IFS-AAS Project on
Developing an Enabling Scientific Equipment Policy in Africa

Consultative Meeting on Scientific Equipment Policy

African Academy of Sciences
Nairobi, Kenya
20-21 August 2015

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Summary

Over a day-and-a-half on 20-21 August, 2015, AAS hosted a Consultative Meeting on Scientific Equipment Policy, one of the concluding activities in the current phase of a MacArthur Foundation-funded project the Academy has been jointly carrying out with long-standing partner, the International Foundation for Science (IFS, based in Stockholm). In addition to colleagues from AAS and IFS, the 42 participants included representatives of academies of sciences and research institutes in Ethiopia, Ghana, Kenya and South Africa; ANAFE; BecA; CEMASTEA; icipe; IOCD; KNEC, NACOSTI, the Ministry of Higher Education, Science and Technology, several universities, institutes and education organizations in Kenya; NEPAD agencies; Seeding Labs; UNESCO; and IFS alumni from six African countries. The meeting's purpose was to raise Pan-African awareness of how the identification and resolution of scientific equipment issues are critical for scientific development in Africa, and to identify national and regional channels to share learned experiences and to influence policy on scientific equipment.

Following welcome remarks from Prof Berhanu Abegaz, AAS Director, Dr Graham Haylor, IFS Director, and a message delivered on behalf of Maciej Nalecz, Director of UNCESCO's SC/PCB, the meeting was opened by HE Dr Moses K Rugutt, Director General of Kenya's National Commission for Science Technology and Innovation (NACOSTI), on behalf of HE Professor Jacob Kaimenyi, the Cabinet Secretary for Higher Education, Science and Technology. Participants were then informed about the project's history, outcomes and outputs by Dr Nighisty Ghezae of IFS and Dr Benjamin Gyampoh of AAS. Representatives from Ethiopia, Ghana and Kenya gave presentations about their respective countries' present efforts at policy change with regards to scientific equipment, effective approaches to advocacy, actors and roles in policy change advocacy, and recommendations to identify and engage with scientific equipment policy change channels.

IFS alumni spoke about their experiences as early-career scientists of a range of issues dealing with scientific equipment and policy advocacy, followed by a presentation on microscience, scientific equipment and policy approaches by Prof John Bradley of RADMASTE Centre in South Africa, and Prof James Cosentino of IOCD. From the day's presentations and deliberations came a spectrum of themes for more detailed discussion, of which participants settled on three to focus their energies: microscience, the impact of research on national development, and existing national and regional frameworks and bodies. From these came suggestions on channels of advocacy for policy change on scientific equipment and who needs to work together.

The meeting concluded with each participant making an informal or formal commitment to take forward efforts at scientific equipment policy change. These ranged from broad intentions to raise awareness about these issues at institutional, national and regional levels, to specific commitments of collaboration and funding. Prof Berhanu Abegaz said, "AAS will pursue an advocacy role to persuade governments and institutions to develop clearly articulated guidelines for the procurement, manufacture, installation, shared use, operation and maintenance of scientific equipment, including microscience equipment. I see our reference to 'equipment policy' as guidelines for equipment within a national STI policy and procurement policy." Dr Graham Haylor also reaffirmed IFS's long-standing commitment to address scientific equipment issues as a contribution to the development of Africa's scientific endeavors.

Background

In follow-up from the “Conference on Getting and Using Equipment for Scientific Research in Africa”, held in Nairobi in May 2012, the International Foundation for Science (IFS) and the African Academy of Sciences (AAS) continued their collaboration during 2013-2014 through the implementation of the MacArthur Foundation-funded project1 on “Scientific Equipment Policy Development and Change”, along with partner organisations in Ethiopia, Ghana and Kenya.

Informed by the discussions and outcomes of an Inception Workshop held in Nairobi in November 2013, these project activities followed:

- Country studies with national co-facilitators in Ethiopia, Ghana and Kenya to review the effectiveness of science equipment policies of key organisations in relation to structures and systems; and to map the national and regional research and policy landscape (January – March 2014)
- National Scientific Equipment Policy Workshops in Ethiopia Ghana and Kenya (March – April 2014)
- Preparation and sharing of the briefing document entitled Toward an Enabling Scientific Equipment Policy in Africa (April – July 2014)

(Reports of the country studies and national workshops are available on the IFS website at http://www.ifs.se/ifs-publications/)

A one-year extension to the project was agreed with MacArthur Foundation for IFS and AAS to work with partners in Ethiopia, Ghana and Kenya, and across Africa, to promote scientific productivity and innovation through identification and resolution of issues regarding equipment needs assessment, procurement, installation, use, service and maintenance, and disposal.

Related to the national scientific equipment policy is also the issue of providing “hands on” opportunities to science practical work in schools. Many organizations like UNESCO, IOCD and AAS believe that the aims of school practical work may be achieved through the application of microscience principles and equipment. To this end, there have been dozens of UNESCO-sponsored workshops held in African countries demonstrating the potential of microscience and indeed a few countries (e.g., Mozambique, Comores and Liberia) have shown interest in evaluating the potential of microscience. AAS and IOCD have also held workshops in Nairobi including a roundtable meeting with Kenyan policy makers.

