywords:** *Higher education, Arusha convention, Centre of excellence, Harmonization, Africa*

## ROLE OF SCIENCE ACADEMIES IN DEVELOPMENT IN AFRICA

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Science, technology and innovation (STI) have played critical roles in development in the past and will be even more so in the future. Evidence of Africa's slack in developing its STI potential and strides made by other continents based on investments in STI clearly indicates that the future of development in Africa lies in the effective harnessing, development and use of knowledge in science, technology and innovation. African societies have always depended on their rich indigenous knowledge to cope with challenges they face. However, higher education and research has not fully embraced this rich indigenous knowledge and has consequently failed to realize the benefits to society that would have accrued by doing so. It is often stated that Science Academies must be close enough to government to work with it but far enough not to lose its ability to think professionally and independently. In the face of competing demands for resources, it is important to recognize that only those investments in science and technology that are based on the best evidence yield the most optimum dividends. Academies must therefore take this challenge in order to position themselves as the most competent bodies to provide such advice. They need to likewise adopt trans-disciplinary approaches to problem solving. Current issues confronting Africa such as climate change and energy cuts across disciplines and African science academies need to bring together the diverse disciplines to bear on these issues. It is unlikely that most African nations will fully meet Millennium Development Goals (MDGs) by 2015. Continuing the 'Business as usual' approach will only result in shifting the dates, resolute commitment with trans-disciplinary platforms are likely to move the continent in the direction of achieving these goals. Academies have important roles to play to mobilize the most talented minds, dialogue with leaders for the right enabling policies and also strive for development of scientifically enlightened community. As Africa develops a science, technology and innovation strategy for the next ten years, Science Academies must provide the needed support and guidance to make it successful.

**Keywords:** *African Science Academies, Science Technology and Innovation (STI), trans-disciplinary science*

## YOUTH AND WOMEN EMPOWERMENT FOR SUSTAINABLE DEVELOPMENT IN AFRICA

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Over the past forty years, global consciousness of and concern for sustainable development has increased enormously in response to the environmental and social, problems that have arisen worldwide. The primary objective of sustainable development is to reduce the absolute poverty of the world's poorest of the poor through provision of lasting and secure livelihoods that minimize resource depletion, environmental degradation, cultural discrimination and social instability.

No effort to advance sustainability will succeed if more than half of the world's population comprising of youths and women are not taken into account. The vital role they both play in the three pillars of sustainable development- economic, social and environment must be acknowledged. There is therefore need for action to unlock their full potential.

Women as small holder farmers constitute 70% of Agricultural labour force and provide 80% of food in sub-Saharan Africa, but they are not involve or consulted in policy decisions. Also they earn only 10% income and own 1% of property. Women on the average reinvest up to 90% of their income into their households compared to only 30% to 40% by men. On the other hand, 35% of African people are between ages of 15 to 35 years. This is the age for foundation laying for the future, building corners and planning for family. Many youths in Africa are faced with daunting challenges of achieving their legitimate life objectives. Empowerment of women and youths is therefore critical for sustainable development in Africa. Also to bring lasting peace and sustainable development in African continent, African youths must be empowered. Empowerment of youths and women is a core development objective fundamental for both human right realization and key to effective and sustainable development outcomes.

Empowerment for sustainable development could be accomplished through appropriate credit scheme, support for income generation activities, capacity building for women farmers groups in value added chains, leadership and entrepreneurship trainings, vocational and business services training, information technology and microfinance. Interventions to promote empowerment should also include imaginative and creative use of new technologies and innovations that hold great promise for improving human health and wellbeing. This includes science and technology tools such as internet and cell phones as well as low technological innovations such as clean cook stoves. All are targeted at improving health, increasing productivity and reducing unpaid labour.

Some of the obstacles faced by youths and women in trying to advance sustainable development goal will be discussed. There is urgent need to elevate youth and women's leadership and participation in both economic, social and environmental policy processes and participation at all government levels. This is in view of the fact that these marginalizes groups play vital role in the three pillars of sustainable development even though their experiences fail to reach decision makers tables for informed policy making. Finally, investment in science, technology, engineering and mathematics (STEM) including environmental science by identifying barriers and developing opportunities for women and youths through mentoring would help in advancing sustainable development.

**Keywords: Women, Sustainable development, Africa, STEM, Empowering youth**



## SUB-THEME I TRANSITION TO LOW CARBON DEVELOPMENT PATHWAYS: IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT IN AFRICA

### PRO-POOR, LOW CARBON DEVELOPMENT: IMPROVING LOW CARBON ENERGY ACCESS AND DEVELOPMENT BENEFITS IN LDCS

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Access to modern energy services is a critical human development priority and can be transformative to the livelihoods of poor people. A tension is sometimes perceived between increasing energy access and pursuing low carbon development. High carbon, conventional energy options are often viewed as cheaper and hence easier for poor countries to pursue. However, multiple synergies potentially exist between human and economic development priorities, and access to low carbon energy technologies. Renewable energy can facilitate access in areas where grid based access is prohibitively expensive and unreliable, energy efficient technologies can improve availability of energy services, such as lighting and heat, and a combination of the two can increase local and national energy security and economic resilience by reducing exposure to the price fluctuations and political constraints of fossil-based energy provision.

Existing policy mechanisms that are intended to facilitate low carbon technology deployment in developing countries – such as the Clean Development Mechanism (CDM) – have had mixed results, and especially little impact in Africa. We argue that this low impact is in part due to a tendency to frame low carbon energy access in developing countries around the notion of low carbon technology transfer, where technology is understood in a narrow sense as hardware. This narrow understanding steers policy towards financing the incremental costs of low carbon hardware, such as can be seen in the CDM. Whilst hardware is clearly important, these financing mechanisms have led to an uneven distribution of investment, both technologically and geographically, with the poorest nations benefiting least, if at all. The majority of support is concentrated towards rapidly emerging economies, where financing environments are already attractive. The technologies funded tend to be low risk or mature, and mostly relate to large project based initiatives that are less likely to attend to the needs of poorer communities.

Building on insights from innovation studies and socio-technical analytical approaches, we suggest that the sustainable deployment of low carbon technologies will depend on policies and actions that foster both hardware and knowledge flows. Moreover, knowledge flows are central to building local innovation capabilities: the capabilities to adopt, adapt, develop, deploy and operate low carbon technologies effectively within specific contexts. But the existing innovation capabilities in any specific context also matter if technologies are to be successfully absorbed in the first place. Given this interdependent relationship, it is critical to the sustainable development of poorer countries that low carbon innovation systems are built along with the deployment of low carbon technologies.

Emerging policy initiatives such as Climate Innovation Centres (CICs) offer the potential to implement such thinking, assuming they do not fall prey to the hardware-and-finance framing evident in the CDM. And, in support of informing the development of such centre-based approaches, we outline research that will attempt to draw lessons from relevant experience in building low carbon innovation systems in developing countries. Specifically, this starts with lessons from the solar home system market in Kenya, where the first CIC will be implemented.

**Keywords:** *Pro-poor, Low carbon, Climate innovation centres, Clean development mechanism, low carbon technologies*

## FINANCING ACCESS TO SUSTAINABLE ENERGY FOR THE POOR IN NIGERIA: THE PUBLIC FINANCE OPTION

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The International Energy Agency (IAE) classifies energy access at three levels: access to basic human needs, productive uses, and modern society needs (Mainhardt-Gibbs et al, 2010). Electricity for lighting, health services, education, communication, and community services that require about 50-100KWh of electricity per person per year are the basic needs for the poor. In addition to the basic ones, the poor demands modern fuel technologies for cooking and heating, and this requires about 50-100Kg of modern fuel or advanced biomass stove. Arguably lack of access and inability of the poor to basic energy needs coerced the poor to look for destructive and unhealthy use of biomass which directly has an adverse impact on environment. Therefore, there should be options for the poor get access to basic and sustainable energy sources that include financing by government, private sector and the international development partners.

This paper, then, explores public finance option for enhancing access of the poor to sustainable bio-mass energy technology in Nigeria in a manner that improves their livelihoods as well as reduce their carbon footprints. In this respect, the paper will seek to answer five key questions: 1) what constraints do the poor have in accessing adequate energy; 2) what roles can governments play in avoiding such barriers; 3) what policies and strategies are required for effective government intervention; 4) what mechanisms should be put in place to implement and manage government interventions; and 5) what measures are required to monitor progress?

**Keywords:** *Low carbon development, Sustainable energy, Public finance, Livelihood, Nigeria*

## TRANSITION TO LOW CARBON PATHWAYS FOR SUSTAINABLE AGRICULTURAL PRODUCTION SYSTEMS IN NIGERIA

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The study examines the carbon profiles (soil and biomass) and management regimes for major agricultural production systems across the broad ecological zones of Nigeria. Of particular focus in the investigation is the extent of soil, plant and animal carbon emissions resulting from land use change and management practices within a given agricultural production systems. The study placed due emphasis on the current agricultural transformation agenda of the federal government of Nigeria to determine their overall implications for carbon emission regimes and related management responses for crop and livestock production. This is with the view to achieving a climate friendly agricultural system, without jeopardizing livelihoods sustainability, food security and effort towards national socio-economic transformation. Various options for transformation to low carbon pathways in context of agricultural production and land management are highlighted. The most viable options on grounds of economic and ecological sustainability were recommended. Preliminary findings indicate that soil and biomass carbon profiles and management regimes for the major agricultural production systems across the agro-ecological zones of Nigeria are complex. The rainforest agro-ecological zone exhibits most variation showing that different management systems impact on the ability of the soil to sequester carbon. While conservation tillage practices reduce the loss of soil carbon stocks associated with land conversion. However, the positive effect of conservation tillage is not comparable to the negative effect of land conversion, and may not result in significant accumulation of carbon in the region. In the drier Sudano-Sahelian region of the country, improved crop and pasture management are required to improve soil and biomass carbon storage. Strategies to attend this for major cereals and livestock production are recommended.

**Keywords:** *Soil and biomass carbon emissions, Land use change, Land management practices, Low*

## TRANSITIONS TO LOW CARBON DEVELOPMENT PATHWAYS: IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT IN AFRICA

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The emerging academic discussion about transition to more sustainable modes of development (or a 'low carbon' or 'green economy') has tended to be dominated to date by European writers largely concerned with a developed world context such as stable states, strong bureaucracies, substantial investments in innovation, mature financial systems, fairly well developed social democratic structures, strong private sectors. Writers interested in transition from rapidly growing developing country economies are few and far between. One reason for this may be the lack of an adequate conceptual linkage among transition, development and growth. Indeed, for many who are interested in sustainability transitions, growth is regarded with suspicion. This sets up a problematic foundation for an inclusive discussion that engages the developing world. To remedy this problem, this paper proposes a synthesis between the Multi-Level Perspective (MLP) the theory of industrial transitions and the theory of long-term development cycles. The resulting synthesis makes it possible to conceptualise the possible dynamics and modalities of the next long-term development cycle. Following long-term development cycles, it will be argued that the year 2009 marked the end of the post-WWII development cycle. What follows is an, more than likely quite a long, interregnum plagued by the consequences of what Edgar Morin called the "polycrisis" - a set of interlocked ecological and socio-economic crises. What is needed is a clear conceptual fusion of the deployment phase of the information age, the unfolding logic of the "spring/summer" phase of the next Kondratief cycle and the dynamics of niche-level innovations. This provides a critical framework for evaluating the key claims being made about the transition to a 'green economy' as contained in UNEP's Green Economy Report and the 2011 UN World Social and Economic Survey. This framework of thinking is then applied to develop a critical analysis of Africa's economic development policies and strategies. It will be argued that unless policy-makers in Africa recognise the deeper logics of transition underway, they will make decisions that will result in severe system failure in the relatively near future. By clearly demonstrating the linkages between transition, development and growth, it will be possible to conceptualise modes of African development that result in the decoupling of rates of economic growth from rates of resource use and negative environmental impacts such as carbon emissions.

**Keywords:** *Multi-level perspective, Niche-Level Innovation, Green economy, Low carbon development*

## ARTISANAL RASTRINEOBOLA ARGENTA LIGHT FISHING ON LAKE VICTORIA, KENYA: TRADITIONAL KEROSENE LAMPS AND PV-BATTERY MODERN LIGHTING SYSTEMS, MARKETS, AND IMPROVING SAFETY AND SUPPLY SECURITY.

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This research investigates the use of modern lighting technology in use for artisanal light fishing for omena/dagaa/mukene (*Rastrineobola argenta*) on Lake Victoria in Kenya. Technical system simulations, analysis of field data, economic modelling, and peer-research literatures indicate there is a clear economic rationale for small-scale stand-alone photovoltaic-based battery charging for new Light Emitting Diode (LED) lighting technology to displace existing pressurised kerosene lamp technology, and implementation of even an unsubsidized custom light fishing system design can deliver a substantial reduction in fishing costs. In addition, our research suggests that new lighting technology designs can more efficiently attract targeted fish species and potentially reduce catch of endangered cichlid species. Furthermore, our initial research findings elucidate numerous external benefits of the new system: new LED lighting systems can be locally designed and assembled, creating a new local service industry; and cost-effective photovoltaic-battery-LED designs may be used in the household during the day/evening in contrast to existing technology. The proposed technology reduces other major costs of fishing such as travel to obtain existing fuel/energy sources; the technology has zero emissions at point of use; is healthier and safer to operate; can eliminate environmental pollution due to kerosene use; increase local energy security, and enable fishers to own a fishing asset with lasting value, potentially of use as collateral to utilise credit services over time.

**Keywords:** *Lake Victoria, Light emitting diode, photovoltaic, kerosene lamp technology*

## CLIMATE CHANGE MITIGATION AND TRADE COMPETITIVENESS: AN ASSESSMENT OF THE CLEAN DEVELOPMENT MECHANISM IN EAST AFRICA

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While on the one hand industrialized countries are progressively inclining towards reducing their combined (GHG) emissions, developing countries on the other seem to be adopting policies and regulations aimed at broadening opportunities that promote socio-economic growth and development. So that trade and environmental policy agendas seem to be running on separate tracks. Countries in the developing South seem to be trapped in developing policy options that mitigate climate change impacts while balancing their stakes in terms of trade gains at global level. Clean Development Mechanism (CDM) is one such avenue that is currently being pursued because it does not only encourage sound environmental management but also industrialization through technology transfer, a prerequisite for greater market access and trade through trade competitiveness. In such setting CDM may appear to be an answered prayer for most developing countries in terms of achieving their socio-economic development visions but there seems to be apparent gaps, obstacles and limitations when we align the same trend to international trade, and in particular trade competitiveness. The reason is because the World Trade Organization (WTO) legal texts do not have clear cut guidelines between sustainable developments through climate change mitigation and free and fair trade through the gradual reduction of trade barriers. Therefore, adopting CDM fully in East Africa may have two pertinent implications within the purview of trade competitiveness: First, as a way of recovering certain costs associated with implementing CDM, the region may opt to impose taxes on goods or products penetrating into their market that do not comply with climate change mitigation procedures, a move that is not only highly likely to happen, but also capable to induce trade diversion. Second, the issue of having adequate structures and policies to buttress the region against imminent shocks arising from changes to a business environment that fully embraces sustainable development as envisaged in the Rio Declaration. This paper assesses the effectiveness of CDM in terms of trade competitiveness within the East African region. It begins by giving a brief introduction on CDM, and then proceeds to give an account of CDM in the East African Partner States, specifically Kenya, Uganda and Tanzania, including the legal, policy and institutional barriers towards implementing the scheme. This is followed by a brief synopsis, as to whether with the status quo; trade liberalization and competitiveness would still suffice. The subject matter of trade competitiveness in light of CDM is then introduced, including possible considerations and their impact on trade in these countries. The paper concludes its findings by giving further pragmatic policy recommendations

**Keywords:** *East African, Clean development mechanism, Greenhouse Gases, WTO, UNFCCC*

## EMPOWERING THE HEALTH OF RURAL FARMERS IN AFRICA THROUGH TELEMEDICINE: CHALLENGES AND PROSPECTS

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Telemedicine and Distance Learning for Health related services are wrongly perceived, assumed as luxury, and financially considered as most expensive systems that can't best fit for people in developing countries. However, the truth is rather contrary to what's perceived and assumed; it is a matter of contextualizing the services with respect to developing countries' existing reality especially in rural Africa. This research focuses on bringing the attention of stakeholders how to implement and operationalize rural Telemedicine projects in the developing countries, emphasising that projects are ensuring rural people benefit. This research cautioned stakeholders to examine first whether telemedicine projects are contextualized before fully entered into implementation phase or not. With proper design and effective implementation of telemedicine technologies serves as a tool to improve the existing health and educational services allowing health practitioners to easily reach out rural people. Telemedicine also saves travel time and resource that would have been spent in search of such services and this research paper informs telemedicine technology suppliers, services providers and service beneficiary to come together and figure out common challenge in order to maximize the benefit or Telemedicine service in rural areas. Cognizant, the role telemedicine plays in rural areas this research has outlined the challenges and prospects of telemedicine in light of expanding health service coverage in rural areas of Africa and recommends implementation of simple but reliable and affordable telemedicine technology services.

**Keywords:** *Telemedicine, Rural Africa, telemedicine technology, distance health education*

## PATHWAYS TO LOW CARBON DEVELOPMENT: ALTERNATIVE ENERGY SOURCES FOR AFRICA

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The economic growth and development of African countries is threatened by deficit and limited access to and use of energy. This is due to the inability of the Africans to use STI to manage the natural resources for their own benefit. This inability in the use of STI is evident in resource under-exploitation or exportation of unprocessed raw materials. As a result, energy supplies available for local populations are largely insufficient. The rate of access to electricity in SSA is only 31% with 14% access rate in the rural areas. Energy consumption, 80%, is essentially reliant on traditional biomass. This over dependency on biomass has led to depletion of over 75% of forest cover resulting in exacerbated climate change impact and threatened biodiversity and sustainability of the energy source. That is why Africa is one of the most vulnerable places to climate change despite contributing only about 3.7% of total world energy-related carbon dioxide emissions. This necessitates implementation of policies that can stimulate development of cleaner energy sources to enhance the adaptive capacity of households to climate change. These alternative clean energy sources are the main focus of this paper.

The move away from use of traditional to use of modern biomass energy or alternative renewable energy sources like wind, solar, hydro, and nuclear can potentially result in climate change mitigation outcomes. This therefore requires removal of barriers to energy access and use to reduce inefficiencies in the use of energy. This, calls for policies that will provide incentives to clean energy production and use. These policies include reduction of energy use tariffs and production tax, time-differentiated electricity pricing.

The paper therefore recommends (1) integration of energy and climate change adaptation and mitigation policies, (2) public investment and private sector involvement in STI and clean energy research and development, (3) involvement of women in modern energy technology projects in rural areas, (4) improvement of energy infrastructures to reduce waste during production and transportation.

**Key words:** *Energy, Climate Change, Policy, STI, Low-Carbon*



## MICROALGAE CULTIVATION AND ITS USE IN THE PRODUCTION OF BIOFUEL AND AGRICULTURAL INPUTS IN LESOTHO

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More than 85% of the energy source in the world is derived from burning of fossil fuels. In Lesotho, the residential energy demand coverage reaches 88% in urban and 95% in rural areas from forest vegetation. Such practices of utilizing biomass by cutting shrubs and woods for fuel consumption has two basic impacts: increasing greenhouse gases effect and desertification, and endangering diversity of indigenous and exotic tree species all together. While securing basic energy requirements of the community, establishment of environmentally compatible technologies that supports and ensures future recycling application to reduce environmental and health impacts of fossil fuels and desertification are equally important. A variety of raw materials which include agricultural wastes (plant residue and animal faeces, municipal solid wastes, market garbage, and wastewater from food and fermentation industries) are used in anaerobic digester to produce methane in a small scale both at farm and village levels. However, the scarce availability of these raw materials due to their use in agricultural farms as a primary source of humus, the use for methane production is very minimal. In some instances, where the production of methane from human faeces is practiced, it is found to be inconvenient due to its offensive odour and sanitation. The use of microalgae as a feedstock for the production of biofuel is a viable biotechnological option to fossil fuels and forest vegetation. Biofuels derived from microalgae decomposition, besides their economic implications as energy and agricultural fertilizer, they reduce greenhouse gas emissions by 85% over reformulated gasoline and crops. The selection of suitable indigenous microalgae strains with less lignocellulotic property and the search for efficient cellulose degrading, acidifying and methanogenic microorganisms is an important task towards successful implementation of the technology for its economic advantage and sustainability. The integration of these activities with agro-energy policies become a cross cutting strategy for future energy and food security in Lesotho and at large in Africa.

**Keywords: Methane, Microalgae, Low carbon fuel, Sustainable renewable energy, Biomass energy**

## CHROME-ALUMINIDE PROTECTIVE COATINGS FOR THERMAL POWER GENERATION APPLICATIONS

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Power plant systems and other utilities that use fossil fuel are susceptible to degradation due to corrosion and wear. The expanding gas-steam or combustion gases through which energy is extracted from burning fuel create highly corrosive environments at high temperatures. To achieve higher efficiencies higher process temperatures are used, but this increases the rates of plant component degradation. Protective coatings applied to these components exposed to such environments like the steel tubes and vanes lead to prolonged life spans, improved performance and reduction of repair/replacement costs and downtime. In addition surface coatings enable the use of simpler, cheaper and more easily available substrate materials with substantial reduction in costs, minimization of demands for strategic materials and improvement in fabricability and performance.

