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TECHNOPOLICY AFRICA

This is the official newsletter of the African Technology Policy Studies Network (ATPS)

Highlights:

ATPS Participates in the Third United Nations Environment Assembly (UNEA-3)

Harnessing Solar PV Technology for Africa

Technology Roadmaps in Ethiopia: Turning Policy Statements into Action

ATPS Vision:
To use Science, Technology and Innovation (STI) as a means for achieving sustainable development in Africa.

ATPS Mission:
To improve the quality of science, technology and innovation (STI) systems research, policy and practice by strengthening capacity for STI knowledge generation, dissemination, and use for sustainable development in Africa.

Overall Objective:
To build Africa's capabilities in science, technology and innovation for sustainable development.

ATPS Motto:
Building Africa's capabilities in science, technology and innovation policy research, policymaking and policy implementation for sustainable development.

INSIDE

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CHAIRMAN'S MESSAGE

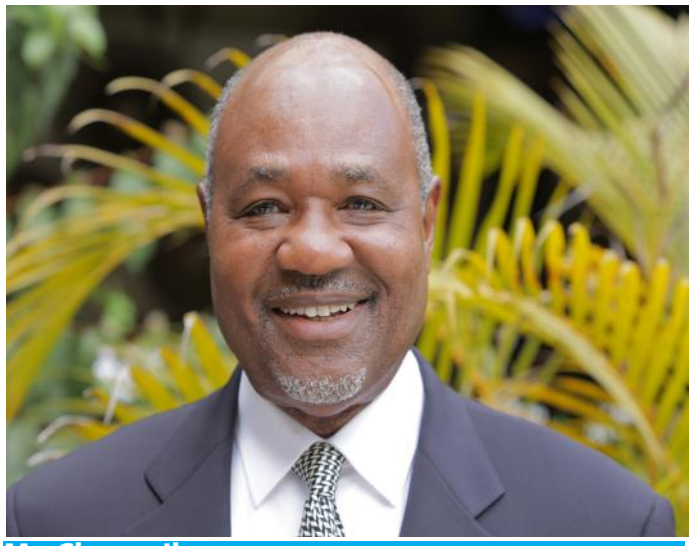
A cursory look at the content of newsletters issued by ATPS in the year 2017 should help even those who may not be familiar with what this organization is about, to begin to get an idea of the vast scope and complexity of issues that the ATPS wishes to undertake, in the hope of helping African governments and institutions formulate effective policies.

To help give focus to its activities, the ATPS Board, staff and network members spent significant time in 2017 in implementing part of the ATPS Phase VII and Phase VIII Strategic Plans (launched in September 2017). The new ATPS Phase VIII Strategic Plan is aligned to the study, development and formulation of polices that will promote domestication of the Agenda 2063 of the African Union as well as the attainment of the UN's Sustainable Development Goals. The new Strategic Plan provides a roadmap for ATPS towards attaining its vision of using Science, Technology and Innovation (STI) as a means for achieving sustainable development in Africa.

While looking into the future and in the spirit of reflection that is usually associated with this time of the year, I am happy to mention some of our successes in 2017 and key contributors to these successes. ATPS and its partners launched a two year regional project on, "Bridging Climate Information Gaps to Strengthen Capacities for Climate Informed Decision-Making." The project aims to support selected African countries with adequate climate information and strengthen their institutional capacities in order to integrate climate information and best practices to inform decision-making at policy and practice levels.

During the quarter, ATPS in partnership with Scinovent Centre and others successfully organized the Science Granting Councils Initiative (SGCI) Annual Forum under the theme, Networking Africa's Science Granting Councils (SGCs). The project aims to strengthen capacities of SGCs to support research and evidence-based policies that contribute to economic and social development in the Continent. The Forum took place from 22-25 November 2017 in Livingstone, Zambia.

We also continued with our work in out-scaling the award winning LandInfo technology in Africa. We acknowledge the financial support we have received from the African Development Bank (AfDB) and the African Forum for Agricultural Advisory Services (AFAAS) to build the capacity of farmers and extension agents on the use of the technology in Nakuru County, Kenya. The LandInfo app is a community driven app that produces accurate soil and climatic information that empowers farmers, extension agents and land-use planners to make farm decisions for improving agricultural productivity and climate change resilience..



Mr. Chuma Ikenze

This year we also commenced steps to revamp and expand the number of ATPS Board of Directors. The process is still ongoing and I am optimistic that during the first quarter of 2018 we shall have a full Board to work in the different sub-committees. These new developments will create a more engaged Board and improve the governance of ATPS.

In the coming year, our focus will be to strengthen our local chapter networks. While it may be said that ATPS activities are fairly well known within scientific/academic communities in most of the countries in which we have our local chapters, we can, at best, claim moderate awareness/recognition among government functionaries in these countries. Awareness of the activities and goals of ATPS within the private sector is still less in our representative countries. We call upon all of you to support us in this endevour as we seek for more partnerships that will help us promote the formulation of effective policies including those that drive and affect social and economic developments at national and regional levels.

I take this opportunity to wish every reader my warmest greetings and a happy New Year 2018.

Mr. Chuma Ikenze,
CEO Kenzel, LLC,
Chair, ATPS Board of Directors

EXECUTIVE DIRECTOR'S MESSAGE

A million thanks to all of you who supported our work in 2017. During this year, ATPS recorded tremendous achievements in fulfilling its Vision – *to use science, technology and innovation (STI) as a means for achieving sustainable development in Africa;* Mission – *to improve the quality of STI systems research, policy and practice* and Objective – *to build Africa's capabilities in STI for sustainable development.*

Highlights of major achievements during the year 2017 are briefly described below:
At the beginning of the year, ATPS was again ranked among the Top Think Tanks in Africa receiving specific rankings as the best think tank network, think tank with the best use of the internet, best advocacy think tank and the best transdisciplinary research think tank. ATPS was also ranked tops as the best managed think tank, top science and technology think tank, think tank with the most significant impact on public policy, and best regional studies center among many others. This rankings are contained in the 2016 Global Go To Index report released by the University of Pennsylvania, USA under the Think Tank and Civil Societies Program.

ATPS received two major separate grants from the International Development Research Center (IDRC) (and its partners the Department for International Development (DFID) and the National Research Foundation (NRF)) and the African Development Bank (AfDB). While the IDRC project focuses on networking Africa's Science Granting Councils (SGCs) and other science system actors to strengthen their capacities to support research and evidence based policies that contribute to economic and social development on the continent under the Science Granting Councils Initiative (SGCI) implemented across 15 countries in sub-Saharan Africa (SSA), the AfDB project aims at bridging climate information gaps to strengthen capabilities for informed decision-making which is implemented in 5 African countries. Progress has already been made in the various projects. In November 2017 we convened about 200 delegates in Livingstone, Zambia to discuss on issues relating to 'public-private partnerships in research and innovation in Africa' under the SGCI. Prior to that, a masterclass paper was commissioned on the topic to experts in the area and presented during the year's annual forum event. On the other hand, the AfDB project was launched in September 2017 in an event well attended by over 100 delegates comprised of ATPS Board members, donors, and other stakeholders drawn from the governments, researchers, private sector and civil society actors. A capacity building programme on the use of LandInfo mobile technology was conducted for over 120 farmers and extension agents in Nakuru County, Kenya under the AfDB project.

During the year, ATPS concluded its consultative processes with relevant stakeholders and launched its Phase VIII Strategic Plan 2017-2022. The Strategy which is tagged the Strategy of Hope identified four thematic priorities and five Programmatic priorities for implementation during the five year period. The thematic priority areas include: Agriculture, food and nutrition; Energy; Climate change and environmental management; and Health innovations. On the other hand, the programmatic priorities which cut across the thematic areas of focus include: STI policy research, policymaking and advocacy; Training, sensitization and capacity building, Youth and gender empowerment; Knowledge brokerage, management and commercialization and Intra-Africa and global collaborations and partnerships. We are soliciting for supports from donors and development partners to enable us fully implement the US$ 30 million Plan. We pledge to ensure value for money received for the implementation of our strategic plan.

Dr. Nicholas Ozor

ATPS also entered into partnership agreements with various like-minded organisations in Africa. These were formalised through the signing of MoUs with these organisations.

There was also a change in the leadership at the ATPS Board of Directors. Mr. Chuma Ikenze was appointed as the new Chair of ATPS Board taking over from Prof. Shaukat Abdulrazak who served for seven years as the ATPS Chair of Board and subsequently retired from the Board. We are very grateful to Prof. Shaukat for his many years of dedicated service to the ATPS. Additionally, we also welcomed three new members to the ATPS Board. They are: Dr. Catherine Adeya Weya, Prof. Crispus Makau Kiamba and Mr. Ralph Richard von Kaufmann. They are to strengthen the Board composition according to the ATPS Article of Association.

Finally, the ATPS has revamped its website. It is now more robust and user friendly and will aid in increasing continuous conversation between ATPS and its board members, National Chapter Coordinators, ATPS members, Donors, Stakeholders and the public at large. We look forward to your continued engagements and supports for the ATPS in 2018.

Dr. Nicholas Ozor,
Executive Director, ATPS

ATPS PARTICIPATES IN THE THIRD UNITED NATIONS ENVIRONMENT ASSEMBLY (UNEA-3): FUNDING SCIENCE FOR A POLLUTION-FREE WORLD: HOW AFRICA CAN CLOSE THE FUNDING GAP

From Left: *Dr. Cheikh Mbow, Dr. Nicholas Ozor, Dr. Erica Key, Mr. Ibrahim Thiaw and Dr. Fatima Denton, panelists during the discussion on "Funding Science for a Pollution Free World: How Africa can close the Science-Funding Gap."*

Dr. Cheikh Mbow
Executive Director, International START Secretariat, 1440 G Street NW, Washington, DC 20009 USA

Session Framing and Rational:

Resource mobilization for sustainability science is an imperative in Africa's today development agenda to meet the ambitious Sustainable Development Goals and the goals of the AU-Agenda 2063. These policy frameworks among others, seek to ensure economic prosperity, political stability, and social justice for all citizens through efficient use of resources. Environmental sustainability is central to these goals and requires cooperation among actors and experts to collaboratively address and plan for action. UNEA-3 focused our attentions on the immediate and pervasive harms of pollution; but the same approaches leveraging science, business, and society can be applied to other areas of critical need conundrums facing in Africa that need substantial, starting with the principle of substantive investment in science to trigger positive change.