Purpose and Aims

This Consultative Meeting (schedule in Appendix 1) with a broader group of stakeholders was held on the campus of AAS on the outskirts of Nairobi. Its purpose was to raise Pan-African awareness of how the identification and resolution of scientific equipment issues are critical for scientific development in Africa, and to identify national and regional channels to share learned experiences and to influence policy on scientific equipment. The three aims of the meeting are for participants to:

- Learn about each other’s experiences of scientific equipment advocacy and policy-making

[1] A full description of the background to this year-long project can be read in the *Briefing Document from IFS and AAS: The Procurement of Scientific Equipment is Holding up Research in Africa*.

- Become aware of recommendations in the scientific equipment briefing document, and to deliberate on the importance of the issue, and
- Make informal commitments to advocate for policy change on scientific equipment

Meeting Participants

Invited participants (Appendix 2) to the consultation meeting included: invited representatives from:

- Academy of Sciences of South Africa
- African Academy of Sciences (AAS)
- African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE)
- Biosciences Eastern and Central Africa Network (BecA)
- CEMASTEA Centre for Mathematics East Africa
- Ethiopian Academy of Sciences
- Government of Kenya, Higher Education, Science and Technology
- International Foundation for Science (IFS)
- IFS alumni associations in Benin, Burkina Faso, Kenya, Ethiopia, Ghana and Madagascar, Togo
- International Organization of Chemical Scientists for Development (IOCD)
- Kenya National Academy of Sciences
- NACOSTI, Kenya
- NEPAD (Planning and Coordinating Agency)
- National Metrology Institute of Ethiopia (NMIE)
- RADMASTE Centre, University of the Witwatersrand, South Africa
- Science and Technology Policy Research Institute (STEPRI) of CSIR, Ghana
- Seeding Labs
- Southern African Network for Biosciences (SANBio)
- UNESCO Microsciences Program

Opening Session

The Consultative Meeting opened with the following welcome remarks.

Prof Berhanu Abegaz (Director, African Academy of Sciences)

At 30 years old, AAS is the only Pan-African Academy, with around 300 Fellows among whom are an increasing number of women. AAS is associated with the AU/NEPAD, though prior to 2012, AAS only had observer status at the AU. It is now recognized by AMCOST, who advised the AUC to work with the Academy, to tap into its pool of expertise and to solicit its support in running the AU prizes, and conduct reviews and foresight studies. In 2013, the AUC and AAS began working closely together. AAS began rendering assistance in evaluating the Kwame Nkrumah Prizes over two successive years (2013-2014). In 2014, AAS held its 9th General Assembly in Brazzaville. The Government of Congo asked AAS to run the African Innovation Prize. In the same year AAS and NEPAD signed partnerships and began setting up AESA (Alliance for Accelerating Excellence in Science in Africa). In 2015 the AU summit recognized AESA and requested AAS and NEPAD to set-up it up to look into the health priorities of the continent.

When AAS was established in 1985 its first president was T R Odhiambo. Mohamed Hassan was the second president beginning in 1999. In 2001 the Nigerian Government contributed $5 million to the AAS Endowment Fund. In 2005 a hosting agreement was signed with the Government of Kenya which gave the Academy diplomatic status and VAT-free privileges.

AAS has been running many activities, especially during the AFORNET project which ended in 2011. Since then we have run programs which have benefited many Africans including Kenyans. Examples include the CIRCLE program, the Cell Biology Regenerative Program, and various workshops. In almost all these cases AAS has enjoyed the partnership and support of KNAS, NCST, and now NACOSTI. AAS is pleased to partner with IFS to organize and host this Consultative Meeting.

Professor Berhanu recognized the presence and appreciated the participation of NEPAD, UNESCO, IOCD, RADMASTE Center, ASSAF, EAS, GAAS and KNAS, Seeding Labs, and various local organizations including NACOSTI, KNAC, KICD, and CEMASTEA.

The objectives of the meeting that AAS/IFS were running several projects focused on policies/Guidelines for scientific equipment (MacArthur supported) and Microscience together with NACOSTI and KNAS. As both projects focus on equipment (micro and Big), it was felt that the “Consultative Meeting” would address both aspects.

There is a lot of evidence showing that absence of guidelines and policies on equipment has become a bottleneck for progress in teaching and research. There is also plenty of evidence that the microscience approach in experimentation is a viable one for giving “hands-on” experience for pupils in schools, as among them are the future leaders of our countries who need to be nurtured and given opportunities to grow up studying the practical sciences.

Dr Graham Haylor (Director, International Foundation for Science)

Welcome to all our distinguished participants, friends and colleagues. Thank you Professor Berhanu Abegaz, Director of the African Academy of Sciences, for your welcome. The International Foundation for Science is delighted to continue our collaboration with the African Academy of Sciences and to bring together so many distinguished colleagues to contribute to this Consultative Meeting on Scientific Equipment Policy. As a donor supporting early-career scientists with competitive research grants we have always taken an interest in scientific equipment, because it is usually the main expenditure by our grantees. We have formally recognised, and worked to address, inadequate scientific infrastructural bases and lack of functioning scientific equipment since 2002. We are acutely aware of the life cycle of valuable scientific equipment and the importance of supporting scientists to navigate its stages, including needs assessment, procurement, installation, use, service and maintenance, and disposal.