Development of advanced surface engineering treatments for optimization of corrosion and wear resistance in recent times have been of a more sophisticated nature compared to the traditional surface treatment technologies such as galvanizing, carburizing and Nitriding. These treatments essentially manipulate the properties of the material's interface to achieve superior properties.

Chromium and Aluminium, simultaneously deposited by diffusion into low alloy steel by the pack-cementation process provide enhanced protection against cyclic oxidation and cyclic hot corrosion. Diffusion takes place in a one-step halide activated thermo-chemical process to form a thin highly adhesive composite Cr-Al coating. The major controlling factor to achieve the desired coatings is the composition of the master alloy. Cyclic oxidation and hot corrosion tests carried out demonstrate the beneficial effects of the two element composite coating.

This paper examines and presents the unique beneficial properties of a chromium-rich aluminide coating and its application as effective barriers to high temperature degradation in thermal power generation plants.

**Keywords: Protective Coatings, high temperatures, Corrosion, Energy Security, Power Generation**

## AN EMISSION TRADING SYSTEM AS A POLICY TOOL FOR LOW CARBON DEVELOPMENT PATHWAY

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Agriculture, forestry and fishing, mining and quarrying, and oil and natural gas are crucial contributors to the GDP of major African economies. These sectors are entirely dependent on natural resources and activities related to industries operating in these sectors, like deforestation in timber industries and large-scale drilling in mining for instance, often lead to environmental degradation. A large portion of the African population, especially the rural population, is directly dependent on the natural resources for their sustenance and livelihoods. Thus the preservation of the continent's natural resources is of paramount importance to sustain the existence of these population segments. Africa's transition to low carbon development pathway thus has economic as well as social dimensions and implications.

Africa's transition to low carbon development demands involvement of unusual ways that would ensure achieving and sustaining the development processes through not only conceptually favourable but also feasible for implementation. Deciding alternative development pathways necessarily involves first appreciation of most African economies dependency on natural resources. Although, nations in Africa could opt to choose different approach on how to sustain their economic development adopting a low carbon development model could be analysed based on three fronts: 1) capitalising on natural capital, 2) embarking on green industrialisation, and 3) creating enabling policies and institutions.

This paper focuses on the third option, creating enabling policies and institutions. There has been much debate over recent decades about the need for a transition to a low carbon economy as well as the means to facilitate the transition and carbon emissions trading and carbon taxes are commonly conceived as the most common policy instruments to facilitate this move since the main target of such policy intervention is to reduce emissions.

**Keywords: Emission trading, Carbon tax, Low carbon development, Policy**

## TRENDS AND POTENTIALS OF RENEWABLE ENERGY DEVELOPMENT IN ETHIOPIA

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Ethiopia as an agrarian economy where 85% of the population engaged in small scale agriculture uses biomass as an energy source an attempt which directly affects agricultural land productivity due to nutrient depletion that would have been replenished through decayed of agricultural residues. Taking into account climate change, environmental vulnerability and depletion of natural resources, the Ethiopian government has launched a strategic direction towards nurturing renewable energy resources. The Growth and Transformation Plan (GTP) which was launched two years ago in July 2010 and to be extended up to July 2015 has set energy target of additional 8000 MW energy to be generated from renewable energy resources in order to meet both local demand and export market. The transformation plan has also introduced different but pragmatic implementation modalities to harness alternative energy technologies mainly to reduce deforestation and climate change induced effects. To this effect this year Ethiopia has again launched Climate Resilient Green Economy that highlights different adaptation and mitigation measures to help reduce emissions while ensuring sustainable development. Ethiopia strongly aspires to build green economy through proper utilization of alternative renewable energy sources such solar, wind, bio-fuels and geothermal among others. This research paper attempts to describe, and analysis trends, lessons, challenges and potentials of renewable energy development from the perspective of technical capacity, financial capacity, private investment role, market base and development partnership locally and through Foreign Direct Investment (FDI). The study uses scientific data collection, validity and reliability testing methods to ensure robustness of the study results. The results of the study are expected to serve as input for policy-makers, implementing bodies and researchers.

**Keywords:** *GTP, Green economy, renewable energy, Ethiopia*

## CONTRIBUTION OF ANIMAL AGRICULTURE TO GREEN HOUSE GASES PRODUCTION IN SWAZILAND: IMPLICATIONS FOR MITIGATION USING BIOTECHNOLOGY

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The economy of Swaziland is heavily depended on agriculture. In 2006, it was reported that agriculture, forestry, and manufacturing contributed 42% of Swaziland's Gross Domestic Product (GDP). Besides economic importance, animal agriculture is important for food production and life sustenance. It is also viewed as symbol of wealth and high social status particularly for the rural folks. Despite the merits of agricultural activities, agricultural production and particularly animal production have been incriminated for an accelerated emission of greenhouse gases. These gases are responsible for global warming and climate change. The aim of this study was to determine the contribution of Animal agriculture to greenhouse gases production and to elicit adaptation strategies to climatic change and the role of modern technologies as mitigating measures. The major and minor greenhouse gases produced by farm animals were computed using the IPCC spread sheet for calculation of greenhouse gases emissions. The major greenhouse gases produced by farm animals were CH<sub>4</sub>, N<sub>2</sub>O, and the minor gasses were NO<sub>x</sub> and CO<sub>2</sub>. The greenhouse gas that was emitted the most by farm animals was CH<sub>4</sub>, 24 Gg or 600 CO<sub>2</sub>e per annum. Ruminants were the major producers of methane. The producers of the least greenhouse gases emissions were non ruminants. Livestock produced 0.87 Gg of N<sub>2</sub>O per annum, a global warming potential of 259 CO<sub>2</sub>e. The findings of the study revealed that feeding ammoniated straw and silage, inoculating with transgenic rumen bacteria, animal breeding, manure storage techniques, use of biogas digester with methane gas recovery and emphasizing non ruminant production are possible strategies that can be employed to reduce the greenhouse gases production by livestock. It was recommended that feed preservation technologies, selection strategies, water harvesting, storage and recycling strategies and intensive livestock production systems could be used as adaptation strategies to climate change in livestock production.

**Keywords:** Green gases, Animal agriculture, Methane, Global warming, Climate change

## SUB-THEME II

# GOVERNANCE OF SCIENCE, TECHNOLOGY AND INNOVATION INCLUDING GENETICS FOR FARMING, BIOTECHNOLOGIES, NANOTECHNOLOGIES AND INDIGENOUS KNOWLEDGE SYSTEMS

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## INTRODUCTION TO THE WORKSHOP

Volker ter Meulen,  
Chairman of EASAC-NASAC project "Planting the Future"

Agriculture faces many challenges for generating food security at a time of increasing pressures from population growth, changing consumption patterns and climate, economic instability, and the need to avoid further loss in ecosystems biodiversity. Better use of genetic resources is a critical part of the necessary response to the challenges of food security. In particular, genetically modified (GM) crops can contribute to tackling the challenges if their development is carried out within a framework of appropriate policy and support for human and laboratory resources.

The African and European academy networks, NASAC and EASAC, have considerable interest in this area and are collaborating in a project "Planting the Future" to explore genetics for an innovative and resilient agriculture. One major work stream in this project is the collection of evidence to ascertain the impact of European actions on previous, current and likely future applications of molecular biosciences in agriculture in African countries. European scientists have expressed concern that European policy may have negative impact on GM research and development outside Europe and one main purpose of the present workshop is to share and analyse African perspectives on these issues.

Our workshop comprises a series of presentations by NASAC and ATPS scientists to set the scene on current developments in farming, biotechnology and nanotechnology across Africa, followed by group discussion to identify critical elements in the present situation and opportunities for the future, within the context of international relationships. There will then be a Panel debate on key issues followed by presentation of an important recent example of an approach to the regulation of GM technology, from South Africa.

The objectives of the workshop are two-fold: (i) to contribute to catalysing ongoing discussion across Africa on agriculture, genetics, biotechnology and nanotechnology and (ii) to inform the advice that EASAC will bring to the attention of EU policy-makers to explain that their choices have implications for other countries and that it is important to work together internationally in support of farming and food security.

**Keywords:** *Genetically modified, Food security, planting the future, biotechnology, nanotechnology*

## CURRENT SITUATION IN GM RESEARCH AND INNOVATION IN GHANA AND THE SUB-REGION: OPPORTUNITIES AND CHALLENGES

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West Africa is a food insecure region. It is estimated (FAO 2012) that 1 in 4 of the world's 840 million malnourished live in West Africa. Rising population and low agricultural productivity worsen the food situation. The application of known technologies in agriculture coupled with modern biotechnology on a need basis will be needed to increase farmer productivity. Countries with the enabling legislation in place have derived benefits from the application of genetic modification (GM) technologies. This presentation shall concentrate on the use of GM technologies in agriculture in the West Africa sub-region and Ghana in particular.

The area of land under commercialised GM crops globally has seen a phenomenal growth from 1.9 m ha in 1996 to 160m ha in 2011. Four crops, namely, maize, soybean, cotton and canola dominate world trade in GM crops. In Ghana and the rest of West Africa, the existence of intractable pests and diseases, declining soil fertility, climate change phenomena of drought and flooding, dwindling land areas and nutrient deficiencies and the danger of agro-chemical residues polluting water resources, offer an opportunity for the use of GM technologies in crop improvement.

The existence of enabling legislation for GM crops, infrastructural support services, markets and a core of well-trained scientists and motivated scientists and informed farmers are challenges to be addressed. Burkina Faso, Ghana, Senegal and Togo are the only countries in the West Africa sub-region that have biosafety legislation in place that allows the handling of GM crops up to commercial release. Nigeria has a cabinet approval for the handling of GM crops up to the confined field trial level but the law to allow commercial release has been passed by its Senate and waiting Presidential assent.

Burkina Faso is commercialising Bt cotton while confined field trials are on-going for Bt cowpea and biofortified sorghum (high carotene and iron content). Nigeria is handling Bt cowpea at the confined field trial level as well as biofortified sorghum. Both Burkina Faso and Nigeria are within the same consortium testing the same crops. Nigeria is also testing at the confined field trial level biofortified cassava (high carotene and iron contents).

There is the need to accelerate research at the Confined Field Trial (CFT) level to enable large scale testing just prior to release to farmers. Biosafety regulations should not be a deterrent to GM crop release for commercial use. The enabling environment should be created to allow the availability of farm inputs and market support services to facilitate the use of GM crops.

**Keywords: GM crops, Bt cowpea, Confined field trial, bio-safety, Ghana**

## CURRENT STATUS OF GM RESEARCH AND INNOVATION IN UGANDA

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Uganda is predominantly an agricultural country with more than 80% of the population engaged in agricultural practice. A third of the land area (6.8 million hectares) is under cultivation and most of the production is for subsistence and local food and income security. Vegetatively propagated food crops like banana, cassava and sweet potatoes are therefore the main food crops produced. These are closely followed by cereals like maize, millet, sorghum and then legumes such as beans and groundnuts. Uganda's climate is tropical hot and wet, creating a unique environment suitable for many crop pest and disease organisms to flourish hence the high diversity and disease pressures and common outbreaks observed. Other constraints include, poor soil fertility, and climate change which has made rainfall unpredictable and high extremes of both hot (drought) and wet seasons (flooding) expected. On the other hand, the continuous consumption of starchy staples has led to high micronutrient deficiencies leading to malnutrition, anaemia, blindness and stunting among children. Therefore, development of improved crop varieties is considered the most sustainable solution in subsistence farming communities. Therefore researchers at the National Agricultural Research Organisation (NARO) of Uganda realised the limitations of traditional breeding to deliver novel varieties with local preferences and adopted modern biotechnology to complement conventional breeding in order to respond to these demands. Through both Government and development partner support, NARO has developed capacity in genetic engineering of local varieties of crops such as banana as well as a framework to regulate contained and confined research of GM crops. This paper presents a review of the status of progress in developing genetic engineering systems of natively adapted crop varieties like banana, cassava, millet, potato and groundnut; status of gene technologies being researched at laboratory and field level as well as the regulatory framework that has approved field evaluation of banana, cassava, cotton, maize and rice.

**Keywords:** *Biotechnology, GM crops, GM research, Innovation, Uganda*



## PREPAREDNESS OF TANZANIA TO UTILIZE GENETICALLY MODIFIED TECHNOLOGY

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Globally, genetically modified technology is already being used to develop new plant varieties with beneficial genetic traits like biological herbicides, fertilisers and modifications used for food production. Furthermore, genetic modification is increasingly playing a major role in the improvement of human and animal health, through the development and production of vaccines, novel diagnosis for various diseases, and provision of medication for the treatment of many diseases.

Although genetic engineering has tremendous potential, progress in the adoption and utilisation of this new technology in Tanzania has been rather slow. Many research and development institutions have reported progress in agricultural biotechnology but very few have established programmes in genetic modification in the fields of agriculture, medical, environment or industrial. Furthermore, research and the use of genetic modification in Tanzania are limited by various factors including: inadequate capacity, lack of sustainable funding mechanism, functional biosafety system, inadequate regional and international cooperation and lack of public awareness.

Tanzania government has established the National Biosafety Framework (NBF) that specifies legal and institutional frameworks for genetic modified organisms' applications in the country. However, majority of the public in the country are unaware of the benefits of genetic modified organisms and if safe application is possible. This presentation attempts to give an overview of status and preparedness of Tanzania to harness genetically modified applications in various fields. It also discusses the challenges, and gives recommendations on the strategies for strengthening the application of this technology in the country.

**Keywords: GMO, Biosafety, Research innovation, Tanzania**

## THE VIRCA PROJECT AND ISSUES ARISING

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Cassava production in East African region is significantly constrained by two viral diseases; cassava brown streak disease (CBSD) and cassava mosaic disease (CMD). The Virus-Resistant Cassava for Africa (VIRCA) project was initiated to develop and deliver virus resistant farmer-preferred cassava cultivars with desirable agronomic and storage root quality attributes using RNAi (gene silencing) technology. Success has been demonstrated in the greenhouse and confined field trials (CFT) conducted in Kenya and in Uganda. Target cultivars for product development have been identified, and are being transformed to generate transgenic events while CFT regulatory approvals are on-going. An integrated field trial program has been designed for trait selection, agronomic performance trials and data collection for compilation of the dossier seeking regulatory approval for commercialization. These activities are supported by communication and regulatory efforts and plans for dissemination of the virus resistant varieties to farmers in the region.

**Keywords:** *Cassava brown streak disease, virus resistant cassava, Confined field trial, East Africa*

## NANOTECHNOLOGY: KEY TO MEETING THE MILLENNIUM DEVELOPMENT GOALS

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Nanotechnology can be harnessed to address some of the world's most critical development problems. Nanotechnology is the study, design, creation, synthesis, manipulation, and application of functional materials, devices, and systems through control of matter at the nanometer scale (1–100 nanometers, one nanometer being equal to  $1 \times 10^{-9}$  of a meter - ten times the diameter of a hydrogen atom. The diameter of a human hair is, on average, 80,000 nanometers), that is, at the atomic and molecular levels, and the exploitation of novel phenomena and properties of matter at that scale. Carbon nanotubes are 100 times stronger than steel but six times lighter. Nanotechnology has the potential to increase the efficiency of energy consumption, help clean the environment, and solve major health problems. It is able to massively increase manufacturing production at significantly reduced costs. Products of nanotechnology are smaller, cheaper, lighter yet more functional and require less energy and fewer raw materials to manufacture.

Nanotechnology suits Africa and the developing world, because it is highly productive, inexpensive and requires only modest amounts of materials and energy. Nanotech inventions can help fight tropical disease, produce an abundance of food, provide for cleaner water, make the transport of goods easier and cheaper to people in remote areas, and provide clean and cheap energy sources. Leading applications of nanotechnology that can most likely contribute to the attainment of the United Nations Millennium Development Goals (MDGs) include: energy storage, production and conversion; agricultural productivity enhancement; disease diagnosis and screening; drug delivery systems; construction; food processing and storage; water treatment; and pest detection and control. Optimum application of these technologies is critical to overcoming sustainable developmental challenges.

This paper examines the link between nanotechnology applications and key MTGs (Eradicate extreme poverty and hunger; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria, and other diseases and ensure environmental sustainability) and explores progress already made to harness nanotechnology in Africa.

**Keywords: Nanotechnology, Nanotubes, Energy, Environment, Sustainable development**

## STUDIES ON NANOBIO TECHNOLOGY CONTROL OF AGRICULTURAL PESTS AND PATHOGENS FOR FOOD SECURITY AND SAFETY

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Much of the problems facing agricultural productivity and sustainability are postharvest losses through the activities of pest and pathogens. Nanoscience and many nanotechnologies are concerned with producing new or enhanced materials. Nanoparticles hold great potentials in various contents. It is a branch of Nano biotechnology which combines biological principle with physical and chemical procedures to generate Nano-sized particles with specific functions. Antibacterial properties of the metallic nanoparticles have been investigated and found useful in the control of staphylococcus aureus among others. Nanoparticles have no toxic chemicals and no adverse effects on food. It has also been applied for dressing of wound, water purification, catheter and various household products due to their antimicrobial activities. The resistance of the causative agents of agricultural products coupled with potential health hazard on the environment gave birth to search for alternative to synthetic chemicals. Nanotechnology/Nano biotechnology is currently the best candidate for ensuring food security, safety and water quality. Federal government especially in developing countries are advised to mount regulating agencies that will be responsible for achieving food security and safety as done in America, India and Indonesia among other countries.

**Keywords: Food security, Nanotechnology, Pathogen, Pest, Safety.**

## PRACTICAL APPLICATION OF MODERN BIOTECHNOLOGY TOOLS TO MUSA BREEDING IN NIGERIA: POTENTIALS FOR INCREASED PRODUCTION

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The breeding of plantains (*Musa* species, AAB) in Nigeria has been approached through 4x – 2x breeding scheme to generate triploid hybrids. In this process, several factors were observed to impede rapid progress, including variations in genome size and structure within and across generations which reduces the accuracy of predicting progeny value from parental performance. The objectives of the study were to: a) assess the potential of early screening of 4x (AAAB) - 2x (AA) *Musa* breeding populations for discriminating ploidy and genome classes based on Flow Cytometry and genome-specific RAPD analysis, b) study the relationship between parents and offspring from 4x-2x families using amplified fragment length polymorphism (AFLP), c) evaluate the agronomic performance of progenies of reciprocal (4x – 2x versus 2x – 4x) crosses in *Musa* to understand how gender or ploidy affect the inheritance of quantitative traits, d) assess the potentials of use of biotechnology tools to enhance plantain and banana production in Nigeria.

The study was carried out at the High Rainfall Station of the International Institute of Tropical Agriculture in Onne (44° 43' N, 7° 01'E, 10 m above sea level). Results indicated that progenies of 4x-2x crosses produced predominantly 3x progenies (94.1%). RAPD analysis identified seven genomic classes, dominated by AAA and AAB configurations segregating 1:1 ( $\chi^2 = 0.21$ ,  $P = 0.05$ ). Five AFLP +3 primer pairs produced 2158 polymorphic bands among the hybrids and parental lines with segregation distortion occurring in the population. The marker similarity index between hybrids in different families ranged from 33.0 to 90.0%, while the genetic distance (GD) ranged from 10% to 67%. The mean contributions of the 4x and 2x parents to their progenies were 0.9: 1.2, respectively. Diploid progenies predominantly produced from 2x – 4x crosses were shorter plants, took shorter time to flower and produced smaller bunches compared to 3x progenies from 4x - 2x crosses. The differences in reciprocal breeding outcomes were attributed to complex microsporogenesis in parents of higher ploidy level. However, the use of biotechnology tools for increased plantain and banana production was highlighted.

**Keywords:** *Musa* breeding, RAPD, AFLP, Segregation distortion, Genetic distance, Micro-sporogenesis, Ploidy, Gender

## ANIMAL GENETIC RESOURCES, INTELLECTUAL PROPERTY RIGHTS AND TRADITIONAL KNOWLEDGE: QUO VADIS?

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Developments in biotechnology and increased investments in research and development in the field of animal breeding calls for granting of Intellectual Property Rights (IPRs) for inventions related to animal genetic resources (AnGRs) in order to encourage innovation and private investment in research and development for economic value of such resources. Patents, trademark and trade secrets, to mention but a few, are examples of intellectual property right (IPR) instruments used by governmental authorities to grant inventors and innovators in the field of industrial property certain exclusive rights to produce, distribute, and license goods and technologies within a country. Communities in some developing countries, likewise, in response to the aforementioned trend, have asserted their traditional rights to genetic resources of their farm animals, including indigenous breeds through, inter alia, the passing of Community Biocultural Protocols (CBPs). Premised on the importance of farm animals for food security, poverty alleviation and even aesthetic value to communities, this paper explores recent attempts by the United Nations Food and Agriculture Organization FAO, to regulate access to AnGR, the current status of patent law and community-based civil society initiatives to bring to the attention of policy makers their rights to genetic resources of their farm animals. To what extent is the current international regime prepared to reconcile these and other unforeseen interests? Where is the whole trend going to end up, Quo Vadis?