Funding challenges is both about developing capacities to fund-raise and the ability to use funding to develop research capacities leading to implementation and enforcement of policies. It is also about domestic resource mobilization (Public and Private) to engage research institutions into regional and global partnerships such as the Belmont Forum group. It has been proven that aid and other flows from external sources will not be sufficient to support research needs. Certainly, leveraging external funds provides an overture towards new possibilities, but it's the long-term investment from local sources that sustain not only the activity but also shape policy and practice. Funding research should be seen in that regard as a productive investment: returns today pave the way for a more robust future, improving quality of life, expanding the job market, increasing revenue streams, informing sustainable development, and sourcing a trained and motivated workforce (safeguards and chaperoning development).

The projection shows that 40% of the global youth will be in Africa by 2050. Natural resources of which Africa has many (geological, forest, arable lands, water, solar), could be used sustainably to be both an asset to its peoples and, through informed choices, a basis for lifting the economies of the poor countries. The growing urbanization of Africa would be able to meet the increased demand of products and services without negatively impacting the environment and climate. Funding on knowledge and innovation, stressing the need to partner the people with other professionals and policy makers to maximize the returns of these investments for business, was the central topic of this conversation, and we strived to respond to the set of questions below.

Questions for the Panel and Interaction with the Public:

- How to identify the priorities across the multifaceted African region, bringing co-existing communities to work on common interest, future science and policy programming and establish proper governance for research in Africa?
- Are the current opportunities for funding research in Africa enough to establish links to connect African priorities with global/regional funding frameworks?

- How do efforts to diversify sources of funding relate to each other and how Belmont Forum can bring benefits to funding bodies in Africa by joining our Collaborative Research Actions (CRAs)?
- How to identify the best practices, lessons learned and challenges for conducting integrated research in Africa, and how Belmont Forum can help facilitate such practices in the region?

Panelists:

- Dr. Erica Key, Executive Director of the Belmont Forum Secretariat, presented its activities, and focused on the advancement of transdisciplinary, multilateral scientific research to inform human action.
- Dr. Fatima Denton, Director of a natural resource management division (Special Initiatives Division) at the UN Economic Commission for Africa, addressed the type of science that is needed to address sustainability challenges in Africa and pollution in particular, as well as the policy implications.
- Dr. Nicholas Ozor, Executive Director of the African Technology Policy Studies Network (ATPS), presented current opportunities in building transdisciplinary networks of researchers, policymakers, private sector actors, and civil society in Science, Technology and Innovations for Africa's sustainable development.
- Dr. Ibrahim Thiaw, Deputy Executive Director for the United Nations Environment Program and Assistant Secretary-General of the United Nations, who discussed the major challenges in the science-policy-business dialogue.
- Dr. Cheikh Mbow, Executive Director of START-International, moderated the session.
- Dr. Edouard Michel, Future Earth Secretariat. Rapporteur

1. Emerging issues and inputs to UNEP and Belmont Forum

The session recognized that support for Sustainability Science training and implementation is critical for building coherent pathways for transformations to sustainability and resilient African societies.

- Knowledge is embedded in all economic and development sectors and is very much linked to research, quality education, training and jobs, but also to locally-designed actionable innovation, fueled by discoveries for rapid, place-based social transformation in Africa.
- Scientific Knowledge becomes an economic sector by itself and requires substantial investment for training, jobs for the youth, innovations and infrastructures adapted to the local development needs.
- Africa's sustainable development goals cannot be achieved without addressing the complex sustainability challenges. Both societies and the environment are changing fast, with convoluted relations that need to be continuously monitored and understood through transdisciplinary knowledge for better policy action.
- Managing complexity is always knowledge-intensive and requires short and long-term solutions, synergies and trade-offs, policy-coherence and criteria for assessing success and failures, consolidating stewardship for long term engagement.
- Environmental Pollution is a compelling example in that regard and requires understanding the sources, drivers and modulating factors of poverty conditions in Africa. Addressing the impacts of environmental pollution on human health, economic growth—losses in investment and financial capital, inhibition of productivity, threat on human wellbeing, jeopardy on natural capital—are all serious impediments to sustainable development and should be a strong concern in all development polices.
- A resilient future and strong nation-state building requires partnerships among scientists, policy-makers, and the development sector, working collaboratively and following sustainability pathways. Options, alternatives and scenarios underscored by local context are needed in production systems and consumption patterns to sustain green industry and green infrastructures, and not the least retrofitting and adjusting previous policies.

For all these emerging challenges, the session recommended that mobilizing financial resources, starting with incentivizing domestic funding of research, building commitments towards research funding goals, sourcing policy development, implementation, and compliance schemes, and nurturing local capacity through partnerships with associated research infrastructure are near-term goals that will enable the longer-term sustainable development pathways. A framework should be developed in Africa to facilitate access to funding for science with support of institutions such as the Belmont Forum. Science should be seen as a safeguard for de-risking development options and as a strategic investment for sustainability. Leveraging funding from local sources including from the private sector is a necessity and not an option for African sovereignty.

2. Key Recommendations Relevant to UNEA-3 and Belmont Forum

- There is no sustainability science without a multi-stakeholder approach (active and pro-active co-design processes). Africa may need to establish a funding framework to enable producers and users of knowledge to meet and advance sustainability science-based actions for Africa.
- The pressing pollution-related challenges raised in this session, because they require policy-relevant knowledge, innovation and regulation, bear the potential to accelerate the priority setting and mechanisms to convene all relevant stakeholders together in order to define the best appropriate agendas and adequate funding mechanisms.

- Africa is not short on talented scientists nor lacking knowledgeable stakeholders. Connecting these informed and empowered groups maximizes return on, making science production a collaborative political endeavor to foster a whole policy landscape, incentives and regulations, that are coherent and oriented toward knowledge production for sustainability.
- Several programmatic fronts need to be addressed simultaneously: research infrastructure, training and curricula that address local issues; professional development for green jobs/youth, cooperative intra-regional agenda-setting at relevant levels and with relevant stakeholders including the business community.

Suggested Actions for Strengthening the Science-Policy Interface:

Capacity Building: Most countries in Africa face the need to bring science to various decision scales starting from local communities. Efforts on capacity building need to be inclusive and formalized to improve application of science at scale.

- ***Coherent policy frameworks*** which others require cohesive policy action that favor synergies, reduce competition and spur cross-sectoral dialogue and new behaviors.
- ***Best practices*** and values for a positive momentum of science development within Africa. There are many initiatives being implemented, such as the recent STI Strategy for Africa (African Union) and burgeoning local citizen-science initiatives that engage the populace while mainstreaming science.
- ***Knowledge Translation*** that brings further value to funded science by making it broadly intelligible and transferrable. This requires knowledge brokering networks in various domains to foster a sustainable dialogue within society.
- ***Promote Transdisciplinarity*** as an innovative way of organizing research bringing all stakeholders to work together to identify research challenges and develop expected outcomes together, so that the results are useful and applicable. This creates a space for the development of truly sustainable processes both in the format and in the expected impacts.

RECIRCULATE PROJECT PARTNERS' VISIT TO THE ATPS

RECIRCULATE Project partners and the ATPS team held a meeting to discuss the modalities on how the project will be implemented. The meeting was held at the ATPS Secretariat Office, Nairobi, Kenya.

The Lancaster University, UK through its Centre for Global Eco-Innovation is leading other partners including the ATPS in the implementation of a project tagged RECIRCULATE - Driving eco-innovation in Africa: capacity-building for a safe circular water economy. ATPS is a phase 2 partner which mainly comprises of high quality, research-led institutions. Other Phase 2 partners include: Botswana International University of Science and Technology, The National Commission for Science and Technology (Malawi) ,and the Copperbelt University Zambia.

The Principal Investigator and Co-PIs of the RECIRCULATE Project are: Prof. Nigel Paul, Dr. Akanimo Odon, Prof. Kirk Semple and Dr. Paul Mckenna. They visited the ATPS secretariat office on 7th September 2017 to discuss details of the project, its aims, expectations and the role of ATPS.

The RECIRCULATE project aims to understand how African eco-innovation systems works, how they differ from European models, and what new innovations would be needed to achieve SDG 8 (Decent work and economic growth) and SDG 13 (Climate action). The main objective is to build the capacity of Africa's eco-innovation community and assist African research organizations to pioneer change aimed at delivering a safe circular water economy for Africa and to develop a long-term strategy to maintain and expand the scope and remit of the UK-Africa knowledge transfer on eco-innovation for achieving SDGs.

The project will majorly work with communities and businesses across Africa to pilot solution for safe water use. The idea is to turn sewage into a safe sustainable fertilizer by using heat to kill pathogens.

ATPS Research Assistant Mr. Alfred Nyambane has been nominated to attend training on Knowledge Exchange and Exchange Management, which is scheduled to take place from January 2018 at Lancaster University, Ghana.

ATPS HOSTS THE 2017 SCIENCE GRANTING COUNCILS INITIATIVE'S ANNUAL FORUM IN LIVINGSTONE ZAMBIA

Dr. Nicholas Ozor, ATPS Executive Director addressing delegates during the 2017 Science Granting Councils Initiative's Annual Forum in Livingstone, Zambia.