In the coming two days you will hear a lot about efforts we have all been making to identify, and consider ways to address, the challenges that scientists face. We hope that our deliberations here at the African Academy of Sciences will help to take these matters into helpful policy domains that can begin to address this important issue which is constraining scientific development in Africa. We aspire to a post-2015 development landscape where science in Africa can play its fullest and most valuable role in fulfilment of sustainable development. Thank you.

Dr Jean-Paul Ngome Abiaga (Assistant Programme Specialist, Division of Science Policy and Capacity-Building, UNESCO)

(On behalf of Maciej Nalecz, Director SC/PCB, message to the Consultative Meeting on Scientific Equipment Policy)

Representatives of the Ministry of Education, Science and Technology of Kenya, Professor Berhanu Abegaz, Executive Director of the African Academy of Sciences, Dr Graham Haylor, Director of the International Foundation for Science, Distinguished participants, ladies and gentlemen,

Allow me to first express my regret that I am unable to personally greet this distinguished gathering. However, I have asked to be represented by my Deputy in the International Basic Sciences Programme, Dr Jean Paul Ngome Abiaga, who is not only representing a young generation of researchers, but he himself is also an African scientist, who, therefore, may present his own experience with the African Scientific Equipment Policy, the main subject of the meeting.

Scientific innovation and capacity development form the fertile ground on which knowledge-based societies are created and they lead to sustainable development, as described by the post-2015 development agenda.

It is vital for all countries to underline the importance of the basic sciences, which lead to new technologies and innovative equipment for sustainable development. UNESCO has made much effort, namely through the International Basic Sciences Programme (IBSP), to improve capacity development among science teachers and students. Advocacy amongst policy makers to improve science curricula through hands-on experimentation for a better understanding of science is crucial and has been one of the challenges of IBSP over the years.

Early experience with the use of scientific equipment can be critical for scientific development. This is no more clear than in Africa, the continent which is one of the two global priorities of the Organization, together with gender equality. For this reason, the IBSP has endorsed the Global microscience programme, an initiative offering hands-on experience with science to youngsters, to become the first and the most important science education activity run under IBSP. Today, more than 15 years from its inception, the microscience programme is still going strong, and is still a core activity of the IBSP.

In a nut shell, the microscience programme is a unique science education project that gives primary and secondary school teachers and students, as well as university students, an opportunity to conduct practical work in physics, chemistry and biology through simple experimentation with disposable micro-scale laboratories. The microscience experiments work through the support of specific kits and guidelines that explain how to carry-out pedagogical scientific experiments. One can define these kits as real portable-laboratories, which are also cost effective and safe, as trainees never need to use more than a couple of drops of chemicals for experimentation.

I would like to take this opportunity to acknowledge Professors Pokrovsky and Bradley, of UNESCO and South Africa, respectively, who conceived this long-standing project and made it possible, through collaboration with IUPAC, the RADMASTE Centre at the University of the Witwatersrand in Johannesburg (South Africa) and Somerset Educational (South Africa), and whose dedication to make this programme a reality never failed.

The IBSP Global microscience programme is also an optimal tool to promote cross-disciplinary quality science education, and a reminder that we should continue to ensure that research, innovation and development, which contribute to ground-breaking findings, are accessible and affordable to everybody. If we act now, we can contribute to the development of the society of tomorrow.

In conclusion, this Consultative meeting offers a unique opportunity to define a clear strategy on how Scientific Equipment can support national and regional goals. We believe that only through experience- and knowledge-sharing is it possible to build a more scientifically inclusive world. The efforts of today will be the positive outcomes of tomorrow.

I wish you a fruitful meeting. Thank you.

Dr Moses K Rugutt (Director General, National Commission for Science Technology and Innovation, Kenya)

My NACOSTI team present here today includes Dr George Ombakho Director of Research Management, Dr Roy Mugiira, Deputy Director, Dr David Otwaoma, Chief Science Secretary (formerly of the International Atomic Energy Association). The issues addressed by this project are vital for NACOSTI in Kenya, which links with the African Union Science Technology and Innovation Strategy for Africa. We will get the brief "Towards an Enabling Scientific Equipment Policy in Africa" from IFS/AAS and we want to run with this policy quickly.

Official Opening

The consultation meeting was officially opened by Prof Isaac O Kibwage, Principal of the College of Health Sciences, on behalf of Professor Jacob Kaimenyi, Cabinet Secretary, Ministry of Higher Education, Science and Technology.
Apologies from Cabinet Secretary.

Ladies and Gentlemen,

It gives me great pleasure to join you this morning for the Consultative Meeting on Scientific Equipment. I am delighted to be associated with African Academy of Sciences (AAS) and the International Foundation of Science as you conclude the collaborative project on Developing an Enabling Scientific Equipment Policy in Africa, funded by the MacArthur Foundation on this auspicious occasion. The issue of equipment is but one of the challenges faced by scientists in Kenya, our East African region and our continent and hence the need to put in place effective mechanisms to provide an enabling environment for our researchers.