**Keywords:** *Animal Genetic Resources, Farmers' Rights, Food Security, Intellectual Property Rights, Traditional Knowledge*

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## SUB-THEME III

### INSTITUTIONAL STRUCTURES AND SOCIAL INNOVATIONS FOR SUSTAINABLE DEVELOPMENT IN AFRICA

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#### FOSTERING SOCIAL INNOVATION FOR SUSTAINABLE DEVELOPMENT WITHIN AN AFRICAN CONTEXT

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Globally, social innovation is increasingly being recognized as an integral part of development; addressing some of the world's emerging issues for example, fair trade, distance learning, hospice and waste reduction to restorative justice and zero-carbon housing. In the United States, at the start of 2009, President Barack Obama announced the establishment of a new office for social innovation at the White House allocating US\$50 million of the 2010 budget to fund for social innovation research and activities namely education and health care as well as economic questions and problems. At nearly the same time, the European Commission issued recommendations on how social innovations could be fostered and expanded to a greater extent for the amended European social agenda. These developments had come in the wake of the global economic and financial market crisis in 2008, making creativity and innovation in general and social innovation in particular essential factors for fostering sustainable growth, securing jobs and increasing competitive abilities. The Young Foundation defines social innovations as new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and creates new social relationships. They are elements of social change that create new social facts, changing beliefs of individual people or groups, highlighting the desire for collaboration and enhancing society's capacity to act. Although social innovation is happening all around us in Africa, surprisingly, very little is known about it. Yet, social innovations are becoming the norms amongst African youths particularly in the area of information, communication and technology, driving social change and economic development from the grassroots. Social innovations are indeed adding an extra capital dimension to sustain the African social fabric which is viewed as engine for growth, and as fundamental source of value. Therefore, ignoring these elements that drive the social fabric of society in favour of only new technologies poses significant challenges including low adoption and sustainability rates, deepening economic woes, social unrest (eg. the Arab spring) and unsustainability of investments in new technologies. Whilst Africa's emerging economies continue to invest in the public, large industrial enterprise, equally important is the need to also invest adequately in social innovations such as social enterprises which are becoming an integral part of the economy, mimicking the true African society – a focus on communities, the people, and social structures as measures of prosperity. By encouraging social innovation, policy-makers strive to pursue a triple triumph: a triumph for society and individuals by providing services that are of high quality, beneficial and affordable to users and add value to their daily lives; a triumph for governments by making the provision of those services more sustainable in the long term; and a triumph for industry by creating new business opportunities and new entrepreneurship.

**Key words:** *Social innovation, social fabric, sustainability, collaboration, stakeholders, Africa*

## THE LAND POTENTIAL KNOWLEDGE SYSTEM (LANDPKS) INCREASING LAND PRODUCTIVITY AND RESILIENCE

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Africa must significantly increase agricultural production to meet the needs of a growing population. Current efforts focus on intensifying production on currently used lands and expanding to un- or under-utilized lands. The success of both strategies requires understanding the land's potential productivity, and its resilience: its ability to resist or recover from degradation. Both potential productivity and resilience can vary widely across areas from less than a hectare to thousands of square kilometers, depending on soils, topography and climate. An understanding of land potential is therefore needed by governments for land use planning and climate change adaptation, and for negotiating land contracts that will ensure that a nation's productive capacity will be maintained. It is needed by national extension and international development organizations to target their investments. Finally, this understanding is needed by individual farmers to determine how to best feed their children today, while ensuring that future generations will also be able to feed themselves.

Much of the necessary information and knowledge to understand land potential already exists in the scientific literature and as local knowledge, but is often not accessible or easily integrated and shared. Where the information and knowledge are accessible, the types of land to which they are relevant is often unclear. In some cases, the most similar soil and climate conditions (and therefore the best places to look for successful management strategies) may exist within a country, while in others the closest analogy may be on a different continent.

The USDA and ATPS have established a partnership to develop a Land-Potential Knowledge System (LandPKS) with initial support from USAID, following on an ongoing ATPS social innovation project supported by the Rockefeller Foundation. The LandPKS will use mobile phone technologies and web-based knowledge engine to allow policymakers and land managers to share and access the most current information and knowledge for their specific type of land. A secondary function of this system will be to directly connect farmers, including women, with nearby farmers who have developed innovative strategies that they have tested on the same type of land. It will also increase the value and efficiency of existing agricultural extension workers by providing them with the tools and information necessary to communicate more specific and timely recommendations to particular groups of farmers (e.g., providing information on drought management specifically to those farmers with soils that are the most sensitive to drought).

Following the development of the knowledge engine and mobile phone applications (2013), LandPKS will be piloted in Kenya and Namibia (2014). These countries were selected because they include a broad range of biophysical conditions (soils and climate), large areas that are currently undergoing different types of land use change, a diversity of land ownership systems (communal, private and public), and very different levels of local knowledge, and management objectives, including both agricultural production and biodiversity conservation. Beginning in 2015, we expect to make LandPKS globally available. LandPKS is being designed to complement and increase the value of the work of a large number of other projects and initiatives, including AfSIS, and we look forward to developing new partnerships as the system evolves. Like many other social innovations, the development and implementation process will rely strongly on partnerships as the benefits of participating in the system are expected to vastly exceed adoption costs for both individuals and organizations.

**Keywords:** Land potential knowledge system, Resilience, Land information, Innovative strategies, USDA, ATPS



## ECONOMIC GROWTH'S SECRET WEAPON: INNOVATION & ENTREPRENEURSHIP

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Africa, one of the world's most appealing, yet untapped and underrated markets, is home to the Big 5: Innovation, Vision, Entrepreneurship, Passion, and Determination. The question then raised is: "But if you have these attributes, why are you dealing with so much poverty, unemployment?" The simple answer to this is that our economies are not growing fast enough and African governments do not invest enough into these skills. This then raises the questions: "how can we grow our economies to the point where we can alleviate poverty and unemployment?" and "what should governments be doing differently?" Whilst you might get hundreds of different answers, mostly theoretical, from experts across the globe, the answer is simple. "Start treating African countries as a business, utilizing and nourishing our strengths to eliminate our weaknesses whilst exploring the opportunities we have thereby reducing our threats". This can be achieved through promoting entrepreneurship and innovation in Africa!

To achieve this, we need to not only provide our children with the skills they will need to become entrepreneurs, but we need to promote and invest in existing entrepreneurs. Currently, less than 1% of African entrepreneurs have access to funding locally to start their ventures. Most African entrepreneurs source funding abroad, which often results in those businesses moving abroad and as a result contributing towards the American, European or Asian economies. Whilst most governments will argue they provide funding for entrepreneurs, their processes and requirements are often unrealistic and unobtainable due to the fact that such investments in entrepreneurs are managed by politicians and not by business people. Furthermore, most governments are now focused on a new buzz word, called social entrepreneurship. Social Entrepreneurship is not new and has been around for a very long time, however the definition of social entrepreneurship within Africa is hazy at best.

Social entrepreneurship is NOT non-profit organisations unless such non-profit organisations are generating income from its activities (provision of products and/or services), it is NOT acting in an entrepreneurial manner. Non-profit organisations might be innovative in terms of the wonderful things they are doing in terms of creating new and vibrant programs, BUT they are innovative and not entrepreneurial. Social entrepreneurs unlike NGOs, are not dependent on philanthropy, voluntarism or government subsidies, but are self-sufficient and sustainable. It is for good reason that governments are focusing on social entrepreneurship as it passes (or rather shares) the responsibility of addressing the pains experienced in society to the social entrepreneur. Government no longer needs to fund such through their own social development funds, but rather relies on businesses to improve the lives of their citizens and help grow the economy. The problem with this strategy is that it is not sustainable given the rate of increased poverty and unemployment in Africa. Governments therefore need to focus on investing in entrepreneurs, social and business entrepreneurs in order to grow their economies.

Economic growth, employment and equality will only be achieved by promoting and investing in the innovative ideas African entrepreneurs have to offer.

**Keywords: Entrepreneurship, innovation, economic growth, poverty, unemployment**

## SOCIAL INNOVATION AND ECONOMIC GROWTH: EXPERIENCES OF THE GLOBAL KNOWLEDGE INITIATIVE

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Scientists, technologists, and development practitioners operate in a time and context in which challenges are more complex, and call for more interdisciplinary approaches than ever before. While challenges are increasingly thorny, a greater number of resources and potential solutions now exist to solve them than at any time in history. Against this complex backdrop, one wonders: will exist resources-scientific, technological, institutional, and knowledge-based be utilized, or will they languish in academic, geographic, or sectoral silos? Going beyond this general question, will available resources reach those who need them to solve the scientific, social, and economic development challenges most important to developing and Least Developed Countries?

The answer to these questions lies in collaborative innovation. The power of collaboration innovation to solve challenges has been established in numerous studies. On the power of collaboration, Lakhani et al. note that "inclusion of random diverse collaborators in problem solving can increase computation performance by a factor of 10 to 100" (2007). Despite its importance, however, structures that optimize the collaborative effort and resources of participants do not often spring forth organically. Rather, forging, optimizing and sustaining "purpose-driven networks" requires intent, tools, commitment, and trust. Where these ingredients mix we see the effects of collaborative innovation: knowledge creation, transfer of ideas from where they are to where they need to be, and the potential to find sustainable solutions to tough challenges.

Drawing from Cowan, Jonard, Mairesse, Newman, Autant-Bernard, Wagner and others, this presentation will offer insights from the past decade of scholarship on knowledge creation, knowledge diffusion, and network structures for innovation. By framing our current understanding of how knowledge moves across actors within Innovation Systems and what attributes of networks correlate with its absorption, we will attempt to clarify the current understanding of networks as facilitators of innovation and economic growth.

Illustrating the power and promise of collaborative innovation, next this presentation shares the experience of the Global Knowledge Initiative as a case study in how collaborative efforts in science, technology, and innovation can solve development challenges and produce economic growth. Since its formation three years ago, the Global Knowledge Initiative has confronted difficult questions about the nature of innovation and how best to produce sustainable development solutions. Drawing on examples of best practice in forming, optimizing, and sustaining international collaborative innovation partnerships in Africa, Asia, and the US, we will consider the evidence available to justify collaborators' transaction costs, offering commentary on what yields success on the ground, with particular emphasis on Least Developed Country contexts. The cost of failing to collaborate is rising; knowing how to structure collaboration, and what type of collaboration works best to increase the rate of innovation, is essential

**Keywords:** *Social innovation, Purpose driven networks, Global knowledge initiative, network structures, LDC*

## CONSTRAINTS AND OPPORTUNITIES OF PROMOTING PUBLIC-PRIVATE PARTNERSHIPS IN IRRIGATED AGRICULTURE FINANCING AND MANAGEMENT IN NIGERIA

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Irrigated agriculture provides a very important part of national food security strategies as well as individual and community livelihoods at the local level. The application of water and its managed use has been an essential factor in raising productivity of agriculture and ensuring predictability in outputs. With variability of rainfall due to climate change and projected increase in population, the need for irrigation becomes more paramount. Yet the performance of many irrigation and drainage systems in Nigeria is generally below potential due to a variety of shortcomings. The monopolistic nature of the sector and its social sensitivity has fostered extensive government intervention that has not always been financially sustainable. Organizational issues such as unsuitable legal frameworks, incompatible actor interests, or inadequate economic incentives have all hampered the performance of the sector. At the irrigation project level, insufficient cost recovery and lack of direct linkages between revenue and expenditure, and between the client and the service agency are the root of the problems resulting to lower performance. Globally, there is a consensus for irrigation sector reform bothering on institutional structure for irrigation management to increase water productivity. While such arrangements are important, some questions arise about these concepts: would it work in situations where the physical infrastructure is dilapidated; what should be the cost-sharing approaches in financing irrigated agriculture; what is the essential set of rights, responsibilities and powers to be included in irrigation management transfer? How can new institutions or regulations be introduced while matching past or traditional ones. These concerns underpin this paper which discussed the constraints and opportunities of public private partnerships in irrigated agriculture management and financing. Case studies were used to exemplify points and provide basis for recommendations.

**Keywords:** *Irrigation, Participation, Sustainability, Risks, Institutions.*

## MAINSTREAMING M-HEALTH INNOVATIONS WITH LOOSELY COUPLED POLICY INTERVENTIONS IN AFRICA

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Healthcare continues to pose challenges of affordability, complexity and access in Africa. As a result, 24% of the global disease burden is born by Africa with only 3% access to healthcare service providers. In contrast, there are more than 600 million mobile phones compared to 11 million hospital beds in Africa. The mobile penetration is almost 82% across Africa and there is evidence base of innovations in service provision through mobile technology. One new area of innovation is the Mobile health or m-Health which is the use of mobile communication and devices for providing healthcare services or achieving health outcomes. Though the field of m-Health is evolving in Africa, it is clear that there are few e-Government, e-Health, and Health Information Systems (HIS) synced policies that take into account the increasing access to mobile telecom infrastructure and availability of m-Health panaceas. Innovation in m-Health applications is being driven by commercial opportunity, community policy, unselfishness and sometimes intellectual curiosity. Mobile health policies are necessary for leveraging innovations and creating safe environment for health care service provision. Innovations in m-Health need enabling policy, funding and regulations at national and institutional levels. This paper presents a context for loosely coupled policy intervention that has two parts: a set of policy issues related to m-Health and a set of leveraging strategies. The notion of loose coupling is invoked to account for the rather weak ties between policy making and practice on one hand and implementation on the other hand. Secondly, the various actors (quadruple helix) in healthcare provision in Africa are often organised in a segmental but loosely coupled way where separate and semi-autonomous work units specialize in different areas of care delivery. Thirdly, while it can be assumed that all African countries have the same aspirations for improved health care provision, the fact that each country is at different levels of development means that not all policy issues are viewed in the same way. Hence there is a need for loosely coupled policy frameworks. The paper further provides a repository of policy information on the best practices, frameworks for success, applications and an evidence base of what works and what doesn't for various contexts and recommendations on m-Health policy environment. The recommendations target the major m-Health policy-makers, telecom operators, systems designers, manufacturers and mobile technology providers, healthcare providers and insurers as well as users. The discussions presented are geared towards fostering an environment for informed innovation to continue to generate novel m-Health approaches to addressing health issues in Africa.

**Keyword:** *m-Health, e-Health, Loosely Coupled Policy, Mobile devices, Quadruple helix, Mobile technology*

## DETERMINANTS OF MICRO-ENTERPRISES GROWTH AND REVENUE IN THE NIGER DELTA, NIGERIA: MICROFINANCE THE WAY FORWARD

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The study was carried out to determine microfinance as a way to encourage growth and revenue of entrepreneurs as a strategy for developing micro-enterprises in Delta and Bayelsa State, Nigeria. Descriptive statistics, likert scale rating technique and ordinary least square model were used to analyse the data which was collected through random sampling technique. About 120 micro-entrepreneurs were interviewed using pretested questionnaire. The results showed that majority (90.0%) of the entrepreneurs were ageing, falling between 31 and 65 years of age. The result shows that 60.0% of female operators dominated relative to male owned enterprises (40.0%). The survey result indicated that most (56.7%) of the micro-enterprises are relatively young in the study area as demonstrated by the experiences acquired. The result further showed that 84.2% of the enterprises employed between 1 and 10 persons only. It shows that majority of the businesses are small and cannot enjoy reasonable economy of large scale. The result also showed that 40.8%, 34.2% and 4.2% of the entrepreneurs had primary, secondary and tertiary education respectively. The result showed that the entrepreneurs are educated. The result indicated that 92.5% of the entrepreneurs have no access to market stores renting. The result showed that majority (72.7%) of the entrepreneurs rent a private store at the rate N60, 001 and above per annum. The result also showed that 90.0% of the entrepreneurs have no access to cold-rooms while 93.3% of the entrepreneurs have no access to electricity supply from the national grid, but uses private generators which increases the cost of production. The result of the regression analysis shows that the revenue from the micro-enterprises was best estimated using the double-log function, which explained 84.7% of the total variation. The study found out that age of entrepreneur, number of employees, length of experience in business, education, income level of entrepreneurs, asset holdings, access to market, and access to electricity supply, access to cold-rooms, amount of loan received and loan usage were positive. The result also showed that cost of renting stores and loan disbursement were negative. The major growth constraints on micro-enterprises as perceived by entrepreneurs was lack of capital (mean = 4.55) and risk (mean = 4.51). Other constraints are high cost of raw material, access to credit, lack of infrastructural facilities, size of loan received, weak purchasing power, working premise/ location, lack of awareness, availability of raw material and marketing problem. The results of the study calls for policies aimed at encouraging agro-based micro-enterprises development by improving the revenue of the entrepreneurs through micro-financing by government and non-governmental organizations to expand market infrastructures and boost agricultural intensification. It is recommended that government and corporate bodies should take this matter with almost importance to encourage rural and urban industrialization to improve the standard of living of entrepreneurs.

**Keywords: Micro finance, Micro-enterprises, Entrepreneurs, Growth, Revenue, Niger Delta**

## MAPPING INSTITUTIONAL LINKAGES IN CLIMATE CHANGE ADAPTATION AND MITIGATION: IMPLICATIONS FOR SUSTAINABLE FOOD SECURITY AND ENVIRONMENTAL QUALITY IN NIGERIA

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The issue of climate change has become more threatening, not only to the sustainable development of socio-economic and agricultural activities of any nation, but to the totality of human existence. The effect of climate change implies that the local climate variability that people have previously experienced and adapted to is changing and this change is observed in a relatively great speed. Many countries in tropical and sub-tropical regions (Nigeria inclusive) are expected to be more vulnerable to warming because of additional temperature increase that will affect the marginal water balance and harm their agricultural sector. Cases of flooding have been on the increase among African countries affecting farmers' output. The effect of climate change is expected to be most severe in Nigeria where current institutional framework for effective climate change resilience is not effective, where funding to agricultural research has been comparatively low, the current spread of agricultural information and training are poorest, technological changes have been the slowest and where domestic economies depend heavily on rain-fed agriculture. Factors that constitute institutional challenges in climate change resilience were discussed in the paper while the framework for effective institutional linkages (formal and informal institutions) and roles expectations of the major actors were highlighted. In conclusion, it was recommended that there should be a responsive capacity building of human resources within the framework of climate change resilience, there should be more vulnerability and adaptation studies with more aggressive mobilization of funds towards adaptation and mitigation at all levels.

**Keywords: Agriculture, Climate change, Sustainability, Institutions, Resilience, Nigeria**

## APPROPRIATE INNOVATION STRUCTURE FOR SUSTAINABLE DEVELOPMENT

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It is becoming more noticeable that innovation is not just invention. New ideas and improvements about processes, services, and products are generated constantly on shop floors, in research institutions, and in every home and that is what is known as innovation. The economy of any country needs smart and flexible innovation system. According to the Science, Technology and Innovation (STI) policy green paper, 2010, STI situation of Ethiopia reveals that the National Innovation system of the country has never been clearly defined. Furthermore, according to the Innovation for Development Report: 2010, (Innovation Capacity Index (ICI) survey that covered 130 countries and identified over 60 factors that have bearing on a country's ability to create an environment that encourages innovation) Ethiopia has been listed as 108th. As a rapid development seeking government's commitment to eradicate poverty, the Government of Ethiopia needs to take science, technology and innovation as the major tools to achieve the aspired development goals of the country. Recent educational interests in science and technology, technological capacity building activities, priority sectors selected and recently approved Science Technology and Innovation (STI) Policy are evidences that could be provided to assure the government's commitment.

Innovation is observed in different forms: government motivates social innovation for solving local and international problems so as to enhance nation's development and cohesion, industries encourage innovation to stay at competitive edge, and educational institutions aim to contribute new things to the body of knowledge which demands innovative thinking. All these need clear and unbiased innovation structure nationally as well as institutionally. If we do not build proficient innovation system for a nation and create favourable and encouraging environment for innovators, then we cannot expect sustainable development. It is the researcher's intention to analyse pertaining situations in Ethiopian and recommend policy directions that suits and prepares Ethiopia for the dynamic and innovative future. Different stakeholders in Ethiopia will be assessed for the study purpose. The former Ethiopian Cleaner production centre which aims to introduce environmental friendly production systems in the industry is one. The other will be Ethiopian intellectual property office where most social and industrial innovations are registered. Federal Micro and Small Enterprises Development Agency of Ethiopia is of high interest in this study. Furthermore, some industries will be assessed to analyse their institutional innovation policies. After analysing these aspects in Ethiopia, future policy direction will be forwarded.