By Alfred Nyambane

ATPS in partnership with Scinovent Centre and other partners in Zambia and Malawi organized the 2017 Science Granting Councils Initiative's Annual Forum from 22 – 23 November 2017 in Livingstone, Zambia. The event was themed, "Effective public – private partnerships for Research and Innovation." ATPS was represented by: Dr. Nicholas Ozor- ATPS Executive Director, Dr. Ernest Acheampong-ATPS Senior Research Officer and Mr. Alfred Nyambane-ATPS Research Officer.

Prof. Nkandu Luo, Minister of Higher Education, Zambia emphasized that it is time for Africa to give priority to research, science and technology. Additionally, Africa has to use its capacity to come up with research based evidence which in turn will influence policymaking.

The Forum was guided by the commissioned paper on the topic, "Effective public – private partnerships for Research and Innovation: Perspectives for African Science Granting Councils" by Prof. Banji Oyeyinka. Dr. Bertha Vallejio and two key discussants, Dr. Khamal Battacharya, the Chief Innovation Officer, Safaricom Ltd, Kenya and Prof. Stuart Tarbener from the Research Council of the United Kingdom gave their perspectives on the paper.

Issues and Messages from the Commissioned Paper

Research Prioritization and Agenda-Setting

Private Public Partnerships (PPPs) are undermined by different focus and research interest priorities from both the public and private sectors. This problem is widespread and affects both developed and developing countries alike, different countries have come up with different ways to counter these challenges for instance, in Netherlands the government through a "Top Priority Sectors Approach" identified the country's top 9 sectors and created incentives and support structures to facilitate competitiveness and position them as global players in their respective value chains while in Costa Rica, the Ministry of Science and Technology and ICT champions agenda setting and leads other sectoral ministries in scouting for private sector research needs before making international calls to address them.

Institutional Architecture/Infrastructure and Governance Patterns

Institutions determine code of behavior by defining what is acceptable and what is not. Additionally, they set rules within which social actors operate. The architecture of the rules could be formal as in contracts or informal as in Memoranda of Understanding (MoUs) for example, cases were highlighted where individuals within organizations circumvented formal structures such as outreach offices and entered into deals with private sector actors. Similarly, in some cases actors attempted to re-interpret and assign different meanings to clauses in the contracts while in other cases sheer complexity of contracts hindered rather than facilitated the partnerships.

A cross-sectional view of delegates present during the 2017 Science Granting Councils Initiative's Annual Forum in Livingstone, Zambia.

Funding Models/ Mobilizing Domestic Resources for R&D

Most Sub-Saharan countries are under-investing in R&D compared to their counterparts in other regions of the world. Many are yet to reach the continental targets of 1% of GDP, even though there have been ambitious declarations from countries such as Kenya to invest up to 2% of GDP; failure to meet the targets notwithstanding. Lessons from Europe shows that Horizon 2020 as a funding mechanism requires a formal MoU between the applicants and the private sector as a pre-condition for funding. It also focuses on projects that show pre-market products/technologies that are nearly ready for commercialization.

Political Economy/Contexts

The reliance on personalities presents challenges especially with change of governments and administrations when people either change roles or are transferred. South Africa exhibits well structured institutions for negotiating PPP contracts however, it may take up to two years to enter into contracts with the government. Similar institutions (contracts) are interpreted differently depending on the country one is dealing with. For instance, in some contexts, the contracts are seen as "aspirational" – outlining what could be achieved together rather than "litigational" – providing the do's and don'ts that could end up in legal suits. In other words, the contracts are assigned "meanings" and could be re-interpreted. These contextual issues define the stability and fluidity of partnerships as well as the speed and predictability of the contracts, their enforcement and attendant ease of doing business in the different countries.

Another political economy question is the extent to which the Private Public Partnerships (PPP) for research and innovation fit in with the current policies and practices. For example, it was noted that a number of countries have enacted Private Public Partnership laws but these are geared more towards large infrastructure projects in water, roads and energy amongst others. To what extent is research and innovation covered in these laws? Are there entry points for research and innovation? These issues were flagged as necessary for further interrogation and reflection. Participants observed the need for robust PPP engagement frameworks in countries where these were lacking and how the SGCI could support their establishment.

The discussions on how to harness the potential and power of public – private partnerships for stimulating research and innovation in Africa is "an on-going conversation" and it is expected that the Annual Forum ignited the debate and provided the initial flames to keep this discussion ongoing. It is also expected that through sharing lessons and best practices, the SGCs will take lead in promoting public – private partnerships and the Science Granting Councils Initiative through its four thematic areas will support their efforts at realizing these dreams.

The event was funded by the International Development Research Centre (IDRC), Department for International Development (DFID) and National Resource Foundation (NRF) South Africa. The Forum brought together about 120 people from 25 countries, including Heads of Research Councils (HoRCs), SGC coordinators, researchers, policymakers, private sector actors and civil society representatives.

HARNESSING SOLAR PV TECHNOLOGY FOR AFRICA

Solar Panels.

By Louis Masuko, Executive Director
Eng. Arnold Swai, Managing Director
ICANNEX CONTRACTORS LTD

Approximately 1.1 billion people in Africa do not have access to electricity and the average kWh consumption per year is <500kWh per capital. A number of factors which have contributed to these unsavory characterization include: cost of electricity transmission and distribution, limited electricity generation capacity and population density which is below 50 households per square meter.

Harnessing renewable energy has been taunted as the panacea in particular solar energy. This is primarily because Africa lies in what is generally referred to as the Solar Zone, receiving between 2800 and 3500 hours of sunshine per year on average and global horizontal radiation of between 4-7.5 kWh/M2. Two key success factors in exploiting this advantage are science and technology however, the boundary between these two is so blurred that many use the two interchangeably. For the purpose of this article it is important that the boundary is explained with passionate clarity to afford the reader the opportunity to clearly follow this discussion.

According to Webster's New Collegiate Dictionary, Science is the knowledge attained through the study, practice or general truths of operation of the general laws especially as obtained and tested through the scientific method. In simple terms science refers to all systematic research carried out by scientists upto the prototype stage. The Oxford dictionary defines technology as the application of scientific knowledge for practical purposes. In other words, when the product of science is applied to solve societal problems or to generate benefits for society it becomes technology. **Figure 1** graphically shows this relationship.

This article therefore focuses on the technology component, while scientific research should be encouraged and carried out on the African continent, it is also important that Africa harnesses the technology available to light and power its households and industries.

Lighting Africa through Solar Technology

In TechnoPolicy Africa Newsletter Issue 009, Mr. Kingsley Ukoba focused on how the science component would contribute to electrifying Africa by exploiting off-grid electrification which normally takes different forms that are collectively referred to as renewable energy; examples of renewable energy include: hydro-power; wind-power; biomass and PV solar. This article will concentrate on the solar PV energy which has attracted a number of initiatives from both outside and within Africa with the aim of lighting up African households and industries. Some of these initiatives include: Africa Development Bank Group Initiative; Lighting Africa Initiative (WB) and Energy Africa Initiative (UK). There are three appropriate technologies that can be harnessed to provide electricity in rural homes and businesses; their selection depends mainly on the dispersion of the households and load profile. These three appropriate technologies include Pico products (lanterns, solar PV lamps, desk lights), Stand Alone Solar Home Systems (SHS) and Mini grids.

Pico Products

Pico products are basically very small solar power systems that do not exceed 20Wp and are mainly suitable for very low income households because the initial cost is low and ownership is

Figure 1

immediate. They provide an entry point for both private suppliers and the community. Additionally, they eliminate the use of kerosene for lighting and also reduce the exposure to carbon dioxide and carbon particularly for women and children. Increased lumens compared to kerosene and wood lighting reduces pressure on eye sight. They also improve security when family members go out at night to relieve themselves or to attend to any other activities for instance, checking on livestock. While these are cheap and affordable even to the low income households, their value proposition to households can be noted above limited.

Stand Alone Solar Home System (SHS)

Regions with a population density of less than 50 household per square meter are characterized by scattered population covering large areas. For the national grid and mini grid technologies this entails higher connection costs due to longer distribution lines. In such situations, the stand alone systems can be a better solution.

The Solar Home Systems (SHS) are generally stand alone systems that are usually installed on the premises that they utilize power eliminating transmission and distribution costs. These range from as small as 20Wp to as big as 720Wp. However, for lack of economies of scale the total cost of energy remains relatively high for the targeted market segments. As a result, many small installations (<100Wp) find their way into private household market and those >100Wp are mainly installed to government employee households, classrooms, police stations, schools laboratories, clinics, health centers, hospital wards and operating theatres funded by donors, international development partners and government. The challenge of science on the continent is therefore to continue developing the PV and battery technologies that further reduce prices while at the same time increasing efficiency and reliability.

SHS's value proposition goes beyond those of Pico products. SHS over and above, create income generation opportunities for small business such as saloons, phone charging, internet and stationary shops. This technology also helps improve services at clinics, health centers and hospitals by providing power for maternity services. Additionally, they provide access to police stations; increase study time at secondary schools and electrification of dormitories is expected to increase the enrolment of students; and teaching of science subjects is enhanced through electrification of rural school laboratories. The business model of Pay As You Go (PAYG) which has been introduced by private suppliers has also helped create credit opportunities for rural households and reduce initial capital investment.

Mini Grid

A mini-grid is generally defined as a set of electricity generators and possibly, energy storage systems interconnected to distribution network that supply the entire electricity demand of a localized group of customers' charged either per kWh consumed or per maximum power amount (W). The size of mini grids mainly ranges from 6kW to 10MW depending on the demand profile of each targeted area, when choosing mini grid technology it is important to look at its availability, reliability and affordability. For this reason, hybrid mini grids combined with solar PV panels, battery bank and genset, powered mainly by diesel are usually the most competitive technical solution. Current calculations of life-cycle costs show that hybrid mini-grids are also cost effective and this translates into competitive prices to the consumers.