My Ministry is in a position to make policy on scientific equipment both at national and institutional levels as it is responsible for national policies and programmes that help Kenyans access quality and affordable, school education, post-school, higher education and academic research.

Ladies and Gentlemen,

The government is committed to addressing the challenges in education to ensure that the sector responds to the manpower needs to maintain the status of a middle-income country and to rapidly industrialize as envisaged in Vision 2030. It is our duty as scholars, policy makers, education managers as well as students to actively participate in the changing of mindsets and attitudes of our society to embrace technology and innovation as the means through which our country can meaningfully participate in this fast-paced knowledge economy.

Ladies and Gentlemen,

My Ministry through NACOSTI have been supporting KNAS activities for more than a decade. I note too that the relationship between KNAS and AAS has been fruitful and that both academies have joined NACOSTI in hosting joint activities. I note too that AAS has collaborated with both KNAS and NACOSTI in areas of equipment policy, microscience, cell biology and regenerative medicine. My Ministry has set up an intergovernmental committee to look into the hosting agreement between AAS and GoK to find ways that will provide better working conditions and privileges for the academy and also extend more support to it. "Business as usual" will not avail necessary tools to bridge the innovation gap. Only the kind of systemic, transformative changes to the urgent resolution of the tasks facing today's African scientists so that they continue obtaining support as they contribute to securing affordable food, water and energy for an increasing population in need of an innovation system will help us avert the most dire scenarios and achieve a sustainable and secure livelihoods in future.

Ladies and Gentlemen,

Let me reiterate that my Ministry is urging NACOSTI, public universities, schools and all wellwishers to continue forging stronger partnership with KNAS, AAS and all our development partners. I am aware that most of 2014 work was in progress resulting in a policy brief titled 'Towards an Enabling Scientific Equipment Policy in Kenya'. This was enriched further by the Kenya Country Study Report, IFS-AAS Project on Developing an Enabling Scientific Equipment Policy in Africa and that all these will give guidelines on how this Consultative Meeting can pave the way forward.

I hence direct that working within the process of the NACOSTI, my Ministry will consider the following issues of importance along each stage of the scientific equipment life-cycle, namely:

- Needs assessment: To justify the acquisition of equipment, consult with all concerned parties, especially scientists, paying particular attention to innovation agendas of institutions and government. A policy should be worked out on donated and second- hand equipment, and how inventories of equipment are developed, maintained and made available.
- Procurement: A policy brief suggesting a "one-stop shop" for identifying and understanding procedures for importing and forwarding scientific equipment to educational and research institution be brought to my attention for onward discussion with my Cabinet colleagues
- Installation: Verify that appropriate measures are taken to accommodate and commission procured equipment.
- Use: Involve accredited calibration bodies such as Kenya Bureau of Standards, Kenya National Accreditation Services, and Kenya Technicians and Technologists Board. Develop the competencies of technical staff. Relevant policies and procedures for sharing equipment and logging its use need to be shared across board for users of the equipment, their institutions and best practices shared.
- Service and maintenance: Ensure that service and maintenance contracts cover all aspects of the equipment needed for effective and efficient performance, including calibration.
- Disposal: Establish a functioning disposal committee that develops policies and procedures on all disposal matters, including timing, safety and use of proceeds.

Across all the equipment life-cycle stages, necessary activities and tasks should be budgeted for and technical training provided for all levels of equipment users, especially for scientists and technicians.

Ladies and Gentlemen,

With these remarks, I call upon AAS, IFS and all participants present to join me in declaring the consultative meeting on scientific equipment policy officially open.

Thank You and God Bless You. God Bless Kenya.

The facilitator then expressed our gratitude for the clarity of the Cabinet Secretary's remarks and the urgency of the cabinet in taking this issue forwards in Kenya. He directed all colleagues to the programme. Highlighting the life cycle of scientific equipment and how helpfully that has framed the work in this project. He stressed that by the conclusion of this meeting we want to reach a point where many of us can make informal commitments of what *we can each do* to take forward the outcomes of the meeting. We will have worked in some topic specific groups. He highlighted that we will have a series of presentations and time for inputs and comments from all, and that these will give rise to points of discussion later in our meeting.

Background of the Project

Dr Nighisty Ghezae, IFS Head of Programme, presented the project background.

IFS has been committed to addressing scientific equipment challenges since its establishment in 1970. Our commitment is operationalized at individual, country and regional levels.

For scientific infrastructure support at an individual level, IFS has helped over 7,835 early-career scientists in Africa, Asia Pacific and Latin America, with research grants and capability enhancing support. A number of these scientists have benefited from using IFS scientific equipment and its procurement services, and they participated in different scientific equipment related trainings.

IFS scientific infrastructure commitment at country and continental levels includes organising conferences, workshops, meetings with pertinent stakeholders to discuss, agree and act on issues related to scientific infrastructure. In 2002, a seminal meeting was held at the University of Buea in Cameroon with a number of stakeholders at which it was agreed that although lack of funds was a serious obstacle an inadequate scientific infrastructural base and lack of functioning scientific equipment was just as critical in explaining deteriorating capacities in African universities to design and execute credible research projects for sustainable African development.