**Keywords: Innovation, Structure, Policy, Science and Technology.**

## ASSESSMENT OF INNOVATIVE INSTITUTIONAL ARRANGEMENTS: THE CASE OF INTEGRATED TAMALE FRUIT COMPANY (ITFC) IN GHANA

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Agriculture is a significant thrust for development in Ghana. It offers a number of profitable activities, including inter-linked transactions or contract farming (out grower scheme) that is still in its infancy in the country. The study focused on the experience of the ITFC; to assess the opportunities, challenges and potential for further investments in water management based contract farming systems. Field visits to stakeholders of the ITFC model and reviews of pertinent literature on national policy towards contract farming were the major activities undertaken. The results revealed that there were no clear cut national policies in terms of contract farming mechanisms over the years. At best the establishment of out grower schemes were mentioned as components for achieving objectives of some projects. The ITFC model depicts the only water management based contract farming experience currently in the country. It produces organic mango on a nucleus farm in conjunction with those produced by its contracted farmers for the export market through the provision of an interest free loan. The parties derive mutual benefits as producers earn long term sustainable incomes and the buyer get large volumes of organic mango for processing and export. The principal stakeholders involved in the contract namely, company, leadership of the out growers association, and individual farmers overwhelmingly expressed satisfaction about the terms guiding the contract. The scheme offered opportunities to increase incomes and reduce risks but examined against a set of criteria for successful solutions, the results were mixed – contribution to smallholders' livelihoods, gender and equity contributions, out-scalability, ease of implementation and resource sustainability. One of the biggest challenges for all stakeholders was establishing mutual trust others were information asymmetries, high transaction costs and incentives for companies to contract with smallholders. The potential roles for investors included the provision of legal and institutional frameworks to enhance transparency and to clarify privileges and responsibilities, support farmer organizations in out grower schemes to ensure farmers' voices were heard and their interest served in the long run, ensuring poor farmers participation by provision of affordable credit and repayment terms that coincided with farming income cycles, safety nets etc., ensuring women farmers participation by setting realistic conditions for financial support and the provision of incentives for companies to invest in poor smallholder farmers.

**Keywords: Contract farming, Water management, ITFC model, Organic mango, Ghana**



## TREATISE AND PRAXIS LINKING SOCIAL INGENUITY AND INSTITUTIONAL INNOVATIONS IN SUSTAINABLE DEVELOPMENT: A CASE RESEARCH IN AFAR AND BORAN

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Common sense would exact an urgent need to bring into equilibrium to scale the destructive magnitude of industry, untenable demographic dynamics and frantic misuse of resources on the one hand and development pastoral sustainable livelihoods on the other. Beyond platitudes and empty pledges, global covenants for a sustainable world have borne little fruit. The Rio+20 jamboree manifestly projected the mercerisation of well-meaning global survival concerns by financially dominant and compelling transnational companies and client states which successfully coerced a dramatic barter of the human environment and life on the planet with admirable succinctness and brazen verve.

The knowledge gap addressed in the research is the link on how local social innovations can be transformed into institutional praxis in sustainable development at the national level. Hence, the research questions underpin (1) what social innovations do exist in communities? (2) What are the environmental challenges to these innovations posed by vectors of vulnerability and (3) how would technology off set this and what measures are being taken to institutionalise these innovations into production practices? These call for a requisite need to look for innovations, which promote appropriate sustainable development administration. Hence, the key objective of this inter-disciplinary research is to analyse critically the discourse on people-driven institutional and social innovations in sustainable development management and elevate this to a higher paradigm of linking the innovations at grassroots level to national policies and praxis.

Methodologically, the research uses both quantitative and qualitative methods to collect, collate and analyse the praxis in the link between societal and institutional innovations, employing four major techniques of participatory action research user-friendly and people-based research, critical recovery of history, valuing and using popular culture, production and diffusion of new knowledge. Two communities in the Afar and Boran areas in Ethiopia, which possess many of the multiple innovation features, have been chosen to participate in the study. The survival of the pastoral production system in both societies is a function of their adaptability to the social and physical environment and strategies that are employed to meet each new challenge maintain the resilience of the system and help minimise unforeseen risks. The study concludes by proposing public polices strands informed by trans-disciplinary systems studies that need to be set in motion in Africa so that those strategies can be transformed into becoming the basis for sustainable livelihoods based on social entrepreneurship and that further innovation capacity development.

**Keywords:** *Sustainable development, Rural entrepreneurship, Sustainable livelihoods, Adaptive strategies, Social innovation, Institutional practice*

## INSTITUTIONAL CHALLENGES OF CURRENT STRUCTURAL CHANGES IN WEST AFRICAN AGRICULTURE: AN ANALYSIS FROM THE BENIN CASE

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A metaphor that best describes the actual state of the agricultural sector in most (francophone) West African countries is "pouring old palm wine in a new pot or using an old pot to serve fresh palm wine". It is my contention that the staff and the operational modes in non-public agricultural research, training and extension organizations, and professional associations lag some decades behind the structural changes underway in the agricultural sector. Of these structural changes four are of interest here: 1) Diversification of farm enterprises' profiles, ranging from smallholder and medium size family farms of half literate male, female or young farmers with differential time allocation schemes (occasional, part and full time farmers), to medium and large agri-business of natives, or to very large agri-business with foreign financial shares; 2) Scattered mechanization (tractor-ploughing, water-pump and irrigation for horticulture and rice cultivation) limited to a few farming operations along the value-chains and therefore constrained by the pace of the non-mechanized operations; 3) Emergence of few industrial agro-food processing enterprises that contract out to smallholder farmers part of their supply in agricultural raw material; and 5) New structures of local and foreign markets for farm and agro-industrial products, following a rapid transformation of the food consumption patterns of increasing urban populations dumped with food imports, while new regulations make it hard to African agriculture to hold any substantial share on western markets.

The paper first highlights these major structural changes with cases studies. Some subsequent manpower and STI needs are discussed. Then, the actual framework of actors, organizations and institutions in charge of agricultural STI is sketched. The text devotes particular attention to the ways in which these organizations reproduce their functioning modes of the 1960s and 70s, despite the multiple reforms they underwent over the past 20 years. Recent innovative R&D and setting of innovation platforms are presented together with their successes and shortcomings. The paper concludes with a few policy recommendations to key players of the sector.

**Keywords:** *Agricultural sector, Structural changes, Agricultural STI platforms, Convergence of sciences, West Africa*

## ENABLING RURAL INNOVATIONS FOR SUSTAINABLE DEVELOPMENT IN MALAWI

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Sustainable Development entails issues of economic prosperity, social inclusion and environmental sustainability. Climate change and variability is considered as one of the most serious threats to sustainable development with adverse impacts on food security, social and economic activities and physical infrastructure. The impacts are so rampant in Africa, which is considered to be one of the most vulnerable regions to climate change in the world. Africa is subject to wide spread poverty, recurrent droughts, hostile climates, unsustainable technologies, and over dependence on rain-fed agriculture as such, the majority of farming households in Africa have struggled to sustain their livelihoods and this has been as a result of numerous social, economical and environmental degradation problems which have been exacerbated by adverse impacts of climate change and climate variability.

Understanding and the Rio+20 declaration on varied fronts, Arise and Shine International- a civil society organisation which was part of the Malawi delegation to the Rio+20, United Nations Conference on Sustainable Development, together with her partners, recently, developed a program entitled, "Enabling Rural Innovations for Sustainable Development in Malawi." This is an action research based program which also aims at evidence based policy formulation and advocacy at national and community levels.

This program is very unique and complements the Malawi government's efforts of eradicating poverty and hunger since it emphasizes in putting farmers first (i.e. taking farmers as partners) in development projects through use of private public partnerships (PPPs) in the context of inclusive or pro poor value chain development approach and building up the capacity of farmers to use their indigenous knowledge for sustainability of their agro enterprises and hence sustainable development of the communities involved and Malawi at large.

This action research program is also based on the hypothesis that utilization of farmers' indigenous knowledge & innovations and improved farmers access to markets of their produce would encourage farmer's investments into the natural resource base, conserve biodiversity, hence enabling farmers to mitigate and adapt to climate change impacts for their livelihood security, and ensure sustainable development of their communities and the nation at large.

The program is being piloted in Traditional Authorities Maliri and Chapananga in Lilongwe and Chikhwawa districts, respectively. Participatory community diagnosis-where resource mapping, enterprise selection through matrix scoring, community visioning and action planning were done, was conducted in the months of July and August 2012 in all the two districts. The baseline survey where individual household questionnaires, focus group discussions and key informant interviews were administered was also done. This creates a basis for participatory monitoring of interventions and impact evaluation of the program. This paper therefore also highlights results of the participatory community diagnosis and baseline survey conducted in the targeted pilot program sites.

**Keywords: Economic prosperity, Social inclusion, Environmental sustainability, Enabling rural innovations**

## THE IMPACT OF REGULATION ON THE ADOPTION AND DIFFUSION OF POINT-OF-SALE TECHNOLOGY IN NIGERIA

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The contribution of a new technology to economic growth can only be realised if the technology is well adopted and widely used. The cashless policy initiated by the Central Bank of Nigeria (CBN) is aimed at reducing Nigeria's heavy dependency on cash transactions, supported by introducing several technology innovations in payments including the Point-of-Sale (POS) technology. For merchants and traders alike, the POS technology provides a more efficient and convenient payment channel to facilitate business transactions. However, adoption rate of the POS technology in Nigeria is at 0.013% of the potential adopters (merchants), far from the projected minimum of 3 POS per merchant by 2015. This level of adoption is very low compared to other African countries such as Uganda (0.45%) or South Africa with more than one POS per merchant. Evidence from the healthcare sector indicates the potential impact of regulation on adoption and diffusion of a technology. The objective of this study is to examine the potential impact of existing regulations. Firstly, as methodology, we use the relevant sections of the official document published by the CBN; "Guidelines on Point of Sale Card Acceptance Services", to critically examine the current regulation of the payment cards market in Nigeria. Secondly, we examine the theoretical underpinnings of how the market for payment cards works, using the two-sided market framework. The emerging framework is then compared to the Nigeria model, to determine indicators of market imbalances and distortions, and how these might impact adoption and usage of POS technology in Nigeria.

We find that the fees structure for POS providers operate outside the standard two-sided market framework, thereby creating imbalances and distortions in the current Nigerian model. Also, the current regulatory structure appears to undermine the learning and persuasion stages of the adoption and diffusion dynamic process, thereby limiting the ability of merchants to acquire and use POS terminals. Moreover, we find evidence of duplication of processes and functions, which increase costs to end-users of POS terminals, and ultimately adoption and usage.

Imposing an operational technology through regulatory mandates is unlikely to be effective in an industry characterised by network externalities. It is important that the fee structure facing merchants balances the two sides of the payment market. Current distortions are not undesirable given the need to ensure smooth functioning of the payment infrastructure in Nigeria (e.g. POS deployment, maintenance, training, and support). However, this may increase costs on the adoption side of the market. Therefore, policies and procedures promoting the POS technology in payment should grow naturally from incentives provision associated with its adoption and usage.

**Keywords:** *Technology adoption and diffusion, Regulation, Network externality, Point-of-sale, Nigeria*

## SUB-THEME IV YOUTH AND GENDER EMPOWERMENT FOR SUSTAINABLE DEVELOPMENT IN AFRICA

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### YOUTH AND GENDER EMPOWERMENT FOR SUSTAINABLE DEVELOPMENT IN AFRICA: THE ROLE OF THE AFRICAN YOUTH FORUM ON SCIENCE AND TECHNOLOGY (AYFST).

Emeka Victor Ngwoke (Chair, AYFST), Abdelaziz Lawani (Vice-Chair, AYFST)

Africa is the most youth continent. Globally youths represent a noticeable segment of the society of the continent and constitute about the third (30%) of the total population in most African countries (Chigunta, 2002). The high rate of their population growth relative to the growth of the economies presents many challenges for their government which are slow to find solutions to the constraints that they are facing. These constraints are named unemployment, poverty, health, education, corruption, development infrastructures, terrorism, disruptive conflicts, etc. and represent major challenges worldwide, particularly in Africa where youths often live in conditions of extreme poverty and social exclusion (ILO, 2006). In spite all these, there are many people who show encouraging dedication and passion for proactive positive change in Africa. African Youth Forum on Science and Technology (AYFST) is such a unique forum in Africa.

This paper presents the situation of youths in Africa and the constraints they are facing. Using case studies from a sample of African countries, it examines the responses proposed by governments and other institutions to youth's challenges which ranged from training, employment programs, micro-finance, health and reproduction services, etc. It analyzed the strengths and weaknesses of these responses which are mainly few, isolated, with minimal impact on youths and low involvement of African youths in designing and implementing solutions/policies for them. The paper also presents the experience of the African Youth Forum on Science and Technology (AYFST) in building the capacity of African youth through training, information sharing, networking and dialogue in relevant topical issues as it concerns agriculture, science, technology and innovation in Africa. Finally it proposes the perspectives and policy options to find solutions for the challenges youths are facing in Africa. Thus, building the capacity of the young people, creating sustained partnerships, and sensitizing the youth to own the vision of transformation are crucial to achieving the dreams we all wish to see in Africa.

**Keywords:** *Youth, Gender empowerment, sustainable development, Science and technology*

## SUCCESSFUL YOUTH INITIATIVES IN AFRICA: LESSONS AND WAY FORWARD FOR ATTAINING SUSTAINABLE DEVELOPMENT

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Sustainable development is meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. Youth involvement is a critical component of any effort towards sustainable development all over the world. This is because about half the population in the developing world for example is under 25 years of age with one in five people globally, falling between the ages 15 and 24. An estimated 1.5 billion people are therefore expected to be in that bracket by 2035. Tapping into the large human resource provided by the youth population that has diverse needs, preferences, and energy will help in addressing the chronic challenges of food insecurity and youth unemployment as well as reduce many social odds being perpetrated by the youths. Youths are prolific consumers, more open to adopt new technologies, and not risk averse; hence, their ability to innovate and generate ideas that could solve societal problems is an asset. All they need is support and mentorship.

The paper examined five youth initiatives across sub-Saharan Africa that is geared towards the integration of youths in attaining sustainable development. These youth initiatives include; The Education for Sustainable Development (ESD) initiative by the United Nations Educational, Scientific and Cultural Organization (UNESCO) on technical and vocational education and training (TVET) Program in Eastern and Central Africa; the Youth Participation in Development case studies of Uganda, Senegal and Tanzania; the African Youth Bio-Entrepreneurship fund; the Africa Youth Initiative on Climate Change (AYICC) and the DuPont and 4-H Youth Development Initiative for Rural Africa. The paper identified the critical success factors that enabled these youth initiatives to be sustainable as well as the key barriers that have affected their optimal performances in realizing their target objectives in development. Results show that the strongest features that have enabled the youth initiatives to succeed were: the existence of platforms that enable knowledge building and sharing; capacity building and training on issues such as entrepreneurship and leadership; promotion and support of youth tailored innovations in addressing the problems in the societies by relevant stakeholders; and the ability to inspire the culture of self-help and discipline amongst the youth. On the other hand, the most serious challenges for the youth initiatives were: unsustainability of the initiatives; and the lack of co-operation, support and understanding at the national and local levels. The paper concludes with the recommendation that African youths will need to be supported and mentored in order to bring out the best from them in terms of innovativeness, energy, and other potentials to ensure developments in sustainable ways. This support and mentorship could come from inter-governmental bodies, regional and national governments, non-governmental organizations, private sector actors and other entrepreneurs. The youths themselves need to learn from the success stories as well as the challenges from other youth initiatives and tailor them to their own specific context in developing societal solutions to the numerous challenges that currently besiege Africa.

**Keywords:** *Youth, Sustainable development lessons, Africa*

## EMPOWERING WOMEN FOR SUSTAINABLE DEVELOPMENT THROUGH STI: THE KEY CHALLENGES

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How to mobilize and engage the youths of Africa in STI capacity building for sustainable development forms the central theme in the current regional and global development debate. This paper joins this debate by interrogating the challenges facing women's participation in STI in the rural societies of Sub-Saharan Africa. The paper argues that the capacity of rural African women to engage in STI production is largely undermined by three inter-related, mutually reinforcing and conspiratorial factors. One is the STI-impoverished, chronically underfunded and practically dysfunctional educational regime accessible to women in rural societies. The second is the pervasive prevalence of poverty that denies women the capacity to access socio-economic resources including quality education and reproductive health care. And, the third is the deeply embedded patriarchal power structures and cultural practices that devalue and exclude women. At the heart of these practices is child marriage that often leads to early pregnancy with its attendant reproductive health risks such as neo-natal mortality, maternal mortality and morbidity including obstetric fistula. Empirical data reveals that Sub-Saharan Africa accounts for over 60% of global maternal deaths annually. And for any woman who dies in childbirth 15-30 others suffer chronic disabilities. Poverty, harmful culture and little (or no) education are in a vicious cycle. And, this cycle must be broken as a necessary condition for releasing the energies of the mass of African women for sustainable development.

The paper recommends a) a comprehensive policy and programmatic intervention to tackle the deepening incidence of poverty especially among women in rural African societies, b) Adoption and practical implementation of the Convention on the Right of Child and the AU Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa, c) Introduction of a new educational curriculum that place overriding emphasis on Science and Technology as the driver of human development and fulcrum of social progress, d) Introduction of 12-year free and compulsory science and technology-focused educational system to replace the current primary and post-primary school system, e) Adequate provision of knowledge delivery infrastructures, f) Establishment of STI community centres where knowledge is "Africanised" (and miniaturised where necessary) to integrate with and develop from existing traditional science, technology and innovation.

**Keywords: Science Technology and Innovation, Sustainable Development, African Women, Child Marriage and Poverty.**

## INNOVATIVE AND ENTREPRENEUR SKILLS FOR EMPLOYMENT: A CHALLENGE FOR THE YOUTH IN AFRICA

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The importance of youth development and empowerment is reflected in the development agenda of national governments, regional entities and international development organizations to build youth capacities for quality and meaningful participation in development and decision making processes. Unemployment among the youth has been of great concern in the society and the issue of matching the education provided in the school and college curricula to the market demands has been of concern not only to parents, teachers and the society but also to curriculum developers themselves on what curricula were suitable. This paper provides a background on technical and vocational education in African countries south of the Sahara and the efforts made by some countries to prepare school graduates for the world of work. The paper provides examples of the centres that were established to provide employable skills for students to become employed after graduation. Despite the efforts made, the paper outlines the problems faced by these countries where many youths flocked into towns and cities after graduation to seek employment. It is argued that the youths require innovative and entrepreneur skills for possible employment after school or college completion. The majority of school leavers who do not acquire employable skills become unemployed and get involved in dirty activities such as loitering, robbery, prostitution, drugs trafficking, etc.

The paper stresses the need to match the school curricula to the market demands and to satisfy the learner to the occupation sought. The emphasis is made to promote the participation of the learners in the process of curricula designs, policy dialogues and development initiatives to ensure that youth perspectives were addressed in these processes and taken into account in policy curricula implementation. The theories on technical and vocational choice are presented and the difficulty in matching the graduates' education to their needs is discussed. These theories that are classified as psychological and non-psychological in nature explain how candidates enter particular careers with or without their choice because of certain circumstances that influence their choices. The paper argues that curriculum developers had to take into consideration of these psychological theories in curricula designs for effective choice by the learners that would impact future candidates' career choices and employment sustainability. It is argued that it is through laid policies to implement suitable designed curricula that the youth can be empowered for sustainable economic growth and social wellbeing for generations to come.

At the end, the paper presents the structure of the South African education system as a case example that might reflect other systems on the continent and highlights the need to strengthen technical and vocational education to cater for increasingly unemployed numbers of the youth on the continent. It is recommended that African education systems design the curricula that provided employable skills, i.e. the systems that avoid training for mono-disciplinary certificates and gear for entrepreneur and innovative skills that match the designed curricula to the market demands.

**Keywords:** *Innovation & entrepreneur skills, Curriculum design, Employable skills, Technical and vocational education*



## BAMBOO BICYCLE AND CAR: GREEN SOLUTION TO NIGERIA'S TRANSPORT PROBLEM

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Transportation is vital to the survival of a majority of Africans especially as it relates to transportation of farm produce and also to commute to and from work. But transportation is a big problem for Nigerians because of fuel scarcity, environmental pollution emanating from exhaust of cars and motorcycles, adulterated fuel purchased from black market and other numerous factors. In order to solve this, we designed and built a bamboo bicycle that can compete favourably with the conventional bicycle and also serve to reduce motor vehicle emissions by serving as a replacement to motorcycles and cars, since bamboo is good carbon sink. The frame of the bicycle was made from eco-friendly materials (bamboo), weighs 2.6 pounds (compared to a steel frame which weighs 3-3.5 pounds), and has a tensile strength of about 40kN/cm<sup>2</sup> compared with steel that can resist 37kN/cm<sup>2</sup>. The durability is excellent. The test unit was built in November, 2009, and so far, volunteer testers are pleased with it in terms of comfort and utility. The research continues with bamboo cars.

**Keywords:** *Bamboo, Bicycle, Eco-friendly, Transportation, Africa*

## YOUTH DEVELOPMENT AND ENGAGEMENT IN SCIENCE, TECHNOLOGY AND INNOVATIONS IN TANZANIA

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Nearly 50% of the developing world population is youth and children (World Bank, 2010). There are about 1.2 billion 15 to 24 year olds youth population in the world and one billion live in developing countries (UN, 2008). This youth bulge represents both a challenge and an opportunity for development. In developing countries, Tanzania in specific, the youths face challenges derived from limited access to resources, education, training, employment, and broader economic development opportunities and therefore becoming the most vulnerable group in the country.