Mini-grids provide capacity for both domestic appliances and local businesses, and have the potential to become the most powerful technological approach for accelerated rural electrification. Mini-grids offer an optimal solution for utilizing localized renewable energy resources. Many locations offer excellent natural conditions for the use of solar photovoltaic (PV). Over and above the value proposition of the first two solar technology options mini grids is that they solve storage and distribution problems, customers have the option of using electricity for cooking hence reducing deforestation, they eliminate the need for high initial investment, provides opportunities for business development (industries such as milling and shelling, water pumping, freezing and drying, welding and carpentry), customers can use appliances such as irons, refrigerators and blowers amongst others. Lastly, the Pay As You Use business model means customers only pay for what they need. Challenges in Mini Grid operations include: securing payment and collection, recovering operating expenses (OPEX) and capital expenditures (CAPEX), reciprocity with local communities, close match of supply and demand, size and technology determination, ensuring long term service provision, consumers' ability to pay, consumers' willingness to pay, cover operation & maintenance costs and cover capital costs
According to the Alliance for Rural Electrification (ARE), translating the great technical potential of the hybrid mini grid into real success stories on the ground has turned out to be extremely challenging. The bottlenecks for sustainable success of mini-grids are not technologies, but financing, management, business models, maintenance, sustainable operations, and socioeconomic conditions. These are technologies that can be harnessed to power households and industries in rural Africa, continued scientific inquiry into these technologies, particularly in Africa is required to improve on the pricing, efficiency and reliability. There is need to also support scientific research and harness these technologies from local, continental and international financial institutions.

ATPS CONDUCTS TRAINING FOR FARMERS AND EXTENSION AGENTS IN KENYA ON THE USE OF THE LANDINFO MOBILE APP

Farmers and extension agents pose for a group photo during the LandInfo mobile app training workshop in Nakuru County, Kenya on day one.

By Sharon Anyango

The African Technology Policy Studies Network (ATPS) successfully organized the LandInfo mobile app training workshop for farmers and extension agents at the Nakuru Agricultural Training Center in Nakuru County, Kenya from 8th to 9th November 2017. The workshop brought together approximately 120 farmers and extension agents from Molo, Njoro, Naivasha, Gilgil, Kuresoi South, Kuresoi North, Subukia, Rongai, Bahati, Nakuru Town West and Nakuru Town East sub-counties.

The workshop aimed at building the capacity of agricultural extension agents and farmers on the use and application of the LandInfo app for the collection of valuable information (climatic and soil) so as to make informed farm decisions that will improve agricultural productivity and climate change resilience.

Mr. Fredrick Owino gave the opening remarks on behalf of the County Directorate of Agriculture in Nakuru Mrs. Grace Kirui. He expressed confidence on the potential of the LandInfo app to assist farmers and extension agents in Nakuru County through the provision of accurate soil and climate information for effective decision-making in Agriculture, land use and climate change adaptation.

Dr. Nicholas Ozor, ATPS Executive Director expressed optimism that the adoption and use of the app will contribute significantly to improved agricultural productivity and climate change resilience by providing reliable information on soil and climate which will support decision-making on sustainable land management practices.

The LandInfo app enables farmers and extension agents to deepen their knowledge on the biophysical characteristics of soils; with knowledge on annual average rainfall and temperature, farmers are able to plan their farming enterprises adequately to avoid losses due to climate variability and hence improve agricultural productivity and climate change resilience.

The LandInfo mobile app is a product of the Land Potential Knowledge System (LandPKS) project, which was developed through a collaborative effort by the ATPS and the United States Department of Agriculture'-Agricultural Research Service (USDA-ARS) and other partners. The app has been successfully used in Samburu, Baringo, Kisumu, Meru Counties and its associated conservancies with initial focus being identifying and prioritizing areas for restoration of perennial grasses and monitoring of livestock carrying capacity on land plus the crop production potential of resettlement areas.

ATPS has been building the capacities of farmers and extension agents in Kenya to deploy the technology in their farm operations. The Agriculture, Fisheries and Food Authority (AFFA) of the Ministry of Agriculture contracted the ATPS to train 100 of their technical agents in Kenya on the use of the app. In December 2016, ATPS trained 50 farmers and extension agents at Kaguru Agricultural Training Centre in Nkubu, Meru County, Kenya through the financial support of the African Forum for Agricultural Advisory Services (AFAAS).

In 2016, ATPS won the coveted Climate Information Prize Award. ATPS received the Wazo Prize for its success in promoting the use of the LandInfo app for improved agricultural productivity. The LandInfo training workshop in Nakuru was supported by the African Development Bank (AfDB) under the Clim-Dev Special Fund and the African Forum for Agricultural Advisory Services (AFAAS).

AFRICA THE RESERVOIR OF NATURAL RESOURCE POTENTIAL AROUND THE WORLD (A REFLECTION FROM LIBERIA)

Workers extracting minerals from a mining ore.

By Amb. Momo Duduboy Taylor Jr
Founder/Executive Director
ASESNRPOL INC

As a Liberian founding Chapter member of ATPS, I would like to draw the attention of readers of this publication to the quantity of natural resources belts in Liberia which include diamonds, gold, iron, uranium, copper, bauxite, petroleum, cocoa beans, rubber, timber (woods) and tropical fruits that are dominant in Liberia yet they remain under-explored. As a Country in the tropical forest belt, there are lots of opportunities that calls for investors' attention. A Country with 4.5 million population has a great potential and increasing investment opportunities that can help to the change the World.

The young generation are in professions that are less focus based and have an infinitesimal contribution towards the natural resources sector. One of the major issues so far has been fear for technical disciplines majorly sciences and the long period it takes for one to reach top.

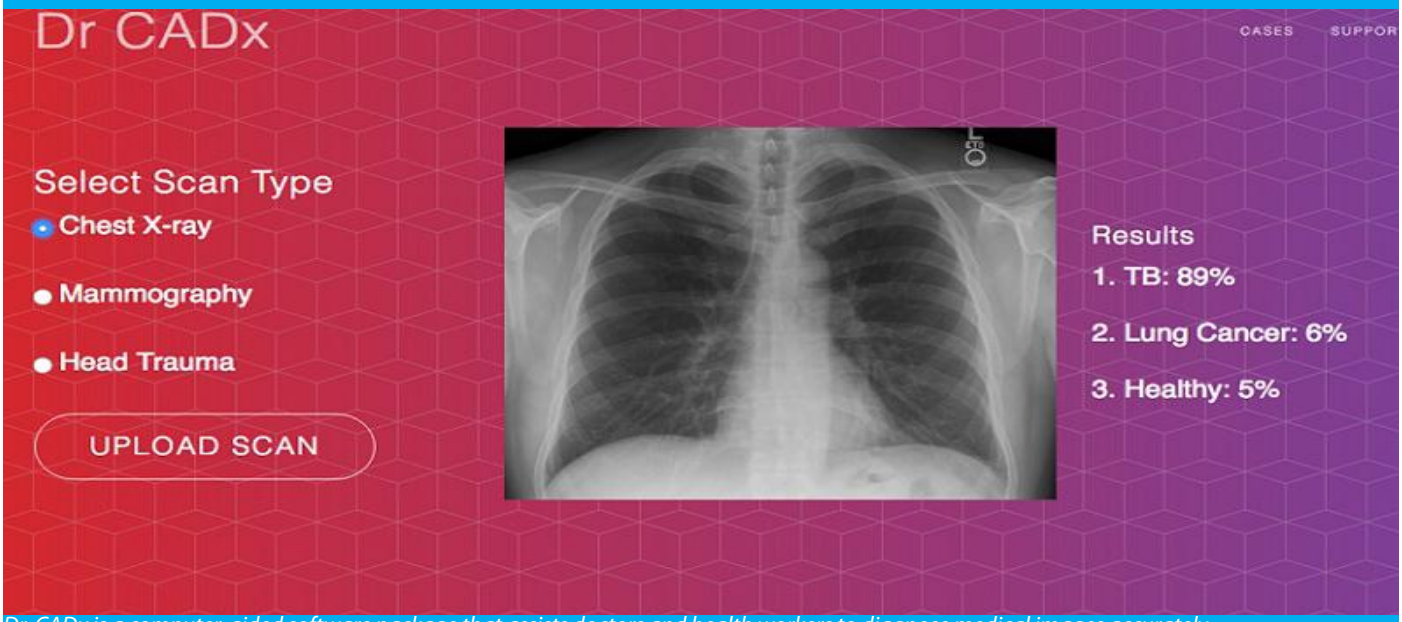
The Association of Scientists Engineers and Sustainable Natural Resource Professional of Liberia (ASESNRPOL INC) has been tremendously working with institutions by encouraging and building over ten thousand students from various primary and secondary schools in Liberia to focus their careers in the field of Science, Engineering and Natural Resource Management. There is an increasing curve in the evolution of other professionals yet focus areas remains a challenge.

ASESNRPOL INC is prepared to work with any investment companies in Africa or around the World in following procedures leading to exploring any of the above listed natural resources in Liberia. The institution has few grounded Petroleum Geophysicists, Petroleum Engineers, Petroleum Geo-Scientists, Geologists, Petroleum & Natural Resources Lawyers, Environmental Lawyers, Environmental Economists, Environmental and Safety Specialists, Chemical Engineers, Mining Engineers, Mechanical Engineers, Exploration Geologist, Exploration Geophysicists, ArcGIS Specialists, Petrologists, Bio-Scientists, Civil Engineers, Electrical Engineers, Biomedical Engineers and Energy Economists.

Our contributions toward improving the economy will give direct benefit to our citizens thus making our resources not be a curse but blessings from God to this generation and generations to come.

Amb. Momo Duduboy Taylor Jr.

TOWARDS ACHIEVING SDG 3: GOOD HEALTH AND WELL-BEING



Dr. CADx is a computer-aided software package that assists doctors and health workers to diagnose medical images accurately.