A four-year project was funded by the MacArthur Foundation entitled PRISM "Procurement, Installation, Service, Maintenance and Use of Scientific Equipment." The first phase of the project involved conducting an audit in 15 universities to get an idea of the situation concerning equipment procurement and use in African universities. The result of the audit indicated that 40 percent of the equipment was not functioning, and that most of the equipment was not installed, was broken down or was obsolete.

The second phase of the PRISM project addressed issues of selection, procurement, transportation, installation and use of scientific equipment and training in six pilot scientific institutions in Africa. In May 2012 we held a conference on “Getting and Using Equipment for Scientific Research in Africa” in Nairobi together with the AAS. The first objective was to learn lessons about and from implementation of the MacArthur Foundation-funded project, and two other approaches to scientific equipment provision, one from IFS, with particular reference to early-career scientists and collaborative teams, and another from BecA (Biosciences Eastern and Central Africa), which provides opportunities in Africa for scientists to utilize well equipped laboratory facilities. A second objective was to discuss and make recommendations on how to effectively provide scientific equipment for universities and research institutions in Africa.

The conference resulted in a deeper and broader understanding among participants of the efficacy of various approaches to scientific equipment provision, and that this would be shared more widely initially through a Briefing Document with other research institutions and funding organizations. Nine key issues arose in the learning when taking equipment issues seriously:

- There is no ‘one size fits all’ in equipment provision
- Participatory planning of procurement, use and maintenance is highly beneficial
- Developing a strategy for equipment procurement is vital
- Use of proper clearing and forwarding agents and lobbying for simplified procedures for importing and forwarding scientific equipment is important
- Face-to-face meetings are best to understand long-term needs and equipment upgrade paths
- It is good to develop ‘standard procedures’ for efficient use, since burdensome paperwork and regulation in institutes and universities can limit the use of installed equipment
- Centralization enables pooling of resources, efficient management, adequate security, infrastructure, and utilities
- It is good to negotiate collaboration around expensive equipment within a country or region
- Try to discourage ‘personalization’ of equipment (the opposite of collaboration)

Addressing the problem of scientific equipment requires developing and implementing sound policy, and this is urgently needed.

A 14-month (April 2013 – May 2014) MacArthur Foundation-funded project implemented with AAS and three country case studies from Ethiopia, Ghana, and Kenya formed the focus To stimulate pan-African interest by sharing the national approaches widely. The three country studies were carried by country teams and three national Scientific Equipment Policy Workshops were held. The most important output of the workshops was a set of messages to makers and influencers of scientific policy, framed around the equipment life-cycle. Using the outcomes of the Country Studies and National Workshops, a Briefing Document was written for each of the three pilot countries. These are being taken forward with relevant policy-influencing and policy-making channels by our project partners in Ethiopia, Ghana and Kenya through steps they identified in their respective National Workshop. A General Briefing Document was then compiled from the three country-focused documents, for the purpose of taking forward these policy messages at continental and regional levels.

The Briefing Document

Dr Benjamin Gyampoh, AAS Head of Program, presented the Briefing Document.

The messages in the Briefing Document are framed around the six stages of the scientific equipment life-cycle:

- Needs assessment
- Procurement
- Installation
- Use
- Service and maintenance
- Disposal

The messages to policy-makers are:

Needs assessment

- Justified individual or shared need
- Approved and prioritized research agenda
- Upgradability
- Retrofitability to older models
- Standardization and compatibility
- Carefully assess equipment
- Quality; whether purchased, donated or second-hand

Procurement

- Implications of procurement acts and processes
- Exemption policies on scientific equipment
- Consider bureaucracies and delays
- Importing, producing, refurbishing, renting/leasing
- Encourage local production
- Procure from foreign companies with local
- Promote better relationships between
- Consider a “one-stop shop”

Installation

- Prepare site for timely installation and commissioning.
- Develop procedures for checklisting
- Calibration
- Acceptance testing
- Safety protocols
- Accredited standards and calibration bodies
- Supplies of consumables and accessories.
- All documents; operating manuals

Use

- Standardize procedures for operation
- Verification

- Validation
- Tracking usage; logging
- Encourage sharing and collaboration.
- Updated equipment inventory or databases

Service and maintenance

- Agree contracts and obtain service warranties
- Regular preventive maintenance
- Repair and calibration
- Records of service and maintenance
- Spare parts availability and affordability
- Software and equipment upgrade
- Generate income from equipment use to support servicing

Disposal

- Policies, procedures, guideline, regulations
- Timing,
- Safety protocols
- Use of proceeds
- Environmental and health risks
- Costs and benefits of replacement, refurbishing, salvaging or donating obsolete equipment

A functioning equipment management system requires effective policies, proper organizational structures, right human resources with requisite training, relevant and working procedures, guidelines, and right budgeting.

Country Experiences from Ethiopia, Ghana and Ethiopia

The suggested framework for the content of the country presentations was:

From the perspective of your organization as a national actor in science, technology and innovation development:

1. What is the present status of efforts at policy change with regards to scientific equipment?

2. What approaches to advocating for such policy changes seem to be working?

3. Who are the institutional, national, and regional actors involved in policy change advocacy, and what are their respective roles?