As part of the solution to the challenges, Tanzania needs a development approach that ensures full participation of young for creative change especially in Science, Technology and Innovation (STI). But reactive change requires resource commitment to get it on one hand and tailored made skill training on the other. In return resource commitment and tailor made training would strength youth gain required skills to meet subsistence needs through properly utilization of resources, promote youth awareness participation in STI, and involve the youth in social development networks and foster inclusive approach to reduce adverse impacts that might be caused by the youth.

The Tanzania national development vision (2025) is a long term desire of the type of society a nation wants to build over a given time frame. It has a number of objectives and strategies in which all focus at developing the country to a middle-income country, with much higher levels of human development. A deeper analysis of the vision, poses critical challenges in terms of contribution of youth in national development and STI. In scrutinizing the youth involvement in the development process, STI are therefore imperative. Taking into account youth inclusion, the paper makes an examination of intervention strategies that considers the full and effective participation of youth in the STI development process which among others include: 1) encouraging and promoting youth-led organizations and the important role they play in supporting youth in capacity-building and providing non-formal education through skills and entrepreneurship development; financial and technical support and promotion of their activities, and 2) providing young people who are disconnected or socially and economically excluded with opportunities to participate in science, technology and innovations. This is through creating effective and efficient channels of cooperation and information exchange among young people, their national Governments and other decision makers.

Such information will serve as a knowledge asset for both practitioners and policy makers to foster activities on youth development through in science, technology and innovations

**Keywords:** *Youth, science and technology, Participation, Development, Tanzania*

## NETWORKING AND EMPOWERING YOUTH IN SCIENCE, TECHNOLOGY, AND INNOVATION (STI): A NEW MODEL FOR YOUTH ENGAGEMENT

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Africa's youth—which constitute approximately 20% of Africa's total population—represent a rich array of untapped resources that if properly resourced and supported could be an engine for African development. However, this demographic faces real and complex challenges that if not addressed directly will leave this population to languish in a perilous cycle of unemployment and poverty. Sixty percent of Africa's youth are unemployed, and 72 % of these youth live on less than \$2 a day. In Kenya alone, the youth represent 60% of the total population. In 2011, youth unemployment stood at 70% of the total unemployment. While this reality is grim, the future for Africa's unemployed youth does not have to be. Targeted interventions aimed at equipping youth with the skills, knowledge, and networks they require for economic empowerment offer a way forward. For many youth, the "lack of networks, knowledge of market suppliers and needs, and entrepreneurship skills" limit the ability to start and grow successfully their own work. To set a new trajectory for youth employment on the continent, one important question looms: how might we create a paradigm shift in the thinking of most of the unemployed youth from over-emphasis on job seeking to job creation? The youth are the future of any society; catalysing human progress in large part requires harnessing their energy, vigour and resourcefulness.

This paper focuses on a novel approach to empowering youth to be job creators rather than job seekers through a networked system of thematic STI hubs. Through these hubs, youth access entrepreneurship training, professional mentoring, and start-up capital. Empirical evidence shows that educating young minds in enterprising behaviour boosts confidence for calculated risk taking and increases incidence of adopting entrepreneurship. Taking a systems-based approach to youth empowerment, this approach seeks to enable a dynamic innovation ecosystem for Africa's emerging entrepreneurs and innovation leaders. Enabling youths' enhanced access to networks, market knowledge, information and communication technologies, innovation and entrepreneurship skills, and financial resources is core to the project. It posits creating a critical mass of youth in STI drawn from all universities in Kenya at the pilot stage and later replicating the project in other parts of the continent. In this way, this approach offers a concrete, scalable way to enhance youth employment, boost their ability to solve local and global challenges, and increase their contribution to societal change and transformation. The social and economic cost of failing to spur youth entrepreneurship and employment is vast, both for the individual and society as a whole. Statistics indicate that investing in youth is not an option but a necessity. ST&I represent powerful tools, not only to spur youth entrepreneurship, but to contribute practical and lasting solutions to some of the critical development challenges facing the African continent. Achieving the goals set forth in Kenya's Vision 2030 and the Millennium Development Goals requires creativity and bold action that fully activates the resources and ingenuity of Africa's youth.

**Keywords: Youth, Entrepreneurship, Unemployment, Innovation, Networks, Empowerment**

## SCIENCE FOR WOMEN: SUPPORTING WOMEN'S DEVELOPMENT AND LIVELIHOOD ACTIVITIES THROUGH SCIENCE TECHNOLOGY AND INNOVATION

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Science, Technology and Innovation (STI) are beginning to gain greater attention within national and international policy agenda following decades of neglect. The renewed interest has significant potential to help meet development goal and improve the lives of people especially women. Promoting gender equity and ensuring that women benefit from STI policies is fundamental to reducing poverty and ensuring equitable development. Although there is growing recognition that STI can contribute significantly to promoting development, STI policies generally lack a gender perspective and therefore do not adequately and equitably address all development concern. Women in agriculture play a prominent role in food production and processing activities in developing countries but they have limited access to resources that could increase quality and quantity of their output. Providing extension services relevant to their needs and assuring women's greater access to land, education and financing could help increase their productivity. Women use water for production, consumption and domestic purposes and assume the largest burden for water collection in developing countries. Yet they are often excluded from decision making in water management.

It is therefore critical that women interest and concern be reflected in efforts at harnessing STI for sustainable development. Women's participation in science can increase their production to the society because among other things they could influence the agenda for science and technology (S &T) research and development (R & D). Because of their key role in economy and society women are powerful agents of change. The study therefore focuses on a number of sectors where women play central role like agriculture, water, energy and transport and illustrate how STI could contribute to women livelihood and development activities. It also highlights how STI can support women through research and extension services. In addition, it points out that women tend to be by passed in STI policies and decision which often do not reflect their specific needs and concerns. It is recommended that policy makers should incorporate a gender dimension in national STI policies and link them to policies on food and agriculture, water, energy, infrastructure and industry. Government should also support women to become scientists and technologist; and recognize and support their local knowledge and innovative practices.

**Keywords – Women, Livelihood activities, STI, Policies, Sustainable Development**

## YOUTH AND ICT FOR DEVELOPMENT: DIGITAL DIVIDE?

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This paper addresses the importance of youth, the challenges they face and how ICT can offer solutions to these challenges through government policies for sustainable development in Africa.

It is vital that today's youth are engaged in designing and developing sustainable programs so that a deeper understanding of the conditions they face are well addressed. International Year of Youth, August 2010-2011, stated that "Africa is the youngest continent as the proportion of youth among the region's total population is higher than in any other continent. In 2010, 70 percent of the region's population was under the age of 30, and slightly more than 20 percent were young people between the ages of 15 to 24". African youth have the potential to be a great impetus for Africa's development, provided that appropriate investments in health and human capital are made. However, if youth issues in the realms of higher education, employment, health, and participation in decision-making processes are not addressed, Africa's development could be negatively affected. In Uganda, the youth are majorly faced by unemployment as a result of a mismatch between education systems and the skills needed in the labour market. In addition the saturated public services and small private sector bases are unable to employ large numbers of people. There is also a mind-set that tells educated young people that they must be employed in white-collar jobs with a low status also accorded to vocational training which causes migration from rural to urban centres. In this paper we present discussions and arguments on how the growing trend in ICT (convergence) in Africa counters the digital divide between the rural and urban communities in Africa. This is because ICT creates an e-platform that brings about accessible, available and affordable e-services in the rural areas. The paper concludes by making the observation that governments in Africa should adopt and emphasize ICT. This could be through budget priority to foster youth development and service delivery in all sectors of education, health and trade through setting up national infrastructure to enhance the communication sector using fiber back bone and satellite communication. This brings about low cost of transmission and promotes access and equitable distribution of ICT services through Mobile Communication, Radio and Television Broadcasting to enhance youths' livelihood.

**Keywords: Information, Communication, Service-delivery, Unemployment, Decision-making**

## THE LINK BETWEEN MATERNAL EMPLOYMENT AND CHILD WELLBEING: EVIDENCE FROM WEST AFRICA

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Among the indices of gender empowerment are equal education and employment opportunities for women. A 2012 Millennium Development Goals Report concludes that gender inequality persists and women continue to face discrimination in access to education, work and economic assets, and participation in government, and that violence against women continues to undermine efforts to reach all goals. In addition to empowerment, the benefits of maternal employment can be couched in terms of increased income, which strengthens the family's ability to purchase health care and other good things of life, and which can have a positive impact on child wellbeing. On the other hand, an employed mother spends time away from the child, with potential reduction in time spent in caring for the child and providing the necessary nutrition and care required for healthy growth and development. Hence, the adverse effect of maternal employment can potentially counteract its benefits.

Researchers have analysed the relationship between maternal employment and various indicators of child wellbeing, including health, breastfeeding and nutrition, cognitive behaviour and development, as well as height, weight and obesity. The actual effect of maternal employment on child health however remains an empirical question, and so far, there is no systematic evidence of this effect in West Africa. This paper aims to provide that evidence using matched mother-child data from the Demographic and Health Survey. The analysis is based on the proximate determinants framework, in which socioeconomic factors are predicted to have an indirect effect on child health through more proximate factors that have a direct influence on child wellbeing.

Results, no doubt, would help in formulating policies that maximise the potentials on promoting gender empowering through maternal employment, while also protecting and preserving child wellbeing.

**Keywords: Maternal employment, Women's empowerment, Child health, Selection, West Africa**  
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## RAPHIA PALM (RAPHIA HOOKERI) WINE PRODUCTION: A GOAL MINE IN NIGERIA

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The study analyzed the profitability of raphia palm wine production in rural villages of Akwa Ibom State, Nigeria. This study was based on primary data obtained from a random sampling of 100 raphia palm-wine tappers and analyzed using descriptive statistics, profitability ratios and regression analysis. The results showed that palm wine tapping is an occupation mainly for the male folks with majority (52%) having no formal education. Labor (51%) and additive cost (44%) constituted the highest proportion of the total cost of production. The former suggests that raphia wine production is labor intensive. The average net income of the raphia palm wine enterprise was N 223,244.90, while the average total cost of production was N 65,771.11. The profitability index (0.77), rate of returns on investments (339.42), rate of returns on variable cost (455.96) and operating ratio (0.217) suggest that raphia palm wine production is profitable in the study area. The multiple regression analysis showed that tapping experience and additive cost positively and significantly influenced the quantity of wine produced. Raphia palm wine production has a hidden potential of improving the welfare of rural dwellers practicing wine tapping. Lack of improved raphia palm variety and lack of access to credit facilities were identified as major constraints to raphia wine production in the study area. These observations underscore the need for the provision of improved varieties of raphia palm seedlings and credit facilities to the raphia palm wine tappers as incentives. Younger people (especially unemployed youth) should be encouraged into tapping raphia palm-wine in the study area.

**Keywords:** Profitability, Resource productivity, Raphia Palm-wine tappers, Welfare, Nigeria

## LEVERAGING TALENT FOR AFRICAN DEVELOPMENT

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This research paper will interrogate the role of talent and institutions in transitioning Africa towards being a continent free of poverty, unemployment and inequality. A theoretical perspective is shared that positions this debate within a politico-economic paradigm, and calls into question the potential for South Africa to lead such a transition. It is proposed that path dependency could trap South Africa in its coal-intensive minerals energy complex, and possibly position underdeveloped African economies towards rapid transition if they have visionary leadership able to see beyond their natural resource endowments, and the supporting institutions to enable such leapfrogging.

The ability of African countries to take advantage of the global knowledge based economy is predicated on their appreciation of the critical role of talent, the enabling role of institutions, and the temporal opportunities availed to build and harness such talent by the scale of procurement of infrastructure. High illiteracy rates and the poor quality of education among African communities mean the marginalization of the affected generations, among who are gems of talent that could otherwise be instrumental in pulling the continent out of its economic and social morass. The creation of effective incentives to harness and unleash the potential of this talent, and the set of institutions that would limit the abuse of market power by dominant players, would contribute to the creative destruction requisite for social and economic development.

Because of the creative destruction that it enables, a well-functioning democracy is a prerequisite for sustaining innovation at the edge. While rapid and sustained development may happen in the absence of democracy, it could possibly top out much earlier than could be anticipated as established players use their market power to crowd out and stifle the next generation of innovators, and lobby the political elite accordingly.

A historical perspective on the political economy of the South African science and innovation system will be utilized to frame the analysis. Institutional constraints imposed by global trade regimes are analysed and their impact on the feasibility of catching up is speculated upon. Avenues opened up by South African membership of the BRICS nations, and African regional trade bodies, are explored for windows available to leapfrogging opportunities.

**Keywords: Talent; Institutions, Procurèrent; innovation; Governance**



## MATERNAL EDUCATION AND CHILD HEALTH IN NIGERIA: IMPLICATION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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Contemporary arguments in world development literature are centred on science, technology and innovation (STI) as a window for achieving accelerated results in different sectors of national and international economy. This study focuses on child health and maternal education which are critical in the development agenda of many nations. In their studies Ginnekin 1988; Sen 1999; WHO 2005 have shown that in all cultures, gender roles assign household and child bearing responsibilities to women including the care of children, and mothers influence early behaviour and establish lifestyle patterns that not only determine their children's future development and capacity for health, but also shape societies. Furthermore education facilitates care-giving behaviour in women, especially with regard to the health of their children. Nigeria is the most populous country in sub-Saharan Africa with population estimated at above 154 million in 2009, with 48% and 52 % living in urban and rural areas respectively. Across the country, child killer diseases like malaria, diarrhoea, pneumonia, and sickle cell anaemia were identified (USAID, 2002).

However, the general objective of the STI policy of Nigeria (FGN, 2011) is to create awareness in the society on the relevance of STI culture for the improvement of quality of life and sustainable economic development. This study investigated the effects of STI facilities (such as portable water, vaccination, place of residence, asset index), and maternal education (primary, secondary and tertiary) on anthropometric (height-for-age) measures of the child by analysing the 2008 National Demographic Health Survey. Using regression models (OLS and probit) the result established the impact of maternal education on height-for-age; the effect of socioeconomic, demographic and environmental indicators on height-for-age; as well as the impact of maternal education on child immunisation. Like most developing countries, the pitfall of STI for Nigeria has been identified to include lack of political will; inconsistent STI policies, non-availability of STI supporting infrastructure, etc.(FGN, 2011) Hence, lessons from the Nigerian experience will serve as a guide to harmonise and refocus the STI, education and health policies of other developing countries of Africa towards sustainable development.

**Keywords: Maternal Education; child health; Science Technology and Innovation policy; sustainable development**

## SUB-THEME V

### MAINSTREAMING TRANS-DISCIPLINARY IN SHTI IN HIGHER EDUCATION

#### SCIENCE, TECHNOLOGY AND INNOVATION POLICY RESEARCH IN AFRICA'S HIGHER EDUCATION: CHALLENGES, PROSPECTS AND OPPORTUNITIES

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This paper investigates the dearth of capabilities for science, technology and innovation (STI) policy research in Africa. It critically explores the roles, contributions and policy implications of Africa's institutions and government bodies towards fostering a solution. The paper analyses the challenges facing STI policy research in Africa, the prospects and opportunities that may lie ahead. It uses these high education institutions and government bodies as the units of analysis in order to develop a framework useful in providing ideas, recommendations and quick practical steps that, if applied, might help close the gaps.

Early efforts towards the establishment of Science and Technology (S&T) and more recently, STI policy research, institutions and networks in Africa started as far back as 1960's. These humble beginnings were in recognition of the need to develop S&T capabilities for research and formulation of autonomous national S&T policies useful in solving the most pressing needs and problems of the continent. Another justification for these efforts was in response to the need to acquire technology. Despite these early endeavours, recent evidence shows that more than forty years later, international organisations and consultants are still called upon to help in the research, evidence gathering, training, formulation, implementation and review of national STI policies in African countries. This indicates that the capabilities needed for STI policy research, policy formulation, implementation and reviews may still not be fully resident in the continent.

As of the year 2011, there are very few African researchers and policy practitioners who have built enough experience in STI policy research and design. Secondly, there is still no African University that has a coherent and internationally recognised programme for STI policy studies. Consequently African countries that formulate STI policies still tend to rely on international organisations and consultants. This is partly attributed to insufficient capacity. Another outcome of this shortfall has led to limited in-house expertise in government ministries and departments resulting in difficulties in implementing S&T/STI policies formulated by international agencies and outside consultants.

African countries need to build in-house STI policy research expertise in higher education levels. This skills base, ultimately, can provide government ministries and departments with the needed capacity so that they can strategically and technically spearhead (formulate, implement, evaluate and review) their national STI policies. In order to access knowledge and adequately exploit the enormous opportunities of modern S&T to the benefit of Africa's sustainable development, the capabilities and expertise for in-depth analytical studies on STI policies are essential. There is therefore a strong case to be made on the need for Africa to develop capabilities for STI policy research in its higher education and governmental levels. This will be necessary for supporting and achieving the continent's policy, socio-economic and developmental goals. With one of the highest concentration of developing countries (DCs) in the world, rapidly increasing population and the least number of researchers per million, the stakes could not be higher.

**Keywords: Science, technology and innovation (STI), Policy research, Higher education, Government institutions, Africa**

## EDUCATION IMPLOSION IN AFRICA: MAINSTREAMING APPROPRIATE EDUCATION TECHNOLOGY AND TRANSDISCIPLINARITY AS A WAY OUT

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Rather than a graduate from school into fulfilling life, lots of an average fresh African graduate is challenged by unemployment, disillusionment and resentment because he acquired unmarketable education devoid of efficient and functional life-skills for job creation and poverty reduction. Education sector is breeding a growing army of unemployed graduates comparable to weapons of mass destruction in Africa. Using the critical, theoretical and documentary research methods, this study reviewed secondary data on education explosion and implosion in Africa and unemployability of school drop-outs, scholars-leavers and graduates. Explosive education expansion was typified by 334-740 % annual student population growth rates for 4 to 5 decades running in some universities in Nigeria. Generally, the number of students in the university rose by 102.8 % between 2001 and 2004. Between 2001 and 2003, the number of secondary school tutors rose by 228.6 %, while the number of university equivalent instructors rose by 116 %. Between the 1960s and the 2000s, the number of subjects taught in primary schools rose by 333 % and by 100 % in secondary schools. From the mid-2000s, however, education implosion began to manifest in double-digit unemployment rate for graduates, dearth of infrastructure, school desertion by learners, plateaued or declining student population amidst 2.83 % rate of national population growth, high rate of boy-child dropout from school, brain-drain, among others. The study also examined and recommended mainstreaming appropriate education technology and trans-disciplinarily as a way out of the crisis and as the basis for defining alternative development paradigms for Africa.

**Keywords:** *Education implosion, Appropriate education technology, Trans-disciplinarily, Africa*

## INTEGRATING HUMANITIES APPROACHES TO SHAPING AFRICAN TECHNOLOGICAL DEVELOPMENT: THE CASE FOR AN INDIGENOUS FUTURES COMPONENT IN THE SCIENCE, TECHNOLOGY AND INNOVATION AGENDA IN AFRICA

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This study reviews current literature on science, technology, and innovation in Africa to study the practice of using data projections augmented with philosophical approaches to science and technology research, and proposing alternative futures. The study focused on research addressing alternative futures related to energy, food security, urban development, water resources, and health in Africa. The motivation for the study was derived from the following questions: Is Africa too embroiled in its current challenges to think of creating a future full of innovation? What does Africa need to evolve sustained advancements in science and technology? Are we at risk of over-investing in structures and processes that are on their way to becoming obsolete or irrelevant while under-investing in the means of success in the future that is dawning on us? Is the major challenge to African competitiveness its lack of vision? And can Africa adequately prevent future challenges by pre-empting them?

Findings showed that although the study of alternative futures is not new in Africa, most of these researches are not indigenous. This was seen to be related to existing problems with knowledge translation and the institutionalization of research systems. Other challenging factors include political tensions over African resources; economic pull towards more lucrative jobs in the science and technology sector; lack of research capacity for implementing trans-disciplinary approaches and collaborations in African academe; poor funding for humanities research due to perceived irrelevance to productivity; and a culture of and bias towards empirical approaches in producing and consuming scientific research. The study further examined how a futures agenda could help shape the growing emphasis on sustainable development and balancing the cost of alternative energy sources, responsible energy consumption, and low carbon economies. Conditions necessary for improving the study of futures in science and technology in Africa were proposed. Channels for improving communication of futures research within the scientific community, and enhancing cross-disciplinary research collaboration, were also described. The discussions also made a case for seeking to pre-empt future challenges by expanding knowledge sources, information sharing, and validation mechanisms to create a sound empirical basis for predicting alternative futures, evolving policy, and guiding resource investment for a sustainable future.