By Sharon Anyango

The 2014 Ebola outbreak in West Africa was the deadliest on the continent. The Ebola virus spread rapidly and hit three countries namely Guinea, Sierra Leone and Liberia. Unfortunately, it led to the death of approximately 70% of the people infected with the virus because the continent was caught unawares; many people had never heard about the disease and the emergency response system at that time were very slow. It was also difficult to curb the spread of the disease as initial tests would take upto five days and when the results were out, the symptoms were similar to flu and malaria hence patients were being treated for the wrong diagnosis.

Since the first Ebola outbreak, there have been a lot of reflections on how to improve the health system in Africa. The 2015 UN Global Sustainable Development Goals has health as a key component to ensure sustainable development and also to reduce poverty. SDG 3 focuses on good health and well-being with an aim of ensuring healthy lives and promoting wellbeing for all at all stages. The major objective is to reduce maternal rate, the rate of communicable diseases and epidemics such as AIDS, and tuberculosis. Additionally, it is expected in the coming fifteen years that countries will strengthen their capacities to detect early warning signs and also respond to emergency cases.

The Ebola crisis led to the development of various technologies in the health sector to correctly diagnose diseases and overall save lives of those living in places which are far away from hospitals. A lot of innovations have since come up, for instance the FieldLab which has been developed by two Masters students at Rhodes University, South Africa is a solar-powered lab in a box which is able to carry out DNA analysis, centrifugation and is also able to accommodate additional parts like a microscope and a thermocycler. The test for viruses is done the same way as in a laboratory in a building. The Field lab is portable and it enables health workers to attend to patients in remote areas like in conflict driven areas or places which are distance away from the hospital.

Dr. CADx is another new innovation that has taken global stage and won various accolades. Developed by Mr. Gift Gana from Zimbabwe, Dr. CADx is a software package that assists doctors and health workers to diagnose medical images more precisely and accurately. Dr. CADX responds to the low number of radiologists on the continent which has forced general health practitioners to interpret medical images who at times fail to interpret the images correctly leading to wrong diagnosis which may result in health complications or even death.

The number of radiologists in Africa is still very low. South Africa boasts of 497 radiologists and 685 radiographers while Kenya prides itself with 248 registered radiologists which is the second highest in Africa. Apparently, 14 African countries do not have any radiologist, which is alarming. There is need for national governments to invest in the field of radiology in African countries and open room for more to join the profession. The few radiologists available often render their services to private hospitals because of good pay and availability of equipment. This denies the poor people the right to healthcare because of the cost factor. Another solution is the incubation of health innovations which are contributing to the health system in Africa. Good health and good sense are two of life's greatest blessing.

Mr. Gift Gana

1. Please tell us about your innovation on Dr. CADx and why you chose that name?

Dr. CADx, is a computer aided diagnostic system that helps doctors to diagnose medical images more accurately and at a low cost. This will help reduce the human errors that have dire consequences to patients and drives up medical costs.

CADx is an acronym for Computer Aided Diagnosis. So, the name is saying this is an artificial intelligence assistant doctor called CADx.

2. What is the niche you realized in Zimbabwe that made you and your team develop Dr. CADx?

The problem that we are tackling is that there is a serious shortage of radiologists, especially in developing countries for instance, in Zimbabwe there are only 17 radiologists to cater for a population of about 16 million and none of them work in public hospitals that serve majority of the population and this is the same scenario across many African countries.

3. How does Dr. CADx work?

Dr. CADx uses state-of-the-art deep learning algorithms to perform image recognition which rapidly and accurately interpret medical images. Deep learning is a technology that simulates how the human brain works to teach itself by learning from a large set of exemplars, in this case to recognise disease patterns in images. Dr. CADx is an easy to use software application through which the doctor simply uploads the image for analysis and in less than a minute gets the diagnosis results with a high accuracy.

4. How accurate is Dr. CADx in diagnosing medical images and does it takes up the role of radiologists?

In our development tests, we have achieved 92% accuracy in diagnosis of TB through chest X-rays, 84% for breast cancer using mammograms and 88% for a set of 5 diseases (TB, lung cancer, pneumonia, emphysema and cardiomegaly) in chest X-rays. Dr. CADx is meant to be a tool in the hands of radiologists and other doctors to augment and not replace them.

5. The number of radiologists in Africa is still low; the ratio of one radiologist in Africa is to a million people while in the USA the ratio is 1: 9,000. In your opinion what needs to be done to increase the number of radiologists in the continent?

The simplistic answer is that greater investment has to be made to train and retain more radiologists. The challenge to achieve this is that Africa economies have to grow to afford that which will be a long process. So, in the interim capacitating non-radiologist doctors with tools like Dr. CADx will go a long way to fill the gap.

6. Is Dr. CADx designed to be used only by radiologists? Can non-radiologists also use it to interpret medical images for instance a patient who has received his/her medical report from the doctor?

Dr. CADx is designed for use by both radiologists and non-radiologists as far as regulations in different jurisdictions permit. As noted earlier, there are very few radiologists in Africa and so the intended user in that setting are other doctors.

7. What are the advantages and disadvantages of using Dr. CADx?

The advantages of Dr.CADX is that it is very fast in interpretation of medical images, highly scalable, improved accuracy and its cost is low. The disadvantage is that it lacks common sense though at a lower rate it can sometimes miss the obvious

8. It has been more than a year since you developed Dr. CADx in August 2016; are there any challenges you faced along the way and what has been your major lesson?

The key to a highly accurate CADx system is a good quality training data and this can be a challenge to find or compile. Major lesson has been when it comes to data, quality is more important that quantity.

Mr. Gift Gana receives an award for his innovation Dr. CADx which emerged tops during the 2016 ICT Innovation Fund in Zimbabwe.

Mr. Gift Gana through his innovation Dr. CADx has received various accolades globally. In 2017 Mr. Gana received the Al Medical Imaging Visionary Leadership Award in Cape Town, South Africa and he was nominated to the 2017 Innovation Prize for Africa which was held in Accra, Ghana . Mr. Gana is also the leading global innovator according to the 2017 Disrupt 100 Index.

Mr. Gift Gana receives the Al Medical Imaging Visionary Leadership Award from Frost & Sullivan in Cape Town, South Africa.

9. What is your take on STEM education in Africa, Have we achieved the intended goal and what more needs to be done?

Our experience has been that finding the right technical expertise is not a stroll in the park, this is an indication that we still need to do more instead of being passive. I have offered to mentor students at a local university in deep learning as they undertake their final year projects thereby helping them to gain the skills required in the market.

10. Dr. CADx will soon be available on laptops and tablets. Are there plans to also incorporate it in mobile phones as currently the number of smart phone users in the continent stands at 293.8 million ?

Yes, we plan to have Dr. CADx available across all devices.

11. How will Dr. CADx be used in hospitals especially in the rural areas where there is low Internet connectivity?

We will offer an offline version in addition to a cloud based solution to cater for areas with poor connectivity.

12. Do you have the intentions of partnering with the Ministry of Health in Zimbabwe so that Dr. CADx will be available in all public hospitals?

Yes.

13. Is the innovation currently available only in Zimbabwe?

The solution is not yet available for routine clinical use anywhere. We are preparing for our first clinical trial in Zimbabwe, and we are currently looking for partnerships to conduct trials in other countries.

14. Dr. CADx has received various accolades not limited to being named as a leading Global Innovator in the 2017 Disrupt 100 Index and the 2017 Al Medical Imaging Visionary Innovation Leadership Award. What have been the lessons so far and what is your team's vision in the next five years?

The path of an entrepreneur is a hard one and getting an accolade is one of those things that says someone acknowledges what we are doing. In five years' time, I expect our solution to be positively impacting tens of millions of patients and we help provide them with more accurate diagnoses.

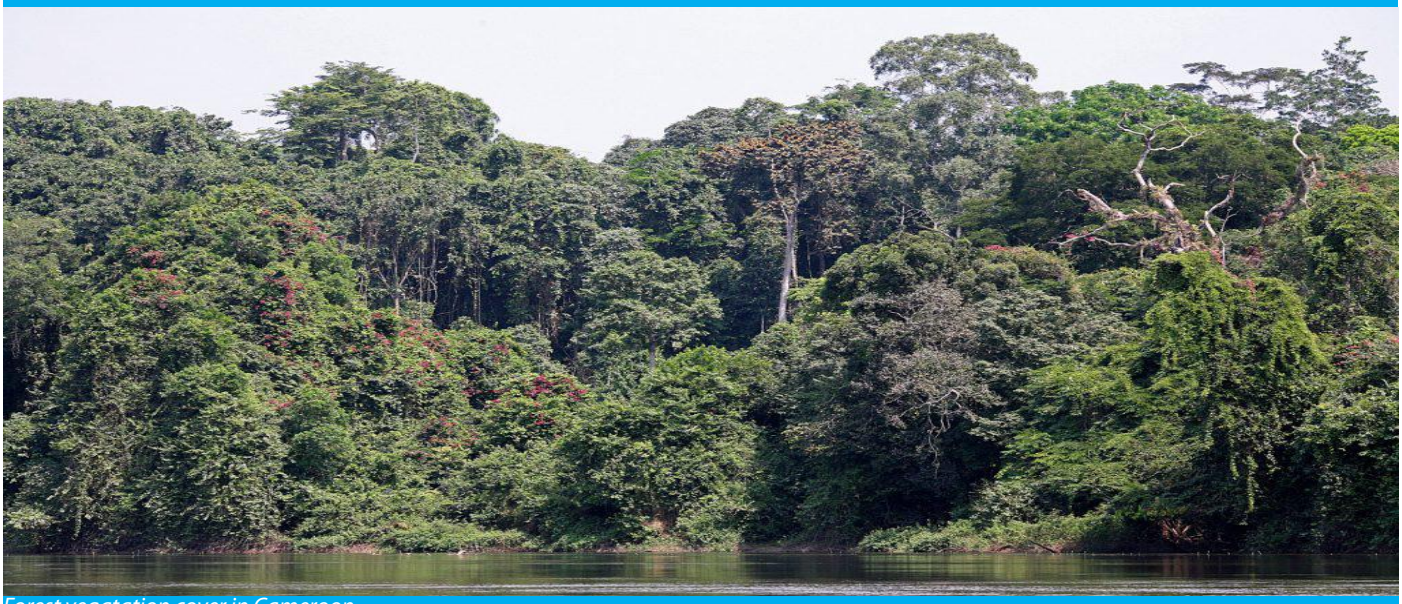
15. What is your message to upcoming innovators?