4. What recommendations can you make to identify and engage with scientific equipment policy change channels?

Please feel free to draw on the outcomes of the Country Study, the National Workshop report, and the policy briefing document to inform your presentation. Be aware, however, that the presentation at this Consultative Meeting is not a report of these. Rather it is intended to take the discussion and momentum forward on the issue of scientific equipment.

Ethiopia

Mr Abebe Mekuriaw, EAS, and Mr Abebayehu Mamo, NMIE, presented the Ethiopia experience.

The study was initiated by IFS/AAS and conducted jointly by EAS and NMIE. It assessed research priorities and status of scientific equipment, and covered seven universities and two research institutes. A National Workshop wasconducted on the preliminary findings of the assessment with representatives from relevant ministries, universities and research institutes participating. It also provided substantive inputs to enrich the report and highlighted the major problems and suggested what needs to be done.

Major findings of the study were:

- Inadequate understanding of the role that SE plays in scientific research/education/services
- The mode of acquisition of scientific equipment is the major contributor to the problems associated to management of scientific equipment
- Absence of organizational units for scientific equipment and weak technical capability at national and institutional levels
- Shortage of qualified human power and training programs for scientific equipment
- Absence of national and institutional scientific equipment policies, guidelines and/or procedures

Recommendations highlights:

- Create an enabling scientific equipment management system by adopting a national scientific equipment policy, developing working procedures, creating specific organizational charts, and establishing fully equipped maintenance workshops.
- Create institutional and national scientific equipment centres
- Develop the required human resources by designing curricula on scientific equipment and start training at undergraduate and graduate levels, and providing opportunities for on the job training for mid-level technical staff
- Standardization of scientific equipment to be acquired through procurement and donation
- Apply the concept of total cost of ownership (TOC) from the inception of scientific equipment acquisition
- Formulate institutional and national scientific equipment policies to strengthen scientific research/education/service
- Develop a SE database at institutional and country level
- Carry out programmed preventive maintenance and calibration of equipment
- Ensure uninterrupted supply of reagents and supplies through established supply chains
- Develop scientific equipment disposal guidelines

In terms of efforts at policy change, the NSTIP encourages and supports research aimed at adaptation of technology and addressing development problems. Encouraging measures are being taken since adoption of the National Science, Technology and Innovation policy (e.g., policy implementation strategy developed; National Science, Technology & Innovation Council established; National Research Council established; National competitive research grant instituted; guidelines to strengthen university-industry linkage adopted. The MoST is also to conduct a country-wide scientific equipment survey.

Policy directions and implementation include:

- Strengthening research infrastructure
- Human resource development
- Creating conducive environment
- Recognition of achievements
- Networking and collaboration
- Making available adequate resources for research (at least 1% of GDP)
- Scientific equipment maintenance, calibration and training services are being provided by NMIE
- Establish an institution that provides capacity building, consultancy and training support to repair and maintenance of research and SE

Approaches to advocating for policy change on scientific equipment need to be considered as part of implementation of the National Science, Technology & Innovation policy; initiated and pushed through the established Science, Technology & Innovation system in the country; which started with consultative discussions with policy makers and universities, research institutes and ministries based on the IFS/AAS study.

Recommendations to engage with scientific policy change channels:

- Consider scientific equipment policy change initiative as part of implementing the NSTI Policy issued in 2012
- Use the established system of STI operation in the country
- Let the research actors speak about the extent of the problems they are facing in relation to scientific equipment
- Target on making the scientific equipment policy issue an agenda of the National STI Council
- Continue efforts until the policy change picture is seen clearly without being satisfied by scattered measures here and there
- Provide as much evidence as possible on the scientific equipment problem

Questions and Answers

Can we see how the existing policy is working? *It took 6-7 years to revise the science and technology policy (2003) we do not advocate change to that policy.*

Are we starting from scratch here or are there some things in place? *Yes, but the need to strengthen the evidence is a key step. Some institutions are better than others in the management of equipment lifecycles and in policy development.*

You said “scientists should speak out.” Are they not speaking out, to whom should they speak? *Yes, but they need to speak to policy makers.*

Ghana

Stephen Awuni, Science and Policy Research Institute, Council for Scientific and Industrial Research, presented the Ghana experience.

The objectives of the study were to review the effectiveness of science equipment policies, and to map the national research and policy landscape. The data collection was based on the work plan between IFS and STEPRI in February 2014. The methodology included desk research from institutional offices, and two interview guides. The ministries responded to the policy aspect of the interview guide. Research institutions, the universities and the polytechnics responded to the scientific equipment aspect of the interview guide. There was purposive sampling of institutions. A national dissemination workshop was held in April 2014. The technical report can be found on the IFS website.

In terms of status of efforts at policy change on scientific equipment, there is establishment of the ministries meant to facilitate policy formulation and implementation of scientific equipment policy. Ministries exercise oversight responsibilities over public agencies on scientific equipment policy. Ministries and their agencies play roles in the acquisition, use and maintenance of scientific equipment. There is a deficiency of policies and frameworks on scientific equipment, and a lack of coherent and well-articulated policies. There are sector specific-policies on in agriculture, health, education, environment, and energy.