**Keywords: Futures, Energy, Trans-disciplinarity, Research, Sustainable development**

## INFORMATION SYSTEMS EDUCATION IN SUB-SAHARAN AFRICA: THE CASE OF KENYAN UNIVERSITY BUSINESS STUDENTS SPECIALIZATION CHOICE TRENDS

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The objective of this study was to investigate the relationship between Information Systems (IS) awareness among Kenyan university students and the choice of IS as a field of specialization. The study posited that the choice of a field of specialization is dependent upon a student's awareness of its existence, its utilization in the real world, its career opportunities, and its strategic importance to the country's economic development agenda. That level of awareness was considered high in this case study. Awareness was considered low if the student only knew of the existence of IS as a field of specialization. The underlying assumptions were that the level of IS awareness as a field of specialization among Kenyan university business students was low, leading to low levels of choice of IS as a field of specialization, in turn leading to low levels of IS education. Low levels of IS education was posited as a possible cause for low systems analytical skills in the field of information systems. The case study was able to establish low levels of IS awareness as a field of specialization among university business students. It was also able to demonstrate that low levels IS awareness impacted negatively on the choice of IS as an area of specialization and to infer that low levels of choice of IS as an area of specialization can lead to low levels of IS education, which may negatively impact availability of systems analytical skills.

**Key words:** *Specialization, Awareness, Systems Analytical Skills, Joint Admissions Board, Public Universities, University Colleges, Parallel Programmes.*

## MAINSTREAMING TRANSDISCIPLINARITY IN STI IN HIGHER EDUCATION

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In higher education specially science, technology medicine engineering and others, the study of statistics (SPSS Standard deviation ...) mathematics, business administration specially marketing, financial management, costing, organization behaviour are very important together with standard and quality systems, risk assessment life cycle assessment environmental standards, social responsibility and business anticipation. The interdisciplinarity systems are important for research , development and innovation that help in decision making , priority listing for technology and research and for sustainable development and quality standard in Africa education and research

**Keywords: Quality standards, Total quality, Risk assessment**

## ANNEX 7: PROFILES OF KEYNOTE SPEAKERS, SESSION CHAIRS AND PANELLISTS



**Prof. Kevin Chika Urama the Executive Director of the African Technology Policy Studies Network (ATPS).** He holds a B. Agric (First Class Honours); MSc (Distinction equiv. Nig.); MPhil (Distinction, Cambridge); Ph.D. (Cambridge) is an Environmental & Ecological Economist. He holds the 2002-3 James Claydon Prize for the most outstanding PhD thesis in Economics or related subjects, St. Edmund's College, University of Cambridge. He was recently awarded the Technology Executive of the Year Award from the Africa Technology Awards, 2012. He is the Inaugural President of the African Society for Ecological Economics (ASEE). He is a member of the High-Level Panel on Global Assessment of Resources for implementing the Strategic

Plan for Biodiversity 2011-2020. He also serves on the boards of several other international organisations, scientific panels and research programs, including: the International Panel for Sustainable Resource Management (as Chair of the Water Working Group), the Intergovernmental Panel on Climate Change (IPCC) as Lead Author of the IPCC SRREN report, and Coordinating Lead Author/Core Writing Team member of IPCC AR5 report (in progress), the OECD Task Force of Green Growth and Poverty Reduction, Governing Board member of the International Research and Training Centre for Science and Technology Strategy (CISTRAT). He is the current chair of the Open Society Foundation's Africa Climate Change Adaptation Initiative (ACCAI) Reference Group, and member of the Technical Advisory Committee (TAC) for the Bioresources Innovations Network for Eastern Africa Development. He is a member of the Editorial (Advisory) Boards of many international journals, including Science and Public Policy, Ecological Economics; and Environmental Policy and Governance.



**Mr. Wondwossen Belete is the National Coordinator, for the ATPS Ethiopian Chapter.**

He currently serves as the President for the Society for Technology Studies. Mr. Belete's previous affiliations include Director of Intellectual Property Protection and Technology Transfer at Ethiopian Intellectual Property Office (EIPO) and Director of Trademarks at Ethiopian Intellectual Property Office. He is also a member of Ethiopia's World Trade Organization (WTO) Accession Team and National Science, Technology and Innovation Policy Drafting Team. Mr. Belete has an MSc, Science and Technology Policy from the University of Strathclyde and BA, Economics in Addis Ababa University.



**H.E Professor Jean-Pierre Ezin is the Commissioner for Human Resources, Science and Technology, AUC, Ethiopia,** He holds a Doctorate in

Mathematical Science, University of Science and Technology, Lille, France, 1981. Since 1972, Dr Ezin has occupied several posts in International Scientific Research Centers such as the Abdus Aalam Centre for Theoretical Physics and the Laurent Schwartz Centre de Mathematiques. He was a senior lecturer in high schools. He has been Rector of Université Nationale du Benin, Dean of Science, Founder and Director of the Institut de Mathématiques et de Sciences physiques in Benin. He was Titular Professor at the Benin National University. He also served the university as mathematics lecturer. He was advisor in the Ministry in charge of Planning, Economic Restructuring and Employment.

Source: [www.au.int](http://www.au.int)





**Prof. Shaukat A. Abdulrazak is the current Chairperson of the ATPS Board.**

He is the Executive Secretary (Chief Executive Officer) of the National Council for Science and Technology (NCST), which is the focal point on Science, Technology and innovation in Kenya. As the Executive Secretary to the NCST, Prof. Abdulrazak is the technical and administrative head of the NCST and is responsible for its day-to-day management of financial and physical resources as well as the management of human resources and programmes. He also guides the Council in the development and advocacy of Science and Technology policy popularization and promotion of science and technology as a tool for national development. Prior to joining the NCST, Prof. Abdulrazak was the Deputy Vice-Chancellor of the Research and Extension unit of the Egerton University in Njoro, Kenya, a position he

held from 2002 – 2007. He also held worked as a Senior Lecturer and Associate Professor the university between 1997-2001 and since 2005 Professor of Animal Science at Egerton University. Prof. Abdulrazak holds membership in many high level organizations including member of the National Economic and Social Council (NESC), Board member of Inter-University Council for East Africa (IUCEA) and Board Member of the African Network for Agriculture, Agroforestry and Natural Resource Education (ANAFE). He is an Editorial Board member of the African Journal for Agricultural Research and has written over 50 publications in referred journals. He is a fellow of Society (FIBiol), U.K and 2009 he was decorated with Moran of Order of Burning Spear (MBS) by His Excellency the President of Kenya. Professor Abdulrazak was included in 2009, 27th Edition of Marquis Who is who in the world.

Prof. Abdulrazak holds an M Sc. in Animal Nutrition, Ph.D. in Animal Science both from the University of Aberdeen, UK and a Post Doctorate certificate from Shimane University, Japan under Japan Society for Promotion of Science.



**Professor Osita Ogbu is the former Executive Director of ATPS (2000 to 2005)**

and is currently the Managing Director /CEO of the African Development Solutions International (ADSI), Nigeria. He is a former Economic Adviser to the President of Nigeria and former Minister, National Planning Commission of the Federal Republic of Nigeria. He is a Professor of Economics and the Director for the Institute for Development Studies, University of Nigeria, at the Nsukka and Enugu Campuses. Prof. Ogbu was formerly the Chairman of the Governing Council, Nigerian Institute of Social and Economic Research (NISER) Ibadan. He sits on several international and local Boards. He is a widely-travelled development consultant and expert (over 40 Countries) has also worked as Economic Advisor to the President of the Federal Republic of Nigeria and CEO National Planning Commission

(Minister of Planning). Professor Ogbu is currently the Managing Director /CEO of the African Development Solutions International (ADSI). Among his recent publications include Technology Transfer and Economic Growth in Africa (eds.), Growth and Development in Africa, Africa World Press Inc, New Jersey, USA: April, 2009 (With Moses Ikiara & Eliud Moyi); "Knowledge Dependence and its Discontents: the Demand for Policy Research in Africa in the era of Globalization" in (eds.), Science and Technology Policy for Development: Dialogues at the Interface, Anthem Press, UK & USA: 2006. Most recently, he was the keynote speaker at the ATPS Conference on Research-Policy Interface in Mombasa, Kenya in 2011.



**Honorable Prof. Margaret Kamar is the Minister for Higher Education Science and Technology in the Republic of Kenya.**

The appointment was made by His Excellency the President on 25th August 2011. Prof. Kamar has been a Professor, Principal and Deputy Vice Chancellor of Moi University, Chepkoilel for period totaling over 20 years. She is the Area MP of Eldoret East Constituency. (Source: [www.scienceandtechnology.go.ke](http://www.scienceandtechnology.go.ke)). Previously, Professor Kamar has also served as the Deputy Vice Chancellor in charge of Research and Extension, Moi University, Eldoret. Prior to that she had been nominated East African Legislative Assembly. Prof. Kamar attained her Ph.D in soil and water conservation in the University of Toronto and Masters in Agriculture in McGill University in Montreal, Canada.

(Source: <http://www.whoswho.co.ke/margaret-kamar>)



**Honorable Honorable Professor Ita Okon Bassey EWA is the current Minister of Science and Technology at the Federal Republic of Nigeria.**

His undergraduate University education was at the University of Nigeria, Nsukka, Nigeria where he obtained B.Sc (Hons) Physics in 1977. His postgraduate programme was at Ahmadu Bello University, Zaria, Nigeria and graduated with M.Sc (Nuclear Physics) and Ph.D (Physics) in 1982 and 1993 respectively. He undertook several professional trainings in analytical nuclear physics sponsored by the International Atomic Energy Agency (IAEA) Vienna, Austria.

Prof. I.O.B. Ewa began his professional training career in Reactor Physics with the Kernforschungszentrum, Karlsruhe, West Germany in 1981; proceeded to Texas A & M University from 1989-1990 for an International Atomic Energy Agency (IAEA) research work on Nuclear Analytical Techniques. Thereafter, he undertook some research work on Neutron Activation Analysis at the Dalhousie University, Halifax, Canada (1995-1996) under the sponsorship of the IAEA. In the year 2000, he was again sponsored by the IAEA to undertake a research work on Monte Carlo Methods in nuclear research reactor applications at the Technical University of Budapest, Hungary.

He was sent in 2002 to the Reactor Centre, Ghana Atomic Energy Commission, Legon, Accra on an IAEA Expert Mission by the International Atomic Energy Agency. Between 2003 and 2004, he was at the International Centre for Theoretical Physics (ICTP), Trieste, Italy where he researched on codes, nuclear data and reaction. In 2008, he was awarded an IAEA Coordinated Research Project on the 'Development and Applications of Calibration Method for HPGe Detectors Used in Measurement of Environmental samples. Professor I.O.B. Ewa, a great educator and Professor has taught physics and supervised over 20 postgraduate thesis at the Physics Department, Ahmadu Bello University, Zaria, Nigeria. He has equally been a researcher at the Nuclear Research Centre, Centre for Energy Research and Training, Ahmadu Bello University, Zaria, Nigeria from 1983 to date. This erudite scholar has to his credit over 100 peer-reviewed journals and technical publications. He is a member of several international professional bodies. Professor Ita Okon Bassey was appointed as the Minister of Science and Technology of the Federal republic of Nigeria in July 2011. (Source: [http://www.fmst.gov.ng/minister\\_profile.php](http://www.fmst.gov.ng/minister_profile.php)).



**Dr. Mohamed Khalil Timamy** is the current Head, Environment Division Department of Rural Economy and Agriculture at the African Union Commission (AUC) in Addis Ababa, Ethiopia.



**Professor Lynn Krieger Mytelka is a Professorial Fellow at UNU-MERIT (Maastricht, NL)** where she directs the Hydrogen Fuel Cell project and over the past three years was also a member of the Executive Committee of the Global Energy Assessment serving as the convening lead author for its work on Policies for Capacity Development and as a lead author of the Chapter on Policies for Energy Technology Innovation Systems (Global Energy Assessment, Toward a Sustainable Future, 2012, Cambridge University Press) . Prior to that, she was Director of UNU-INTECH, predecessor of UNU-MERIT and Director of the Division on Investment, Technology and Enterprise Development at UNCTAD in Geneva (1996-1999) on leave from her position as a Professor in the Faculty of Management and Public Policy at Carleton University, Ottawa, Canada. Professor Mytelka has served as a senior international advisor to UNIDO, the Department of Science and Technology (South

Africa), the CGIAR-ILRI and has headed projects at the EU, OECD, UNEP and IDRC. Among her recent publications are Making Choices About Hydrogen: Transport Issues for Developing Countries (edited with Grant Boyle) Tokyo: UNU Press & Ottawa: IDRC Press, 2008, Innovation and Economic Development (ed.) The International Library of Critical Writings in Economics, Cheltenham, UK, Edward Elgar, 2007, and "Technology Transfer Issues in Environmental Goods and Services", Geneva: ICTSD, Issue Paper No. 6, 2007.



**Professor Caroline S. Wagner is an expert in the field of science and technology** and its association to policy, society, and innovation, holds the Ambassador Milton A. and Roslyn Z. Wolf Chair in International Affairs at the John Glenn School of Public Affairs, The Ohio State University, Columbus, Ohio. Dr. Wagner earned her doctorate from the University of Amsterdam in Science and Technology Dynamics with a focus on collaborative research networks; she received her Master of Arts degree in Science, Technology and Public Policy from George Washington University; and she holds a Bachelor of Arts from Trinity College, Washington, DC.

Her career in science and technology policy analysis has spanned more than thirty years and three continents. At The RAND Corporation, she was deputy to the director of the Science & Technology Policy Institute, a research centre serving the White House Office of Science and Technology Policy. This included coordinating research projects related to science and technology subjects across a number of disciplines and locations. Wagner's role was to act as project manager, writer, and policy analyst on more than 12 major projects for RAND.

Professor Wagner has served within the United States federal government for as a professional staff member for the U.S. Congress Committee on Science, Space, and Technology. Caroline also served as a research scientist at George Washington University's Centre for International Science and Technology Policy, teaching and conducting research on collaborative research

networks in science. She has been an advisor to the European Commission, the World Bank's Knowledge Report and other projects, the United States National Science Foundation, the Organization for Economic Cooperation and Development and several governments. As part of the United Nations Millennium Development Project, Wagner served on the Task Force on [Science, Technology, and Innovation](#) and served as an author of the final report. Dr. Wagner is an advisor to the [Places and Spaces, and Science Maps](#) visualization projects, headed by Professor Katy Borner, University of Indiana. An Elected Fellow of the American Association for the Advancement of Science, Wagner is the North American editor of the Science & Public Policy Journal. She is also the author of the book ["The New Invisible College: Science for Development."](#) She is currently under contract with Stanford University Press to complete a book entitled, "The Collaborative Era in Science."



**Professor Eric C. Eboh a Professor of Agricultural Economics, University of Nigeria, Nsukka.**

He was the Executive Director, African Institute for Applied Economics (AIAE) from 2003-2012 and presently the President, Agricultural Policy Research Network (APRNet). At the University of Nigeria, he serves as the Director, Distance Learning Programme. He is a member of the United Nations International Scientific Panel on Sustainable Resource Management. Prof. Eboh has accumulated extensive professional experience as Advisor/Consultant to several international development organisations such as UNECA, IDRC and Nigeria-based programmes/projects of DFID, USAID, UNDP, EU, World Bank/IFC, IDRC, EU and others. His main research/professional interests include resource & environmental economics, policy analysis and monitoring & evaluation. Since 1990, he has carried out research & studies. Prof. Eboh has led more than 60 research and policy network projects in the last 10 years. He has published over 80 peer-reviewed publications: journal articles, technical and research papers. In addition, his book publications include Political Economy of National Development: Issues and Perspectives", "Social and Economic Research: Principles and Methods", "Rural Development in Nigeria: Concepts, Processes and Prospects", "Promoting Non-Oil Private Sector: Evidence and Recommendations", "Global Economic Crisis and Nigeria: Taking the Right Lessons, Avoiding the Wrong Lessons" and "Business Environment in Nigeria" and Business Environment in Nigeria 2010



**Professor Turner T. Isoun is the Vice-Chair of the ATPS Board** and a former

Minister of Science and Technology of the Federal Republic of Nigeria between October 2000 and May 2007. During his tenure, he initiated policies that promoted both high-tech and low-tech science for development and specifically guided the NigerSat I (a land observation satellite) and NIGCOMSAT 1 (an advanced communication satellite) projects from development to launch. Prof. Isoun holds a BSc (hons), D.V.M. (Doctor of Veterinary Medicine), and PHD in Veterinary Medicine and Pathology from Michigan State University. His research findings have been recorded in over 50 scientific publications and scholarly journals. His early career includes lecturing at the University of Nigeria and University of Ibadan where he taught at undergraduate and post-graduate levels. Prof. Isoun is a fellow of the Nigerian Academy of Sciences and the African Academy of Sciences. He has also served on the academy's Executive Board and was the first Executive Editor of the pan-African science journal, Discovery and Innovation, a publication that promotes science and technology, applied and theoretical, academic and commercialized in Africa. Prof. Isoun is widely travelled in North and South America, Europe, Asia and Africa, and is conversant with the physical, political, and S&T challenges of these continents. He has met and networked with many academics, policy makers and representatives of major international organizations in the course of his travels.



**Professor Christopher J. Leaver is an Emeritus Professor of Plant Science and a Fellow of St John's College, University of Oxford, UK.**

He received his BSc and PhD from Imperial College London and carried out postdoctoral research as a Fulbright Scholar, at Purdue University, USA. He then moved to the University of Edinburgh as a Lecturer, then Reader, SERC Senior Research Fellow and Professor of Plant Molecular Biology. In 1990 he was appointed Sibthorpe Professor and Head of the Department of Plant Science at the University of Oxford and became Emeritus Professor in 2008.

He pioneered research into the molecular and biochemical basis of mitochondrial biogenesis and function during plant development and differentiation in general, and during pollen formation, senescence and programmed cell death in particular. His early work laid the

basis for our understanding of the molecular and cellular basis of cytoplasmic male sterility and fertility restoration in major crop plants and he has published over 150 papers in major international journals. Since the initial development of GM crop technology he has been committed to creating a dialogue and informing the public understanding of this important area of science and continues to communicate by lecturing to schools, undergraduates and the general public and by engagement with the media. He was a founding Trustee and is currently an executive committee member of the charity Sense about Science ([www.senseaboutscience.org.uk](http://www.senseaboutscience.org.uk)).

He is a Fellow of the Royal Society of London, Fellow of the Royal Society of Edinburgh, member of Academia Europaea and the European Molecular Biology Organisation of which he was chair of Council. He was made a Commander of the British Empire for services to plant sciences and was elected a corresponding member and inaugural Fellow of The American Society of Plant Biologists. Awards include the T H Huxley Gold Medal Imperial College, Commonwealth Bursary, CSIRO, Canberra. EMBO Senior Fellowship, Biozentrum Basel, Tate and Lyle Award the Phytochemical Society of Europe, Royal Society/Academie des Sciences Visiting Lecturer to France, Humboldt Prize, Raine Medical Research Foundation Visiting Professor, University of Western Australia and he is currently a Visiting Professor University of Western Australia. He has served on numerous national and international advisory bodies and councils including the UK, Agriculture and Food Research Council, Biotechnology and Biological Sciences Research Council, MAFF: Priorities Board for R&D, and Chairman of the Arable Crops Advisory Sectoral Group, Advisory Council on Science & Technology, Evaluation Committee, Centre of Excellence Programme, NIAB, Japan, Chairman of Scientific Advisory Board, UK Institute of Arable Crops Research. Chair University of Oxford Technology Transfer Advisory Group. Director, Isis Innovations Ltd. Member GM Science Review Panel for HM Government. Trustee of the Natural History Museum, London. Member of Scientific Advisory Board, Singapore Institute of Molecular and Cell Biology. Member of A\*Star Graduate Academy, International Advisory Panel, Singapore. Delegate of the Oxford University Press. Committee for Scientific Planning and Review, International Council for Science ([www.icsu.org](http://www.icsu.org)), Paris.

He is currently a Trustee of the John Innes Foundation and Governing Body Member of the John Innes Centre, Norwich. Member, External Scientific Advisory Board for the Institute of Molecular and Cell Biology, University of Oporto, Portugal, Scientific Advisory Board of Australian Research Council Centre of Excellence in Plant Energy Biology, Western Australia, Chair of the International Advisory Panel of National University of Singapore Graduate School, Advisor in Biological Sciences to the Carnegie Trust for the Universities of Scotland.



**Professor Anupam Varma**, graduated from the University of Allahabad in 1959 and obtained M.Sc. degree in Botany from the same University in 1961. In 1964 he went to Rothamsted Experimental Station, UK under the Commonwealth Fellowship Programme for higher studies. After obtaining Ph.D. degree from London University in 1967, he joined the Indian Agricultural Research Institute (IARI), New Delhi. Since then he has been working at the same Institute in varying capacities as Senior Virologist (1968-75), Principal Virologist (1975-84), Professor of Virology (1984-86), Professor of Plant Pathology (1986-88), Head, Division of Plant Pathology (1988-95), Dean, Post Graduate School (1995-2000), National Professor ICAR (2000-2005), Indian National Science Academy (INSA) Senior Scientist (2005 - 2010), INSA Honorary Scientist (2010 – to date) and Adjunct Professor, IARI (2010 – to date). He has been a Visiting Scientist at the Australian National University, Canberra, Scottish Crop Research Institute, Dundee, UK, and INRA, Bordeaux, France.