Things usually take longer and cost more than originally planned, but you just have to keep on it.

16. Your favourite quote?

Keep on keeping on.

THE STATE OF CLIMATE CHANGE IN CAMEROON



Forest vegatation cover in Cameroon.

By Prof. Sylvester Ndeso Atanga- ATPS National Chapter Coordinator Cameroon
Kum Christian Tegha- Research Coordinator, ATPS Cameroon

Cameroon is a country blessed with natural resources but it is heavily dependent on revenues generated from oil, timber, and agricultural products which could undermine sustainable growth in future if alternative economic activities are not sought. The country also has other unexploited mineral resources such as bauxite, natural gas, iron and cobalt.

Climate change affects Cameroon's development because of its consequences which will change the fate of many generations to come and particularly its impact on the poor if no appropriate measures are taken. The adverse effects of climatic change to which Cameroon is exposed to are already exerting considerable stress on important sectors from which revenue for development is generated such as agriculture and exploitation of natural resources. This poses a serious threat to national development and poverty reduction.

The climate of Cameroon has been heavily variable over the last several decades often with very high amplitudes. Climatic factors in Cameroon already limit the availability of freshwaters which causes decreased crop yields, land degradation, poor economic growth, and large social problems such as the spread of diseases. To overcome these climate change challenges, unprecedented efforts are needed based on insights in natural, social, economic, political, and health sciences. The support of decision-making processes based on a thorough understanding of all related processes is mandatory to overcome this pressing problem.

Climate Change in Cameroon

As a result of its geographical position, Cameroon has a great diversity in ecosystems and climates. It is traditionally divided into 5 agro-ecological zones that broadly follow the cut-up of its natural regions:

- Coastal plain with a coastal and mountainous facade. It is characterized by the "Cameroonian" moist equatorial climate and has the highest rainfall in the country.
- South Cameroon Plateau, South and East, a tropical rainforest environment with a very dense hydrographic network.
- The High Plateau Zone; covering the North West and West Regions, it is an upland region with a monsoon equatorial climate. It is the country's 2nd "water shed".
- The Guinean High Savannah in the Centre of the country with Sudano-Guinean vegetation on the Adamawa plateau is the country's 1st "Catchment Area". Many major rivers take their rise from here.
- The Sudano-sahelian zone in the North with savannah vegetation and semi-arid climate.

Cameroon is 5th among the richest African countries in terms of biodiversity. The country's forests host 40% of African animal species representing 48% of mammals, at least 54% of bird species, 50% of the continent's known amphibians, 30%-75% of reptiles, 42% of identified African butterflies, and at least 21% of its fishery resources. Cameroon has two main types of climate: the equatorial and tropical climate which are influenced by altitude and the monsoon winds. Cameroon also exhibits all major climates of the African continent popularly known as "Africa in miniature". The South and Southwest Cameroon contains coastal and rainforest regions that are characterised by hot and humid conditions, the mountains in the North West and West of Cameroon have a mild climate, and the Northern desert regions are hot and dry. The annual average temperatures vary from 20°C to 28°C and increase as

one moves northwards. The country has one main rainy season and rainfall varies with distance from the sea, altitude and latitude, dropping as one moves from the sea (7500mm) to the interior 2500 mm, and from the south (2000 mm) to the north (550 mm). Cameroon is therefore experiencing a number of diverse climate change impacts that vary between different regions of the country. The average temperatures in Cameroon have been on the rise since 1930 with a net increase 0.95°C between 1930 and 1995; the average rainfall has also decreased by over 2% per decade since 1960, although the dense rainforest region continues to include some of the wettest places on earth. These changes have been linked to extreme weather conditions across the country. The Northern Sudano-Sahelian region is experiencing increased incidences of drought and desert advancement that have scorched large expanses of land, whilst the Southwest coastal and rainforest regions have experienced increased periods of prolonged rainfall that have led to flooding, with landslides in the Northwestern Region. Cameroon is a country of extreme contrasts and climate change is expected to make these differences more pronounced.

Future Prediction of Climate Change in Cameroon

The average annual temperature has risen by 0.7°C since 1960 and corresponds to an increase of 0.15°C per decade. It is predicted to increase between 1.5°C and 4.5°C by 2100 with a 1.6°C to 3.3°C rise in coastal zones and a 2.1°C to 4.5°C rise in the Northern region. However, there is evidence to suggest that this temperature rise could in fact reach as high as 2°C by 2060 if something is not done (mitigation). The average annual rainfall in Cameroon has fallen by approximately 2.2% per decade (2.9 mm per month) since 1960. Some studies and models predict that the average rainfall will continue to decrease, leading to a prolonged dry season in the Northern region as the three month rainy season common to that area migrates south. Desert conditions are expected to dominate the Northern region by 2100. Decreased rainfall and increased temperatures are also expected to decrease run off by up to 21%, subsequently drying up feeder rivers and streams across the country. It is predicted that Lake Chad which border Cameroon will be nearly completely dried up by 2060 with devastating consequences on the ecosystem and biodiversity in the region. Cameroon is also expected to experience the impacts of sea level rise over the next Century along the coast.

Expected Social and Environmental Impacts of Climate Change in Cameroon

Vulnerability varies with natural region. The main climate change risks were evaluated for each natural region. The northern region is characterized by drought, violent winds, floods and landslides and slips, to which erosion can be included. In the Adamawa, a region naturally exposed to seismic and volcanic risks, landslides caused by heavy rains and the existing relief energy (gravity) constitute the most recurrent risk. To this can be added the risk of erosion caused by over grazing. The Western highlands for their part are characterized in literature by the risk of gas emissions from lakes, Monoun and Nyos, due to heavy rainfall and the sheer seriousness of the same climate risks as those in the Adamawa plateau. The South Cameroon plateau, on the contrary, will witness heat waves resulting from global warming. These shall be added to flooding, landslides and erosion. Lastly, in the coastal region, intense and abundant rainfall will cause recurrent flooding, mass movements and erosion. Based on all the information collected and analysed, the northern part of Cameroon seems to be most vulnerable to climate change in the country, followed by the coast and the Western highlands. The South Cameroon plateau appears to be the least affected, but care must still be taken because of deforestation, forestry and mining which jeopardises conservation and can accelerate the above mentioned threats.

The agricultural sector in Cameroon due to its high sensitivity as a result of availability of water, erosion and flooding, it shall be the most affected by climate change in Cameroon. Similarly, energy production is entirely dependent on the hydrological system and considering the influence of the availability of energy resources on the other development sectors, the vulnerability of the main rivers' regimes will have a major impact on the development of the country as a whole. As a concern especially to human groups; the main vulnerability factor is poverty in peri-urban areas, in addition to mass exodus from rural areas to urban areas which already face a huge demographic pressure from youths and vulnerable classes seeking better living conditions. The forest sector is also of great economic importance, second only to oil production. However, unregulated logging in some areas is contributing to the effects of climate change and causing irreparable environmental damage. As temperatures continue to rise these impacts are expected to become more profound throughout the century. Low adaptive capacity: the poorest populations in areas sensitive to climate change like in theSudano -Sahelian zone and the coastal areas are already struggling to cope with current extreme weather events and climate variability. The greater frequency and severity of climate shocks is repeatedly eroding coping capacity in most of these areas.

The Need for Adaptation

In Cameroon, development and livelihood systems are still closely linked to environmental services given the miniscule transitional changes from land-based economy in diversification of asset portfolios. This complex pattern of dependence on natural resources increases the risks, unpredictability and uncertainties surrounding human livelihood as the natural resource systems remain sensitive to changes brought about by climate. Thus, the vulnerability of the forest ecosystems to climate impacts ultimately creates risks to the livelihoods of

forest-dependent communities and to national development and economic activities linked to forests. Invariably, adaptation of both the ecological aspects (the forest ecosystem itself) and the social aspects (the people and their livelihoods, which depend on the forest resources) of the coupled system becomes inevitable. It is still against this backdrop that it is believed that forests can equally serve as an entry point for adaptation. However, a study commissioned by the United Nations Institute for Training and Research (UNITAR) revealed that many African countries including Cameroon do not take climate change as a key priority in their decision-making processes and long-term forest management plans. In addition, despite its importance, forests are not also fully captured in the national development planning processes especially in their roles for climate change and poverty reduction strategies. Therefore, it is necessary to develop institutional and policy interventions necessary to facilitate the incorporation of climate change into forestry such as practical guidance. Such institutional and policy interventions should increase the role of forests in local and national development and facilitate the development of livelihood adaptation strategies on a framework of forest ecosystems.

Cameroon's Government Response to Climate Change

The Cameroon's government response to climate change has been mixed. The country is active at the international and regional levels in a number of processes, such as her participation in the Central African Forests Commission (CAFCOM or COMIFAC), established in 2005 as part of a commitment to sustainable forest management in the Congo Basin. Regional awareness on climate change has been established in line with the opportunities presented by emerging carbon markets and financial incentives for voluntary reductions in national deforestation rates. Through CAFCOM, Cameroon has played an important role in contributing to the development of the REDD+ option, in particular with regards to avoiding deforestation and forest degradation, and also the enhancement of carbon stocks in protected areas. At the national level the government's response to climate change is much less clear. Political discourse around climate change has not yet emerged in Cameroon despite the country's high level international commitments.