Scientific equipment acquisition is in accordance with the Procurement Act 663 of 2003. Its main objective is promoting efficiency, value for money, and eliminating corruption in procurement. There are no processes that simplify the acquisition and clearance of equipment. There must be adherence to the procurement law through competitive bidding or sole-sourcing. There is procurement through partners in research programmes or projects, but in compliance with the procurement law.

Educational scientific equipment and research laboratory equipment are admitted under the exempt regimes. MDAs are mandated to apply for exemptions based on institutional needs. The MoF budget for scientific equipment is not found as a single expenditure item. Institutions budget (of government subvention) for maintenance and procurement. It is budgeted under MDAs where scientific equipment use is pronounced. Funds rarely come. Some institutions use IGFs to procure and maintain the equipment, e.g., CSIR-Ghana (Act 521, 1996) generates 30% of its budgetary allocation through IGF. Not all the institutions have been able to realize their targets. This development negatively affects equipment procurement. Some donor-funded projects support some institutions to procure scientific equipment. Bureaucracy and delays in provision of tax exemption on duty of research equipment results in some institutions paying for duty even though they qualify.

On policy advocacy changes:

- Various national policy documents and plans provide guidance on scientific equipment apart from the procurement law, e.g., Education Strategic Plan 2010-2020; National STI Policy and Development Plan; Ghana Shared Growth Development Agenda (GSGDA I & II); National Infrastructural Plan
- There are no specific regional science equipment policies
- Few documents emphasize scientific research, e.g., ECOWAS STI policy; AU plan of action 2007-2008 (at least 1% of GDP of member countries for R&D); Procurement Act 663, in 2003.
- MDAs play roles in the acquisition, use and maintenance of scientific equipment.

On actors in the acquisition, use and maintenance of scientific equipment:

- NDPC’s role is in guiding scientific institutions on equipment policies.
- GSA and CSIR-IIR operate routine calibration exercises.
- GSA, the national standards body, is mandated to undertake calibration, standardization, and weighing and measuring instruments.
- GSA is a member of ISO and AOS.
- IIR collaborates with GSA in their activities relating to metrology.
- Scientific institutions have linkages with the mass media on the subject of

scientific activities.
- The mass media has the capacity to influence scientific policy change through documentaries, newspaper articles, and radio

National, institutional, and regional actors in policy change advocacy include:

- MoF, MESTI, MOEd, GES, NDPC, NCTE, PPA, research institutions, universities, polytechnics, SHS.
- MESTI (National STI policy and Development Plan of Ghana)
- NDPC [Ghana Shared Growth Development Agenda (GSGDA) I (2010-2013) and II (2014-2017)]
- Regional: ECOWAS STI policy, AU plan of action 2007-2008

Recommendations for engaging with scientific equipment policy change channels:

- Actors should prioritize scientific equipment acquisition and maintenance.
- MESTI, MOEd, NDPC should have effective institutional frameworks for scientific equipment.
- Finance: There should be provision of adequate funding.
- Ministries and GRA: Effective implementation of the exemption policy regarding bureaucracies, taxes and duties on scientific equipment.
- MDAs: Train scientific staff in scientific skills, use and maintenance of scientific equipment; encourage local production (e.g., IIR) of laboratory research equipment.
- Scientific equipment is mainly manufactured abroad. This has implications for sustainability in the maintenance and use of the equipment.

Questions and Answers

It may be good also to refer to the EU Action Plan as you have but the STI Strategy for Africa is a relevant strategy to also consider. How do you measure the comprehensiveness of a policy how do you define policy deficiency? Maybe when you approach a policy maker you need to break up your critique into small issues. *There is no science equipment policy as such some policies touch on this.*

What are MDAs? *Ministries, Departments and Agencies.*

How far have you gone in fighting corruption related to science equipment procurement, and how does the act you mentioned differentiate scientific equipment from other equipment procurement? *Competitive bidding is required and has to some extent streamlined procurement and diminished corruption but we don't have figures. The act is about public procurement in general. There is no differentiation.*

Kenya

Dr David Otwoma and Mr Stephen Situma, NACOSTI, presented the Kenya experience.

The objectives of the 2014 country study on scientific equipment were to map the research and policy landscape, and to review, if any, the scientific equipment policies in research-based organizations, such as research institutes, universities, and government departments. No industry-linked institutions were surveyed.

The major finding was that in general there is no scientific equipment policy. Individual research institutions have developed some semblance of the policy, though no equipment management system. Research/academia-industry collaborations happen but are not well structured. Most equipment is from program spin-offs and ownership is sometimes contested. The procurement process is bureaucratic. There are no tax rebates for equipment, no specific curriculum for capacity-building of managers of the equipment and users, and no comprehensive data bases of both researchers and technicians.

Suggestions from the study included that any scientific progress depends on good research infrastructure, that is well maintained and in good working condition. There is a need for a national policy and institutional framework that support needs assessment, procurement procedures, use and user capability, service and maintenance, and disposal of equipment.