**Professor Emmanuel Ezugwu** graduated from the Federal Polytechnic, Idah, in Metallurgy in 1981. In 1982, he joined Warwick Manufacturing Centre, University of Warwick, Coventry, United Kingdom for his Masters and Doctorate degrees. He received his Masters degree in 1983 and his PhD in 1986. Professor worked as Research Fellow at the Warwick Manufacturing Centre, University of Warwick and promoted to the position of Senior Research and Teaching Fellow in 1990. Professor Ezugwu served as Senior Lectureship position at London South Bank University in 1993, carried out Research programme on the Machining of exotic Aerospace alloys. In 1996, he was promoted to Reader (Associate Professor) in Advanced Manufacturing Technology and to Professor of Engineering Systems in 1998/99 academic sessions. Professor held the pioneer position of Director, Machining Research Centre at London South Bank University from 1998 to 2009. He was a Visiting Professor at various universities and institutions. Professor Ezugwu has authored or co-authored 4 books and well over 165 publications in high impact international journals and conferences (mainly invited). Professor Ezugwu is a Chartered Engineer and Fellow of the Institution of Engineering and Technology/ He is a registered international consultant for different international and UN agencies. He is also a qualified Auditor/Lead Auditor for ISO 9000 Quality Certification and a PRINCE 2 Project Management consultant. In April 2009, Professor Emmanuel Ezugwu was appointed the pioneer Provost of the Air Force Institute of Technology (AFIT), Kaduna.

**Dr. Peggy Oti-Boateng is a Senior Programme Specialist in Science and Technology, UNESCO Regional Office for Science in Africa, (ROSTA) Nairobi, Kenya.**



She was a Senior Research Fellow of the Technology Consultancy Centre (TCC), KNUST where she has also served as the Director at various periods. She holds a PhD in Nutrition and Food Technology for the University of Adelaide, Australia. She has over 26 years professional experience in teaching, research and development and consultancy service in science, technology and innovation (STI). She has a passion for harnessing STI for solving basic needs of food, energy, water, health, sustainable environment for the poor and the promotion of technologies for the establishment of small-scale enterprises for economic empowerment of women and job creation for both rural and urban communities. Her research expertise is shared through teaching undergraduate and graduate students in Biochemistry and Business Administration, graduate entrepreneurship development and mentoring. She also has expertise in the development and evaluation of

innovative systems for the promotion of sustainable industrial and socio-economic growth for knowledge-based society.

She is the author of several journal articles, technical papers, manuals, baseline reports, books and book chapters on science, technology and innovation policy, food technology, health and nutrition, microfinance and HIV/AIDS. She is a member of the International Advisory Group for the International Conference for Women in Engineering and Science-ICWES15 and member of the UK-based Food Chain Journal Editorial Advisory Board.



**Professor Sir Brian Heap is member of the ATPS Board.** He is President of the European Academies Science Advisory Council, Senior Scientific Advisor at the Malaysian Commonwealth Studies Centre, Cambridge, and former Master of St Edmund's College, Cambridge.

As a biological scientist, he has doctorates from Nottingham and Cambridge, published extensively on endocrine physiology, reproductive biology, biotechnology, and became Director of Research at the Institute of Animal Physiology and Genetics Research (Cambridge and Edinburgh) and at the Biotechnology and Biological Sciences Research Council. Elected Fellow of the Royal Society, he held posts as Foreign Secretary, Vice-President, and editor of the Philosophical Transactions of the Royal Society, Series B, and was President of the Institute of Biology, and UK Representative on the European Science Foundation and the NATO Science Committee.



**Ms. Alice Sena Lamptey is Higher Education Advisor to the Pan African University (PAU)** Project Management Unit (PMU) Department of Human Resources Science and Technology (HRST) African Union Commission (AUC) and the Coordinator of the Working Group on Higher Education of the Association for the Development of Education in Africa (ADEA). Ms. Lamptey is a PhD Research Associate at the Higher Education Group (HEG) Department of Management Sciences University of Tampere Finland and holds a Masters Degree in Business Administration (MBA) from the University of Ghana Legon.



**Dr. Benjamin Apraku Gyampoh is the Program Officer at the African Academy of Sciences.** He is a climate scientist with a strong background in Natural Resources Management. He has worked extensively on several aspects of climate science including vulnerability assessment; coping mechanisms, adaptation and mitigation strategies; and indigenous knowledge in adaptation to climate change.

Prior to joining the African Academy of Sciences, he worked with the International Water Management Institute (IWMI) in Accra, Ghana. He has also worked with the Environment Protection Agency of Ghana in preparing policy briefs on 'Climate Change and Disaster Risk Reduction' and 'Taking Advantage of Opportunities in Climate Change'. He led the UNPD's Africa Adaptation Programme study on "Mapping and Documenting Indigenous Knowledge in Climate Change Adaptation in Ghana" as well as "Optimal Institutional Coordination Mechanism for the Management of Climate Change Related Health Risks" with Ghana's Ministry of Health.



**Prof Agnes W. Mwang'ombe is a member of the ATPS Board and is the Chair of the African Women Forum for Science and Technology (AWFST).**

She has been the Principal of the College of Agricultural and Veterinary Services (CAVS) of the University of Nairobi Upper Kabete Campus since September 2005, prior to which she was the university's Dean of the Faculty of Agriculture for two years. Her area of specialization is plant pathology and she obtained her PhD in plant pathology from the University of London in 1987. A year later, she joined the teaching staff at the University of Nairobi as a lecturer in the Department of Crop Science. She rose through the academic ranks to become a senior lecturer in 1991 and associate professor in 1997. She is a member of the board of the African Crop Science Society and served as the president of the society between 2003 and 2005. Besides crop science, Prof Mwang'ombe has been actively engaged in the formulation and implementation of agricultural policy in Kenya. In recognition of her work in this regard, she was appointed the chair of the board of the Kenya Institute for Public Policy Research and Analysis in 2007, a position she currently holds. She is also involved in charity education programs for girls and mentorship programs for young women scientists in East Africa. In 1996, she was elected the first chair of KEPAWAE - the Kenya Professional Association of Women in Agriculture and Environment. Through this organization, professional women in the fields of agriculture and environmental sciences offer technical expertise and material support to Kenyan rural women farmers through transfer of appropriate farming technologies and development of project proposals. Prof Mwang'ombe co-founded an NGO - Arid and Semi-arid Lands Foundation - to identify and promote projects aimed at sustainable food production and natural resource management in Kenya's arid and semi-arid lands that comprise over 70 per cent of the country's area. She presently serves as the NGO's director.



**Professor Obioma Nwaorgu Nwaorgu is the Vice-Chair of the African Women Forum for Science and Technology (AWFST).**

She is a professor of Public Health Parasitology/Medical Entomology and Epidemiology. She has over 20 years' experience in university teaching, research projects (including TDR/WHO), and administrative and human resources development including establishing and developing various department academic programs. She has supervised at least 20 MSc and PhD projects.

Professor Nwaorgu joined the Roll Back Malaria unit in January, 2002 after successfully completing her Global Health Fellowship program in Roll Back Malaria from September 1999 to December 2001. She has offered extensive advisory services to the National and State Ministries of Health in Nigeria on development and implementation of curative and preventive health programs in rural communities. She has pioneered at least three disease control programs in Nigeria as a chairman or task force member (Guinea worm, Onchocerciasis, Schistosomiasis etc.). Professor Nwaorgu is involved in consultancy, monitoring and evaluation services for various international and national organizations and NGOs (UNICEF, Global 2000, APOC/WHO, UNDP, Ford Foundation, Mac-Arthur Foundation, USA, Features Group USA, Rainbow). She is also extensively involved in NGO and peer educator training programs for enhancing community capacity in disease prevention and control including HIV/AIDS.



**Professor Mark Swilling is Division Head: Sustainable Development in the School of Public Management and Planning at the University of Stellenbosch and Academic Director of the Sustainability Institute.**

He was co-founder, former Director and Professor of the Graduate School of Public and Development Management (P&DM), University of the Witwatersrand, 1993-1997. P&DM was established in the early 1990s



to prepare South Africans from historically disadvantaged backgrounds for senior leadership positions in the post-1994 democratic government. He is the current ATPS-South Africa National Chapter Coordinator. Prior to joining the Graduate School of Public and Development, Swilling worked for PLANACT - an urban development NGO which he helped establish in 1985. After a period as Senior Researcher at the Centre for Policy Studies in Johannesburg (1986-1990) where he focussed on state security policy, he worked on a full-time basis for PLANACT, 1990-1993. Here his main duties included providing the democratic movement with technical and policy support during the lead-up to the first democratic elections in 1994, with particular reference to urban development and the transformation of local government. He also participated in the active design, facilitation and implementation of large-scale housing delivery projects in the Eastern Cape, North West Province, and Gauteng. He assisted in the initiation of various NGOs in various parts of South Africa, is on the Editorial Boards of leading academic journals, and serves on the International Advisory Committee of CASSAD, Nigeria.

Swilling has published several edited and co-authored books, over 60 academic articles and contributed extensively to public debate in the popular press on issues related to development, democratisation, governance and social movements. One of his books was *Governing Africa's Cities* which was published in 1996 by the Wits University Press and was written by a team of leading African intellectuals whose contributions cover over 40 different African cities. His most recent publication is the *Scope and Size of the Non-Profit Sector in South Africa*, which brings together four years of research that was conducted in collaboration with the Comparative Non-profit Sector Project at Johns Hopkins University (Baltimore, USA). He also helped initiate (but is no longer linked to) the Africa Human Genome Initiative, which is a joint venture between the Human Sciences Research Council, the Academy of Sciences of Southern Africa and the Sustainability Institute. Swilling holds his Ph.D. from the University of Warwick and has a BA and a BA (Honours) obtained through the Department of Political Studies at the University of the Witwatersrand where he was also a lecturer from 1982 - 1987. He has received various merit awards, including election into the international Ashoka Fellowship.



**Professor David Doepel is the director of the Africa Research Group, Research Institute for Resource Technology at Murdoch University Perth, Western Australia.**

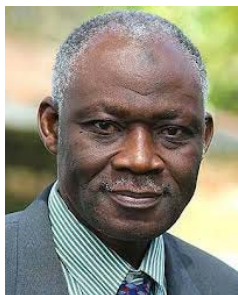
He is responsible for overseeing research in the areas of water, renewable energy, and minerals - the resources of Western Australia. He is also currently serving as the interim CEO of the Australian National Centre of Excellence in Desalination, which is located at Murdoch University. Previously he served as a Principal Policy Adviser to the Hon. Alan Carpenter Premier of Western Australia. Prior to that engagement he

was the Regional Director for the Americas, based in Los Angeles, for the Western Australian Trade and Investment Office. In that role he was responsible for the State Government's strategic marketing efforts on behalf of industry in the Americas. In both positions Prof. Doepel was a powerful advocate for Western Australian technology, creativity and innovation. He holds degrees from Murdoch University, the Melbourne College of Divinity and Boston University.



**Professor Volker ter Meulen** qualified as MD in 1960. He received training in virology in the USA. He specialised in paediatrics and in clinical virology. In 1975 he became Chairman of the Institute of Virology, Univ. Würzburg, and was Dean of the Faculty of Medicine from 1998-2002. He has worked on pathogenic aspects of viral infections, in particular infections of the central nervous system. Nationally and internationally, ter Meulen has served over the years in advisory committees of government bodies and scientific societies/unions. From 2003-2010, ter Meulen was President of the German Academy of Sciences Leopoldina. Under his leadership, the Leopoldina has strengthened its international commitments in different inter-academic councils and was appointed National Academy of Sciences in 2008. From 2007-2010, he was President of the

European Academies Science Advisory Council (EASAC), an association of the National Academies of the European Union



**Professor Walter Alhassan has served as the Director General for the Ghana Council for Scientific and Industrial Research** and Dean of Agriculture at the Abubakar Tafawa Balewa University (Nigeria). Dr. Alhassan has conducted extensive studies on the status and application of agricultural biotechnology in Africa. He holds degrees in animal, poultry and dairy sciences and tropical agriculture from the University of Guelph (Canada), the University of Wisconsin (US), and the Kwame Nkrumah University of Science and Technology (Ghana). He is the former Biotech and Biosafety Policy Coordinator for FARA agricultural research coordination and has continued to serve FARA as the Agriculture Biotechnology and Biosafety Policy and Consultant.

Currently, he is the coordinator for the African Biotechnology and Biosafety Policy Platform and the Syngenta Foundation for Sustainable Agriculture (SFSA) project Strengthening Capacity for Safe Biotechnology Management in Sub-Saharan Africa (SABIMA).



**Professor Indira Nath is a member of the ATPS Board** and holds a Doctor of Medicine degree with a major in Pathology from the All India Institute of Medical Sciences, New Delhi, India. Prof. Nath was a Post-doctoral Fellow at the Royal College of Surgeons and National Institute for Medical Research, Mill Hill, London. She has been awarded membership (MRCPath) on basis of publications by the Royal college of Pathologists in the UK. Dr. Nath is an Elected Fellow in various Science Academies including Indian National Science Academy and the Third World Academy in Trieste, Italy. She has been engaged as an expert for

research grant proposals and awards by various key institutions and holds membership in organizations such as the International Forum on Biosecurity, US NAS. Prof. Nath has also been engaged in Science Policy Management activities in various capacities including holding Membership at the Scientific Advisory Committee to the Cabinet (SAC-C) between 2003-2007. She has also worked with various departments within the Ministry of Science and Technology in India which include the Department of Science and Technology; Department of Biotechnology; Department of Ocean Development; Council of Scientific and Industrial Research and the Indian Council of Medical Research. She has authored many research papers and invited articles, reviews, editorials and reports.



**Mr. Tennyson Magombo is the outgoing chairperson of African Youth Forum in Science and Technology (AYFST).** He is also the Executive Director of Arise and Shine International ([www.asi-mw.org](http://www.asi-mw.org)) an NGO which he founded and is registered as a company limited by guarantee under the laws of Malawi. He is passionate about organic/ecological agriculture and as such is an agribusiness entrepreneur who manages his own company known as Tingadalire Organic Food Products.



**Professor Vincent Chinedum Anigbogu is the Director General, Institute for National Transformation,** which has centers in Atlanta, Nairobi (Kenya), Kampala (Uganda), and Lagos (Nigeria). He is also the President and CEO of the consulting firm, JC (Jesus Christ) Quality Management Group in US, Nigeria, and Uganda. He has a Ph.D. in Analytical Chemistry from the University of Alabama in 1986. He also obtained his M.Sc. in Analytical Chemistry and B.S. in Chemistry from

Indiana University of Pennsylvania, Indiana, PA in 1981 and 1978, respectively. He has taught, conducted research, and published in the field of analytical Chemistry for nearly 20 years at

several universities including Agnes Scott College, Decatur, GA (1992-95) and Clark Atlanta University, Atlanta, GA (1995-2004). Upon discovering his calling into ministry and passion in leadership development, he left the field of chemistry in 2004 to pursue his in passion leading to the establishment of the Institute for National Transformation, which now has centres in many countries and growing. Professor Anigbogu's dream is to see the development of purposeful leaders who will impact their generation and Africa



**Professor Christopher J. Garforth is Professor of Agricultural Extension and Rural Development at the University of Reading** and is a co-director Media for Education and Development (Mediae). His PhD research on the dynamics of agricultural land use in Nigeria in 1974 first stimulated an interest in knowledge, communication and innovation among rural populations. He then worked for the Ministry of Agriculture in Botswana, setting up a media research unit in their Agricultural Information Services. From there, he moved to Reading where he has been teaching and researching in the field of communication for thirty years. He directs Reading's MSc in Communication and Innovation for Development. He has carried out research, training and consultancy

assignments in over 40 countries in Asia, Africa, the Middle East and Europe, including work on Mediae projects in Kenya, Tanzania, Uganda and Sudan. He has been involved in projects to reform public sector extension systems in Bangladesh, Uganda and Kenya. Recent and current research includes studies of the dynamics of rural livelihoods in Ghana, farmers' adaptation to climate change in Nigeria, women livestock keepers' access to knowledge on animal health, and farmers' interpretations of environmental and climate change in China. He is supervising PhD research in several African and Asian countries on the role of institutions, communication and knowledge systems in rural livelihoods. He is the chairman of the Tropical Agricultural Association.



**Professor Francis M. Mutua** is an Associate Professor of the University of Nairobi in the Department of Meteorology. He is the head of the surface water resources and hydrometeorology thematic unit in the department, the school of physical sciences. He was also the Coordinator and Lead Trainer of the very successful regional WMO/ UNESCO/IHE sponsored International Postgraduate course in Water Resources Systems and Management, which was conducted in the Institute for Meteorological Training and Research, Dagoretti Corner, Nairobi, in collaboration with the University of Nairobi (1991-2006).

Prof Mutua is a member of the African Meteorological Society (AMS), Kenya Meteorological Society (KMS) and the International Association of Hydrological Sciences (IAHS). Prof Mutua holds many key responsibilities, some of which include: Board member, International Center for Hazards and Risk Management (ICHARM) – Japan; Board Member, International Research and Training Center on Erosion and Sedimentation (IRTCES) China; Member of the Scientific Steering Committee of the Nile Basin Research Programme, Bergen University, Norway; National Project Coordinator for Kenya, Applied Training Project, Nile Basin Initiative; Regional Coordinator, Droughts and Floods Studies, UNESCO/Flanders Nile-FRIEND Project; and Member, National Climate Change Coordinating Committee, Kenya. In his academic career, Prof Mutua has won many awards including the prestigious Gandhi Smarak Award of the University of Nairobi, twice in a two consecutive years.

He has been External Examiner as well as supervisor/promoter for many Masters and PhD research work in many local, regional and international universities in the field of hydrology and hydraulics. Prof Mutua has done a wide range of consultancies with many international organizations such as FAO, the African technology and Policy Studies (ATPS) Network, the Lake Victoria Environmental Management Project (LVEMP), UNDP/GEF on climate change impacts, the IGAD Climate Prediction and Applications Center (ICPAC) and Government of Kenya.



**Dr. Billy Katontoka is affiliated with the Africa Carbon Credit Exchange, Zambia.** Dr. Katontoka has led the work on carbon project development and implementation at ACCE/GKI in Zambia and Africa as a whole. Billy has studied Green Technology & Carbon Markets, Green Technologies/Carbon Markets at the Technical University of Denmark. He also attained his MBA, Finance/Marketing at the Edith Cowan University and BA, Economics & Mathematical Statistics at the University of Zambia.



**Dr. Robert Byrne has been working in the sustainable energy field for more than 15 years:** as an engineer, a manager and a policy analyst. He is particularly experienced in energy and development in an African context, having spent a total of five years on renewable energy projects in a number of countries (Botswana, Tanzania and Kenya). He is a research fellow in SPRU (Science & Technology Policy Research) at the University of Sussex, where he also convenes the Energy and Climate domain work of the STEPS Centre. Alongside these roles, he helps to co-ordinate the Energy and Emissions Theme of the Tyndall Centre for Climate Change Research. His focus is the role of science, technology and innovation in energy and development, sustainability and poverty reduction.

Dr Rob Byrne, Research Fellow, SPRU (Science & Technology Policy Research), STEPS Centre and Tyndall Centre for Climate Change Research School of Business, Management and Economics.



**Prof. Michael Ifeanyi Uguru, B. Agric (First Class Honours) and MSc (University of Nigeria), is a Professor at the University of Nigeria** at the Department of Crop Science. Some of his research breakthroughs and achievements are his winning works including Hope: A dual purpose Tomato variety for Nigeria farmers and cannery and the Organic Formula for growing high premium crops during the research competitions in Nigeria Universities Research and Development Fair in 2008 and 2010 respectively. Prof. Uguru has also engaged his research expertise with several institutions within and outside the region. Prof Uguru is well published and has completed the supervision of

more than 12 Masters' Projects and three Ph. D dissertations. His current memberships include the Genetic Society and Science Association, both in Nigeria.



**Dr. David Bennett is the Project Co-Leader of the Biosciences for Farming in Africa (B4FA).**

He is a guest at the Kluver Laboratory for Biotechnology, Delft University of Technology, Netherlands; Visitor at St Edmund's College, Cambridge; and Director of Cambridge Biomedical Consultants Ltd. PhD in biochemical genetics, MA in science policy studies with long-term experience in the relations between science, industry, government, law, the public and the media. Works internationally with the European Commission, government departments, companies, universities, public bodies and the media.

He is a guest at the Kluver Laboratory for Biotechnology, Delft University of Technology, Netherlands; Visitor at St Edmund's College, Cambridge; and Director of Cambridge Biomedical Consultants Ltd. PhD in biochemical genetics, MA in science policy studies with long-term experience in the relations between science, industry, government, law, the public and the media. Works internationally with the European Commission, government departments, companies, universities, public bodies and the media.