Adaptation

Mitigation and Option Strategies: Summary of strategic options per agro-ecological zone

	Forest with bimodal rainfall zone	Moist forest with monomodal rainfall zone	High plateaus zone	Guinea high savannah zone	Sudano Sahelian zone
Competitive agriculture that respects the forests and natural resources shall be promoted					
Green agriculture (agro-forestry, composting, etc.)	+++	+++	++		
Integration of arable cultivation/livestock	+	++	+++	+++	+++
Accompanying measures (microcredit, training, etc.)	+	++	+	+	+++
Energy sources are diversified to reduce pressure on wood					
Improved stoves/ ovens	+	++	+++	+++	+++
Planting for purposes of energy supply	+	+	+++	+++	
Alternative energies	+	++	++	++	+++
The growth in the carbon stock shall be favoured through sustainable forestry					
RIL	+++	+++			
• Improvement of performance	+++	+++			
• Reinforcement of protected area management	++	+	+	+++	++
• Afforestation, reforestation	+	++	+++	++	+++
• Forest monitoring	+++	++	+	+	++

+ to +++: from least to most important.

Adaptation to climate change in Cameroon is still very timid and takes place in two methods. Endogenous methods which come from the population facing the climate change risk, and other measures from the various administrative sectors and personal notes from experts. The Endogenous methods vary with natural region and type of activity in each region. The use of improved breeds, modification of the agricultural calendar, the fight against bush fires, dispersal of livestock, construction of dykes, transhumance, planting of trees, improvement of seed conservation, diversification of activities, reduction of food rations, construction on piles, recycling of wastes, creation of community forests are the main adaptation measures adopted by the population in the different natural regions. Regarding institutions, adaptation options involve the total control of water, diversification of crops, reactivation of reforestation programmes, vulgarization of fodder banks, construction of soil protection and restoration structures, climate risk management, domestication of some wild species, etc. The cost of adaptation measures cannot be estimated at this stage.

Cameroon REDD+ Strategy

Cameroon supports the initiative to reduce emissions from deforestation and forest degradation and wishes that forest conservation and sustainable management efforts be taken into account. To this effect, an adjustment factor has to be defined and taken into consideration in the calculation and reduction carbon emissions. Cameroon opts for the implementation of a market mechanism where all efforts at reduction can be evaluated in terms of carbon credit that can be traded on the carbon market.

Cameroon's GHG emission as estimated in the year 2000 revealed that total emissions amounted to 40,985.43 Gg of CO2 as compared to an absorption of 107,672.06 Gg. The inventory thus shows that GHG emission (excluding Land Use, Land-use change and Forestry (LULUCF) stands at 29,571 Gg of CO2 Eq. Inclusion of the LULUCF sector will raise these emissions to 29,599 Gg CO2 Eq. and absorptions of about 76,582 Gg CO2 Eq. (-76 582 Gg Eq. CO2), amounting to a net absorption of 46,983 Gg CO2 Eq. (- 46 983 Gg CO2 Eq.). Generally speaking, Cameroon is therefore a GHG sink with a capacity to absorb 46,983 Gg CO2 Eq. Table 2 shows a list of the technologies per sector used in Cameroon.

Institutional Strategies

The UNFCCC requires each country to have a National Focal Point and a National Climate Change Committee, both of which are already established in Cameroon in the Ministry of Environment and Nature Protection and Sustainable Development (MINEPDED). In 2005 the government provided a First National Communication to the UNFCCC and in 2010 prepared a set of Nationally Appropriate Mitigation Actions (NAMAs). The administrative leadership for climate change is currently situated in MINEPDED and is coordinated through a monitoring unit (Cellule du Monitoring) headed by the UNFCCC focal point. The unit is staffed by the Ministry and includes civil servants from a range of backgrounds including livestock and agriculture, satellite geometry, environmental business development, and communications specialists. Current activities are focused on the REDD+ and mitigation with little focus

Energy	Waste	LULUCF	Agriculture	Livestock
Hydro-electricity, micro hydroelectricity plant	Incinerator	Reforestation	Irrigation	Rational pasture management
Thermal plant (oil)	Methanisation	Reforestation	Organic manure	Transhumance
Power generators	Waste recycling	Protected area	Water reservoir	Animal vaccination and health monitoring
Solar	Composting	Resting	Terrace cultivation	Crossbreeding
Fuel wood	Waste sorting	Bushfires control	Hedges	Use of agricultural residues as animal feed
Biomass	Effluent water treatment	Rational pasture management	Improved fallowing with legumes	Use of industrial residues as animal feed
Butane gas	Filtration of industrial effluent waters	Forest management units	Mineral fertilisers	
Biogas	Purification plants	Forest cartography and zoning	Biotechnology	
Improved fireplaces	Community forest	Fight against erosion		
Fossil fuel	Community forest	Contour ploughing		
Thermal plant (gas)	Agroforestry	Multicropping and related forms		

focus on adaptation. Despite reports of strong technical leadership and awareness on climate change from the Focal Point, the capacity of this unit to drive the climate change agenda beyond its own immediate activities and workplace has been limited thus far. As the coordinating ministry for the environment and the nature protection, MINEPDED is mandated to coordinate climate change at the Ministry level. To date MINEPDED has been slow to convene ministries and build momentum for climate change across government. Although a number of line ministries, for example the Ministry of Agriculture, are becoming increasingly aware of the impacts of climate change they are currently unable to identify how it should be mainstreamed across their sector programmes. Lack of capacity for costing at the sector and national levels is also evident across government departments.

Research and Systematic Observation: Cameroon has a Ministry of Research and a Department of National Meteorology. Since 2011, MINEPED has rehabilitated about twenty meteorological stations to facilitate the collection of climate data. A national climate change observatory has been set up in the ministry. The main stakeholders in the area of systematic observation and research on climate change in Cameroon include:

- The Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA);
- The Department of National Meteorology (DMN); ONACC, MINRESI, and Cameroon's Universities. Research in Cameroon is appreciable but only a handful of institutions have an activity scope that more or less deals with climate change outside CIFOR, ICRAF, IRD and CIRAD

Legislative Strategies

Early at its launch in 1992, Cameroon signed the UNFCCC convention and ratified it in 2004, thereby signifying its readiness to contribute to the reduction of greenhouse gas (GHG) emissions. The UNFCCC provided the basis for concerted international action to mitigate climate change and to adapt to its impacts. Its provisions were far-sighted, innovative and firmly embedded in the concept of sustainable development.

In 2006 the government launched a National Environment Management Plan (NEMP), this was the first legislation to be introduced that has strict environmental requirements including environmental impacts. In December 2009, the President signed a decree that set out the functions of a newly created National Observatory on Climate Change (ONACC) which is established under MINEPDED. This indicated a level of political "buy-in" for climate change previously not experienced at the national level, although the Decree has yet to be passed and at the time of writing ONACC is not yet operational. MINEP's Climate Change Unit reports that it is already undertaking a number of activities that fall under ONACC, without having additional resources for these tasks. Donor and civil society respondents expressed frustrations around the ONACC process and the delays faced in establishing this unit. Concern was also expressed that the creation of ONACC under the existing Climate Change Unit in MINEP could result in climate change being monopolised by a small number of actors who could act as gatekeepers to information and resources for climate change in the future assessments, air quality safeguards, and the preservation of local ecosystems and natural resources.

Looking at Cameroon's national development plan, the Vision 2035, which focuses on the need for improved governance, enhanced economic growth, employment, and increased social unity and development, it does not address the impacts and challenges of climate change although general reference is made on the need for climate change to be considered in national and regional development issues. As a result, the medium-term Growth and Employment Strategy (GESP) fails to adequately include climate change in the country's development plan. Alongside gender and specific groups the GESP states that "the effects of climate change will be examined in the planning, programming and budgeting phases, in order to sufficiently mainstream them in the economic and social development process". This is not yet happening and there is no government leadership on how this mainstreaming should begin to take place. Political leadership and commitment for climate change will need to be scaled up significantly if climate change is to become embedded across sector programmes.

From the major policy documents in Cameroon and other relevant policy texts, press releases and government statements, reviewed for this paper, the First and Second National Communication (NC) submitted to UNFCCC in 2005 and 2016 respectively are the only documents that deal directly with the issues of climate change. The first NC mostly focused on mitigation aspects and related issues while the Second National Communication of the country dealt successively with GHG inventories, the country's ability to mitigate GHG emissions, vulnerability to climate variation, and climate change adaptation, Shortcomings and Constraints Observed in the Implementation of UNFCCC. Several shortcomings can prevent or slow down the implementation of the UNFCCC in Cameroon.

- Regarding law and regulations, there are difficulties in the operationalization of ONACC (National Climate Change Observatory).
- At the institutional level, the national structure in charge of implementing the Convention has not yet been given an adequate financial and material capacity to fulfil its UNFCCC mission.
- Awareness on the developmental stakes of climate change is insufficient and because of this, the "climate change" dimension has not yet been taken into account some of the national development policies and strategies (GESP, PRSP).
- From the technical perspective, lack of sufficient and dependable data and qualitative and quantitative shortage of national technical expertise, and insufficient nature of financial contributions is a major challenge.

Financial, Technical and Human Resource Needs. Some of these needs identified include:

- Funding for the implementation of priority projects;
- Operational capacity building for institutions and experts; Information and education of the public.

TECHNOLOGY ROADMAPS IN ETHIOPIA: TURNING POLICY STATEMENTS INTO ACTION

The Chinese built Ring road in Ethiopia.

By Wondwossen Belete
ATPS National Chapter Coordinator, Ethiopia

The Science, Technology and Innovation Policy of Ethiopia was approved by Cabinet in 2012. This policy focused on the absorption and adaptation of established practices to suit local resource endowments and market prospects. This is reflected in the policy's vision which is stated as: "to entrench the capabilities which enable rapid learning, adaptation and utilization of effective foreign technologies by the year 2022/23." The policy strategies are designed to support the acquisition; diffusion and upgrading of technologies that already exist in more technologically advanced countries.