**Dr. Claudia Canales Holzeis, EASAC Secretariat** for the Planting the Future Project, Research Associate at Biosciences for Farming in Africa (B4FA) and Visiting Academic at the Department of Plant Sciences, University of Oxford. She has nine years' experience in plant genetics research. She worked as a Senior Project Officer for the International Service for the Acquisition of Agri-Biotech Applications (ISAAA), based in the Philippines, on science communication and technology transfer projects. She is a graduate of the University of Reading in environmental biology and holds a PhD in plant genetics from the University of Oxford.



**Robin Fears, PhD DSc., trained as a biochemist and had 30 years' experience in the pharmaceutical industry in the UK in R&D.**

The early years were focused on cardiovascular disease and neurosciences, from discovery through to marketed product. The final decade of this industry experience was occupied in setting up a policy group for R&D in Europe. Since then, for the past 10 years, self-employed as a consultant, he has worked as advisor to various bodies in universities, academies of science and medicine, industry and with parliamentary and government groups, on issues relating to biosciences and innovation in the EU. He has provided support to the EASAC Biosciences Programme for a range of projects in biomedical and plant sciences and emerging technologies since 2002.



**Professor Norah K. Olembo is a former Chair of the ATPS Board** is former Executive Director of Africa Biotechnology Stakeholders Forum (ABSF), Kenya. She holds a PhD in Biochemistry; Msc in Zoology; and a Bsc (Honours) degree (Chemistry, Zoology, Botany) from the University of Nairobi. She has trained in recombinant DNA techniques at the Courtould Institute, Middlesex Hospital, London. Prof. Olembo has worked as a consultant for various organizations including the Kenya Nongovernmental Committee for the 1985 United Nations End of Decade Women's Conference; the UNEP Biodiversity/ Biotechnology Program; the CGIAR Secretariat/World Bank; the International Service for National Agricultural Research; among others. She has published over 30 proceedings, abstract reports and research papers in

various international scientific journals. Prof. Olembo belongs to over 30 professional societies and organizations including the Genetic Resources Policy Committee of the International Plant Genetic Resources Institute (IPGRI), the Commission for Biological Education (CBE) of the International Union Trustee of the Public Law Institute, the National Committee of Kenya National Academy of Science, the International Association for Women Biochemist, among others.



**Dr. Jeffrey Herrick is a soil scientist with the Agricultural Research Service of the United States Department of Agriculture (USDA-ARS)** in Las Cruces, New Mexico. He also holds adjunct faculty appointments in the Departments of Plant and Environmental Science, and Animal and Range Science, New Mexico State University, Las Cruces, NM, and is an Adjunct Research Scientist, in the Nicholas School of the Environment at Duke University. He currently serves as the US Government's science representative to the United Nations Convention to Combat Desertification (UNCCD). His work includes basic research on the factors that control the resistance and resilience of arid and semi-arid ecosystems, and applied research leading to the

development of protocols for inventory, assessment, monitoring and knowledge sharing at

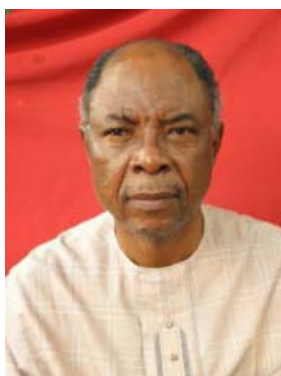
pasture plot to national scales. He has authored or co-authored over 140 publications, in addition to leading or contributing to the development of numerous science implementation documents for US federal agencies. He collaborates actively with individuals and organizations in Africa, Asia and Latin America.



**Mr. Denis Fourie is an entrepreneur, lobbyist, mentor and international speaker**, often referred to as “The Cowboy CEO” for his non-diplomatic and direct approach to discussing important matters. Best known as the founder and former Group CEO of the highly successful group of companies, The Lobbyist Group, he is a highly successful entrepreneur, visionary, leader, international speaker and coach. Since graduating in 1994 with both a diploma in Electronics and Business Commerce, he worked his way from the ground up in many companies, gaining exposure to various industries and sectors internationally, and before long had moved into senior strategic executive roles with his strong ability to not only think out of the box, but to influence and lead people. He has conceptualised, started, managed and sold several successful businesses during his career.

Currently Fourie serves as the Founder and CEO of The Trusted Advisor, following his passion in working with entrepreneurs and business executives across all market segments, providing them with niche mentorship and trusted advisory services. His organisation's focus is on growing entrepreneurship in Africa by providing entrepreneurs with the mentorship and tools they need to take their businesses from concept to growing their businesses. He also serves as Chairman and Executive Advisor on several boards for Local and International Companies, and holds trusted advisor status to several governments and royal families, in addition to being on the advisory panel for several international development organisations.

He has received various prestigious accolades for his success in business and his contribution to entrepreneurship in developing countries. He is also an international guest speaker, sharing his experiences on business leadership, innovation, entrepreneurship, sustainable development and skills upliftment. He is a professional lobbyist and global networker, working closely with governments, investors and businesses on global strategic trade and investment transactions. As a strategic negotiator, he has negotiated and closed billion dollar transactions for organisations and governments, as well as lending his negotiation abilities to resolving hostage crises', labour disputes and facilitating strategic transactions.



**Professor Sonny Chidebelu is a Professor of Agribusiness/Agricultural Economics at the university of Nigeria**, Nsukka lecturing in Agriculture Economics. He holds a Ph.D from the University of Georgia, Athens, Georgia, USA, 1980 and a M.Sc, Universty of Guelph, Guelph, Ontario, Canada, 1977, B.Sc, University of Nigeria, Nsukka, Nigeria, 1973. He has supervised about 60 postgraduate students and is an external examiner to many universities, reviewed papers for many journals, published about 60 papers in national and international journals, Consulted for national and international organizations, taught courses at all levels in universities. He has been awarded various prizes, honours and scholarships.



**Mr. Emeka, Victor Ngwoke is the current Chair of the ATPS-African Youth Forum on Science and Technology (AYFST).** He also serves as the

Coordinator, African Youth Forum on Science and Technology (AYFST), Nigeria Chapter and a steering committee member, AYFST. He obtained his first degree in Electrical Engineering at the University of Nigeria, Nsukka. At present, he is a research student with the same University where he is working on Electrical Power Devices. Emeka is working with Aster Infrastructure Services Limited as a project engineer since 2012.

He has also worked with National Bureau of Statistics (NBS) as a National Youth Corps member in 2008. He has been a vibrant youth leader since his University days. He was a student leader at the University of Nigeria, Nsukka. He was the president of Federated Association of Nsukka Students. Emeka has got good international exposure. He has attended conferences and workshops in many African countries such as Kenya, Ghana, Uganda and Ethiopia. He has undertaken various sensitisation activities in Nigeria for the post primary school students on the essence of sound education and good technical knowledge for social-economic transformation of Africa. He is the lead author in a book publication "Freedom from Examination Malpractice: a Key to Sustainable Development".



**Mr. Abdelaziz Lawani is Chairperson of AYFST in Benin and Vice-Chair of AYFST at the continental level (Africa).** He is an Agricultural Economist,

Researcher at the Beninese Center for Environment, Economic and Social Development (CEBEDES) and founder and Executive Director of "Youth and Development" a Nonprofit Organization which works to empower youths in Sub-Saharan Africa. Abdelaziz has left his marks on the importance of youths in the development process in his country. Under his leadership AYFST-Benin became a strong organization of more than three hundred young researchers and professionals working to develop the culture of innovations using sciences and technologies among youths. Abdelaziz Lawani has conducted ground-breaking

research on agricultural and resource economics, protected areas economic evaluation, urban agriculture, value chain analysis, decentralization, etc. He obtained his undergraduate degree in Agricultural Engineering from Abomey-Calavi University (Benin) and a dual Master of Sciences in Agricultural Economics (2007) and Development Economics (2009) from the same university.

In 2010 Abdelaziz Lawani received the prestigious Fulbright scholarship to pursue his PhD in Economics at North Carolina State University. He is currently a grantee of the Norman Borlaug fellowship under which his research investigates the impact of food stocks on price transmission and stabilization. He obtained in 2010 the ATPS award for his project on youths as driven force behind resilient communities face to climate change in Karimama and Malanville (Benin). He is also an influential member of Benin State Department's Alumni which has been awarded the US Alumni Engagement Innovation Fund for their Initiative to encourage women in high schools to pursue their education in Sciences, Technology, Engineering and Mathematics (in Benin).



**Professor Malachy Okwueze is the Deputy Vice Chancellor, Administration, University of Nigeria, Nsukka.** He is a Professor of Religion and Ethics at

the University of Nigeria, Nsukka where he teaches Biblical Hebrew, Old Testament and Religion & Society.

He holds a Master of Arts and Ph. D Degrees in Religion from the University of Nigeria, Nsukka obtained in 1989 and 1995 respectively. He also holds an LL.B Degree in Law from the University of Nigeria (Enugu Campus). Malachy who is equally a Lawyer was called to the Nigerian Bar in 1996 after successfully completing the necessary training at the Nigerian Law School, Lagos from where he graduated at the Nigerian

Law School, Lagos in 1996. He has participated in a wide range of conferences and also authored five standard texts published by reputable publishers, over 30 Peer reviewed articles in reputable Journals. He has also completed the supervision of more than 20 Masters' Projects and 13 Ph. D dissertations. Professor Malachy has won the following prizes in the course of his education and training: University of Nigeria Prize for Best the Graduating Student of the university 1986/87 Graduating Class, Nigeria Industrial Development Bank, (NIDB) Prize for the Best Student in Commercial law, UNEC 1992 Graduating Class, Chief T.O.S Benson Prize for the Second Best Over All Performance, Nigeria Law School Bar Final Examinations, 1996 Graduating Class.



**Dr. (Mrs.) A. I. Achike** is a Lecturer in the Department of Agricultural Economics, University of Nigeria, Nsukka. She teaches in the same Department at both undergraduate and postgraduate levels.



**Asadu, Charles Livinus Anija is a Professor** with versed knowledge and experiences in Pedology/ Soil Survey/ Resource Management & Agronomy. He is the Head of the Department of Soil Science, University of Nigeria, Nsukka.

Prof. Asadu attained his Bachelor of Agriculture in Soil Science (First Class Hons.), MSc., and Ph.D (Soil Science) all from UNN; Training certificates from the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria in 1989 and Dresden University, Germany (2000). He is a Member of seven professional associations, held offices in seven community based associations outside the university, served as chairman/coordinator of six university Committees, member of five university committees. He has served as the Head of Department and Associate Dean of Agriculture. He is also the Founder and director Hillview Unique Secondary School Edem-Nru Nsukka, and Agriculture Resource Management (NGO), instrumental to the formation Nru Youth Forum, Awareness Club, Nsukka, Association of Nsukka Professors and Department of Soil Science Alumni/Alumnae Association. Won nine awards including VC research leadership 2006/2007 at UNN.

Has supervised many undergraduate and post graduate degrees successfully, served as external examiner for four universities and as external assessors for professorial cadre for four universities. Teaches over 12 courses cutting across first degree, PGD and MSc. A consulting /review editor for 12 journals, served as a consultant and later a visiting scientist at the IITA, Ibadan, Nigeria. Carried out over ten local research works/projects and international research works/projects, involving visits to Uganda, Ghana, Congo DR, Congo BR and Cameroon.

Has attended over 29 conferences and workshops and four summer/winter colleges at the Abdusalam International Centre for Theoretical Physics (ICTP), Trieste, Italy. Professor Asadu as well published several International Journal and Conference Proceedings, National Journals and Conference Proceedings, books, working Papers, Technical/ Project Reports, editorship among others.





**Atieno Ndede-Amadi, PhD is author of the best-seller book 'Five Simple Steps to Business Planning, a Do-It-Yourself Workbook'**, the book 'Challenges of the Digital Age: An MIS Analysis Framework, The Case Study of a Retail Chain Store' and co-author of the book ICT Mainstreaming: Research Perspectives from Kenya. She is professor, researcher, consultant, and practitioner of Management Information Systems (MIS), Strategic Management, and Entrepreneurship. She has taught at international and local universities including Bowling Green State University in Ohio, USA and Jomo Kenyatta University of Agriculture & Technology in Nairobi, Kenya. She has published widely in refereed journals including The Information Society; Business Process Management; IEEE Transactions in Education; European Journal of Information Systems; Systemic Practice and Action Research; and Advances in Management Accounting. She has also consulted widely both internationally and locally for the World Bank, African Institute for Capacity Development (AICAD), African Technology Policy Studies Network (ATPS), Kenya National Cleaner Production Centre (KNCPC), and for African Governments including Kenya and Rwanda. She is the Founder and Chief Executive Officer of Africa's Brain Gain, Inc. (ABG) and the Kenya Kountry Business Incubator (KeKoBI), and Founder and Chairperson of the Business Incubation Association of Kenya (BIAK).



**Dr. Mahama Ouedraogo is the current Head of Division, Science & Technology Division under the Human Resources, Science & Technology (HRST) Department at the African Union Commission (AUC).** He has also served as the Executive Secretary of the African Union Scientific, Technical and Research Commission (STRC) based in Lagos, Nigeria. The AUC Science & Technology Division under the HRST is responsible for Africa's Technology paradigm of development.

## EXECUTIVE CONFERENCE ORGANIZING COMMITTEE (ECOC)



(Supervisor of ECOC)

**Prof. Kevin Chika Urama** the Executive Director of the African Technology Policy Studies Network (ATPS). (Ref - Annex 7)



(Chair of ECOC)

**Dr. Nicholas Ozor B. Agric (Nig., First Class Honours); MSc (Nig., Distinction) Ph.D. (Reading & Nig.),** is a Senior Research Officer at the African Technology Policy Studies Network (ATPS) Nairobi, Kenya where he provides leadership in Climate Change and Agricultural Innovations research and research capacity building. Prior to his appointment at the ATPS he worked as a lecturer in the Department of Agricultural Extension, University of Nigeria, Nsukka, Enugu State, Nigeria. Dr Ozor is a Commonwealth Scholar (Split-site Doctoral Programme) and holds the Best PhD Thesis Award in Agriculture in Nigeria, 2006, under the Nigerian Universities Doctoral Theses Award Scheme (NUDTAS) organized by the National Universities Commission. He also holds the Wellcome Trust Award for the Best PhD Presenter in 2006

during the Development Studies Association Conference at the University of Reading, United Kingdom. Dr Ozor has led and is currently leading many internationally funded research studies bordering on natural resource management, innovation studies, climate change, development issues, policy issues, technology management and transfer, advocacy, and private sector involvements. He has good mastery of the computers and its applications to problem solving situations. Dr Ozor is a member of many professional organizations and has published over 40 articles in reputable international journals and as book chapters. He has attended many international conferences/workshops aimed at evolving sustainable best practices for national, regional and international development initiatives. He holds many distinctive prizes and awards for academic excellence and good community leadership.



(Technical Coordinator of ECOC)

**Dr. Kelali Tekle** is the ATPS Post Doctoral Research Officer. Mr. Tekle graduated in Chemistry from Addis Ababa University, Master of Science in Bioenvironmental Science /Environmental Engineering at the Tottori University Faculty of Agriculture, Tottori, Japan. He attained his Ph.D in Managerial Economics at the United Graduate School of Agricultural Sciences, at the Tottori University in Japan.

He previously worked in various capacities: as the Director General at the Tigray National Regional State Science and Technology, Regional Projects Coordinator, board member and chair in various colleges and institutions. He has worked at Amhara National Regional State Educational Bureau and previously as the Acting Director and teacher in High school IV. He has published several articles in the fields of economics, science and technology. He received a certificate from Guinness WorldRecords for his innovative work.



(Finance Coordinator)

**Mr. Richard Murimi Muriuki is the Finance and Administration Manager at ATPS.**

He is responsible for the overall Administration, Personnel and Finance management at the ATPS. He is also responsible for providing information, technical support and advice to the ATPS team in all HR and finance related matters and coordinating such activities. In addition Mr Muriuki is responsible for provision of strategic leadership and guidance in developing and implementing guidelines and procedures governing finance, human resources and administration support system at the ATPS. Prior to joining to becoming the ATPS Finance and Administration Manager, Richard served as the ATPS Finance Officer. Mr Murimi also worked for Swift global (K) Ltd as an Accountant before joining the ATPS. Richard holds a Bachelor of Education (Economics and Accounting) and is a Certified Public Accountant (CPA-K). He also holds a Higher Diploma in Human Resource Management from the Institute of Human Resource Management and a Masters in Business Administration from the University of Nairobi.



(Logistics Coordinator)

**Ms. Carol Thuku is a Senior Secretary and Programme Administrative Assistant at the African Technology policy Studies Network (ATPS).**

She joined the Network in 2000 from the International Development Research Centre (IDRC) where she did her internship and worked briefly as a receptionist and temporary secretary. Carol Holds a Bachelor of Commerce (B.Com) degree from the Africa Nazarene University. She is a professional secretary with certification from the Pitman Qualifications body later integrated into City & Guilds (UK). She has over 10 years' experience in office administration and management; programme and grant administration; and organization and coordination of conferences and events. She is conversant in basic French



(Technical Assistant)

**Mr. Ernest Nti Acheampong is a Research Officer at ATPS.**

He is responsible for undertaking research, coordinating research capacity building programs, and fundraising activities. He was previously working for the International Water Management Institute, Accra, Ghana, as a research officer. Ernest holds a bachelor's degree in Natural Resource Management from the Kwame Nkrumah University of Science and Technology in Kumasi, Ghana. He also holds a double master degree in International Land and Water Management, and Agricultural Systems Research and Development from the Wageningen University and Research Center and Montpellier SupAgro in the Netherlands and France respectively. Ernest has worked with both national and international Non-Governmental Research Organizations who are engaged in multi-disciplinary research. He has engaged in several research projects including the Community Integrated Conservation Project, Climate Steward Programs, Basin Focal Project and Agricultural Water Management Solutions Project. Ernest has also gained additional knowledge and experiences through participation in research training and development programs in tropical ecology and biodiversity conservation organized by the Tropical Biology Association in Madagascar, and the Earthwatch Institute in Kenya, and Capacity Building in Agricultural Water Management Strategies using AquaCrop model, jointly organized by Food and Agricultural Organization (FAO), UN-Water Decade Programme on Capacity Development (UNW-DPC) and Soil and Water Environmental Research Institute (SWERI), Cairo, Egypt.



(Logistics Assistant)

**Ms. Eunice Kariuki is an Administration & Programmes Assistant at ATPS.** Her main duties include procurement of goods and services for the ATPS office, monitoring the supply and replenishment of materials in the office among others tasks. Eunice holds a BSc degree in International Business Administration from United States International University, a Diploma in Secretarial duties from PITMANS, Level 1 of Accounts and International Computer Driving license levels 1 and 2. She is currently pursuing an MBA from Daystar

University. Eunice has worked at AICAD (African Institute for Capacity Development) as an Administrative Assistant, a Programmes Assistant and as a Personal Assistant to the Managing Director of a Car Dealing Company in Nairobi



(IT Support)

**Mr. Nelson Akenga** Joined ATPS on 1 July 2008 as an intern in the information technology section under the Finance and Administration department. He was later retained on a part time basis in 2009 in the same capacity while still taking his studies. Akenga was confirmed as a full time employee at ATPS in January 2010. Akenga holds a Bsc. degree in Software Engineering from Kenyatta University and is also a Cisco Certified Network Associate currently undergoing training in Oracle Database Administration and Microsoft Certified IT Professional. While at ATPS, Nelson manages the Local Area Network, the ATPS website together

with its mini sites as well as providing technical support to staff.



(Communications & Outreach Coordinator)

**Ms Sarah Wakasa** joined the ATPS family on 1 November 2012 as a Communications and Outreach Officer. Prior to her appointment at the ATPS she worked as the Communication/Information Officer – Regional Office for Africa United Nations International Strategy for Disaster Reduction. She has also worked for the African Economic Research Consortium (AERC) as a Publications & Communication Assistant. Sarah also worked with the Division of Communication and Public Information (DCPI) under United Nations Environment Programme (UNEP) and earlier on in Daystar University, as a student editor for several universities' Publications and other communication

material, Radio Presenter/Producer for the Student Radio Station and Resident Advisor (Media/Communications) for the I Choose Life Africa.



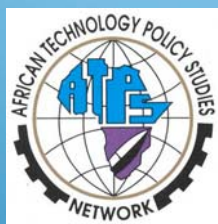
(Communications Assistant)

**Ms. Jacinta Kahi** is a Communications Assistant at ATPS. At ATPS, she is responsible for reviewing and editing ATPS publications; supporting the Francophone National chapters; translating ATPS publications from English-French-English; managing the ATPS Library; being a rapporteur at ATPS meetings; transcribing conference proceedings; assisting in media outreach and dissemination of information; assisting in regular updating of the ATPS website; assisting in administrative work. She holds a Bachelor of Education degree (Arts – French and Secretarial Studies) from Kenyatta University. Prior to working at ATPS, Jacinta was working as a Content Editor at Inmobia Entertainment.



(Consultant)

**Ms. Edel Kwoba** is the ATPS Media Specialist.



*Building Science, Technology & Innovation Capacity Today for Sustainable Development tomorrow*

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