To turn the vision into concrete action, different activities and programs have been implemented over the last five years. One of these is the development of a series of roadmaps in different technology areas by outlining performance targets, pathways, priorities and time frames for technology transfer and local technological capability building. The roadmaps are intended to facilitate the process of national innovation system building. They are expected to guide technology investment decisions by identifying critical technologies and technology gaps, and also identifying ways to leverage R&D investments. The technology roadmaps visualize potential trajectories to be followed in order to go from the current state to a desired future state. They aim to ensure that links among tasks and priorities for action in the near, medium and long term are clearly outlined.

The roadmaps are shown both at macro and micro levels to make decisions easier and facilitate the transfer of selected technologies. For each product or service the roadmaps show the product type, alternative technologies, the mode of transfer and the time frame for the transfer. **(See Table 1)**

The technology road mapping process was led by the Ministry of Science and Technology. Technical committees which comprises of experts in different technology fields were established to develop the roadmaps. Members of these committees were drawn from government agencies, research organizations and academic institutes. In order to develop the technology roadmaps, experts established baseline conditions in each sector and analyzed the current state of the technology which put into consideration the social, technolo-

1. Livestock technology	2. Environment technology	3.Meat technology	4. Information and communication technology (ICT)
5.Crop technology	6.Fertilizer technology	7. Sugar technology	8. Leather technology
9. Irrigation technology	10. Cement technology	11. Coffee technology	12. Road technology
13. Textile & garment technology	14. Chemical technology	15. Pharmaceutical technology	16. Construction technology
17. Metal technology	18. Mines technology	19. Energy technology	20. Railway technology

gical, economical, environmental and political drivers by identifying and listing opportunities and threats for each sector. Key factors that affect the process of technology transfer and development such as government policies and demand conditions were examined. Trends that are likely to lead to new policies were also considered. The technologies identified were mainly based on ideas which came up during technical sessions of experts and inputs obtained from field visits. Additional inputs for the development of the roadmaps were obtained from stakeholder engagement and professional opinions of national and international experts.

The development of the technology roadmaps is a commendable job. However, achieving the roadmaps' goals requires commitment to action from key decision makers and stakeholders. The true measure of success is whether or not the roadmaps are implemented and the priorities are addressed therefore, the roadmaps should be communicated to convey key messages and key stakeholder groups need to be reached and engaged. It is also necessary to re-evaluate technology pathways at regular intervals and adjust the roadmaps.

Mr. Wondwossen Belete
ATPS National Chapter Coordinator, Ethiopia

ATPS APPOINTS NEW BOARD MEMBERS

Prof. Crispus Makau Kiamba

Dr. Catherine Adeya Weya

Mr. Ralph Richard von Kaufmann

The ATPS management congratulates Prof. Crispus Makau Kiamba, Dr. Catherine Adeya Weya and Mr. Ralph Richard von Kaufman for their appointment as members of the ATPS Board of Directors. Their appointment was officially approved by other members during their Board meeting in September 2017.

Prof. Kiamba is currently in the School of Built Environment, University of Nairobi, Kenya. He has previously served as the Chief Executive Officer at the Commission for Higher Education, Kenya and he is a former Vice-chancellor of the University of Nairobi, Kenya. He has also served as the Permanent Secretary in the Ministry of Higher Education, Science and Technology, Kenya (2008-2013) and Ministry of Science and Technology, Kenya (2006-2008). Prof. Kiamba is currently a member of the Technical Support Teams of the two World Bank affiliated projects: the African Higher Education Centres of Excellence (ACE) Project and the Partnership for Skills in Applied Sciences, Engineering and Technology (PASET).

Dr. Catherine Adeya Weya is an Information Specialist with over 20 years of experience in the ICT research sector, having worked for agencies like UNU-INTECH in Netherlands. She has done various research projects including Industrial Clusters and Innovation Systems in Africa. Dr. Weya is a member of the Editorial board for *Journal of Perspectives on Global Development & Technology* and she has ever been appointed to take up the role of being a judge during the *Vision 2030 ICT Innovation Awards* and the *Innovation Prize for Africa.*

Mr. Ralph Richard von Kaufmann is currently an associate consultant at the African Agribusiness Incubators Network (AAIN). He has previously worked at Leeds University; University of Nairobi; Kenya Agricultural Finance Corporation; Botswana Ministry of Agriculture; Botswana National Development Bank; Forum for Agricultural Research in Africa; International Livestock Research Institute (ILRI)-Kenya, Botswana, Nigeria and Ethiopia. Additionally, he has also served as the Director for Capacity Strengthening Facility Coordinator at the Universities, Business and Research in Agricultural Innovation (Uni-BRAIN). Mr. Kaufmann core interests are in the field of business incubation, foresign, controlled environment agriculture and livestock.

Other ATPS board members include: Prof. Oyebanji Oyeyinka Oyelaran, Dr. Peggy Oti-Boateng, Dr. El Tayed Mustafa and Mr. Chuma Ikenze. ATPS Executive Director, Dr. Nicholas Ozor serves as an ex-officio member and Secretary to the Board.

The ATPS management welcomes them and pledges to support to them in order to steer ATPS forward towards becoming the leading international centre of excellence and reference in science, technology and innovation systems research, training and capacity building, communication and sensitization, knowledge brokerage, policy advocacy and outreach in Africa.

OPPORTUNITIES

Call for Participants: Air Pollution in Emerging Mega-Cities: Sources, Evolution and Impacts

The British Council's Researcher Links programme, offered under the Newton Fund is pleased to invite Early Career Researchers (ECRs) based in UK, Kenya and South Africa to participate in a five-day workshop on air pollution in emerging mega-cities in Africa. The workshop is being coordinated by Lancaster University (UK), African Technology and Policy Studies (Kenya), and North West University (South Africa).

The workshop aims to:

- Establish the current state of science and future needs of the atmospheric research community in order to address the growing issue of air pollution, climate change and their impacts on the society in and around emerging mega-cities;
- Introduce Early Career Researchers (ECRs) to a wide range of techniques and skills required to pursue cutting edge, transformative atmospheric research;
- Raise awareness of the need for transdisciplinary co-produced research to holistically tackle the challenges of the UN Sustainable Development Goals;
- Establish a cohort of ECRs engaged in chemistry-climate and air pollution research in UK, Kenya and South Africa, who have the potential to become future research leaders;
- Facilitate cross-boundary networking and identify common experience on which to build future collaborative partnerships with fellow ECRs, established scientists, policy makers and stakeholders.

The workshop will be facilitated by established researchers and practitioners who will also act as mentors to participating ECRs. The event will take place from **Monday 16 April - Friday 20 April 2018** at the African Technology Policy Studies Network (ATPS), Nairobi, Kenya.

APPLICATION: The application form is available at https://atpsnet.org/projects/call-for-participants/ . The form should be completed and returned to the relevant country contact by **Sunday 18th February 2018.**

For applicants in **Kenya**: Send to Alfred Nyambane, ATPS (**anyambane@atpsnet.org**)

For applicants in **UK**: Send to Dr. Kirsti Ashworth, LU (**k.s.ashworth1@lancaster.ac.uk**)

For applicants in **South Africa**: Send to Roelof Burger, NWU (**Roelof.Burger@nwu.ac.za**)

Opportunities for Women Entrepreneurs in ATPS Network

The African Women Entrepreneurship Cooperative (AWEC) is inviting applications from women entrepreneurs and business owners from any country in Africa and members of the ATPS network; there are no restrictions on the business industries represented. According to the Global Entrepreneurship Monitor Africa produces more women entrepreneurs than any other region in the world however, they face barriers that threaten to undermine innovation and growth. Some of these challenges include: -unequal access to financial management training and capital; lack of networking opportunities, lack of high-quality, affordable and online learning options; and unequal access to business education and management training. The AWEC aims to build a pan-African community of women entrepreneurs and business owners, empowering them with strategy, leadership and business management skills needed for growth and economic advancement.

Participants **MUST** be ready to commit themselves for a 12-month training program.

Applications are open from **31st January 2018** to **14th February 2018.**

For more information on how to apply please visit https://www.thecge.net/awec/

LANDINFO MOBILE APP TRAINING IN NAKURU, KENYA

Mr. Frederick Owino from the County Directorate of Agriculture Nakuru County, Kenya welcomes participants to the LandInfo mobile app training workshop.

Participants in the field using the LandInfo mobile app to determine the biophysical characteristics of soil in Nakuru County, Kenya.

Participants testing the soil sample at Nakuru Agricultural Training Centre in Nakuru County, Kenya.

ATPS team that participated in the two- day training workshop in Nakuru County, Kenya.

A cross-sectional view of participants during the classroom session of the two- day training workshop in Nakuru County, Kenya.

*Dr. Nicholas Ozor **(Right)** awards a certificate to a participant for having successfully completed the LandInfo mobile app training workshop in Nakuru County, Kenya.*

UN SCIENCE POLICY BUSINESS FORUM

From Left: *Dr. Cheikh Mbow, Dr. Nicholas Ozor, Dr. Erica Key, Mr. Ibrahim Thiaw and Dr. Fatima Denton, panelists during the discussion on, "Funding Science for a Pollution Free World: How Africa can close the Science-Funding Gap."*

Dr. Nicholas Ozor, ATPS Executive Director addressing delegates at the UNEA-3 Belmont Forum Breakfast session.

A delegate asking a question during the UNEA-3 Belmont Forum Session.

Dr. Cheikh Mbow moderating the panel discussion on ,"Funding Science for a Pollution Free World: How Africa can close the Science-Funding Gap."

Dr. Cheikh Mbow engaging delegates who attended the UNEA-3 Belmont Forum Session.

A cross-sectional view of delegates present at the UNEA-3 Belmont Forum Session.

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