In terms of policy initiatives the second MTP captures ST&I infrastructure development. The draft science and technology policy also stressed the needs on ST&I infrastructure. Initiatives on emerging technology policies have captured both equipment and capacity. SEPU and CEMASTEA have one but they are underfunded. Kenya enacted the ST&I Act in 2013, providing for a 2% of annual GDP for R&D. A policy on National Physical Science Research laboratory should help inform the way forward. There is no mention of a policy on scientific equipment acquisition and use, though they have a bearing on the policy.

Proposed approaches involve the Ministry of Education Science and Technology and NACOSTI leading a process of policy development. The policy should address the shortcomings in the survey. It should draw up a list of stakeholders to be categorized into suppliers, financiers, and users/managers; create a funding system for acquiring equipment; maintain a database of researchers and technicians; domesticate the national policy on scientific equipment management; and set up a team to monitor and coordinate the process. This could be housed in the National Physical Research Laboratory.

Questions and Answers

Devolution is important in Kenya right now to the 47 counties and each is supposed to have universities domiciled in each country. They all need to think about scientific equipment. There are 60 universities and we need a policy on how best to manage this issue. Some equipment is expensive so we need to cluster universities and share equipment. In Kenya we have ILRI, ICRISAT, ICIPE. They have useful and expensive equipment. We need to negotiate how our researchers can access and use that equipment. Two percent of GDP is 900 million USD and that is a big commitment. Let us have a national equipment centre and base the expensive equipment there, maintained and managed and available for use. This recommendation to establish a database of researchers and technicians or technologists, this is excellent. This is not known and well understood today, and is a start to working together.

I would like to say that schools have issues and I am concerned. Children want to be taught “doing” not “listening” and theoretical teaching. We are killing minds, even at basic levels we can make learners take interest in science through practical teaching.

Experiences of Early-Career Scientists

The IFS alumni representative presentation was given by David Chiawo. The title was “Science equipment in research and higher education systems in Africa: Status, challenges and policy expectations.” Alumni came from Benin, Burkina Faso, Cameroon, Ethiopia Ghana, Kenya, Madagascar and Togo.

Links between science and national/regional development:

- Driving force towards achieving MDGs and SDGs
- Hunger, food security and sustainable agriculture
- SDG 9: Build resilient instrastructure, promote sustainable industrialization and foster innovation
- AU strategy called STISA (Science, Technology and Innovation For Africa) 2014-2024
- Science and technology for innovation: a key strategy for achieving African Union's Agenda 2063

ADB 2012: "But let me tell you the bigger STI story. The one that I believe will help Africa compete globally – what you have heard the past two days. We need a scientific revolution in Africa: research and development is key. We need a "Sputnik moment" in Africa."

RUFORUM 2015: "Higher education provides high returns to investment in SSA (latest studies show up to 21%), higher than that for primary and secondary education with potential to support future employment for the growing youth population and respond to the need for job creation to boost agribusiness and development."

African governments and heads of states Malabo Declaration (2014): enhancing investment finance in agriculture; ending hunger in Africa by 2025; and enhancing resilience of livelihoods and production systems to climate change and other related risks.

Challenges in procurement include:

- process is tedious
- bureaucracy and delivery
- clearance at customs
- limited funding for equipment purchase
- handling donations

Certification has recently improved procurement.

Training challenges include lack of capacity on some equipment, installation and use, maintenance, and technical assistants.

Inventory and sharing issues are:

- Accessibility, availability, automation
- Databases are lacking or poor
- Central database and updating status
- Sharing

We need a training platform to facilitate sharing, and human resource mobility in policy frameworks.

Laboratory management and disposal issues include environmental and human health, biosafety for laboratory waste management, laboratory SOPs, and training.

For the way forward:

- What is expected of us?
- What is the role of early-career researchers (IFS alumni)?

- What is the role of national and regional institutions?
- What is the role of policy makers?

IFS alumni can:

- Promote and strengthen networking
- Participate in policy development
- Do collaborative thematic and applied research
- Reinforce research mentorship
- Promote equipment sharing through training
- Communicate results at diverse levels; research informing policy; research with value to communities; industrialists, farmers, communities, e.g., cases of Madagascar; Burkina; NAGOYA protocol; Ghana; RUFORUM

At national levels: national funds for research, multi-institutional research programs, and equipping national institutions by areas of research.

At regional levels: centers of excellence, resource mobilization, cutting edge research, harmonization of sectorial policies (West Africa, ECOWAS, WAHO, AU).

Key messages:

- More funding for research
- Improve policy on procurement, customs, tax exemptions and bureaucracies
- Budget allocation for maintenance and TA training
- Keep and automate science equipment inventory
- Establish core laboratories
- Adopt environmental management system and biosafety lab SOPs

Statement on Microscience, Scientific Equipment Policy and Programs

The first part of the presentation was given by Prof John Bradley, The Microscience Project, RADMASTE Centre, University of the Witwatersrand, Johannesburg, South Africa. This par was titled “Towards a Microscience Solution: Evaluation of the micro-science kits (MSK) pilot project in Tanzania.”

In terms of pilot project implementation, MSKs to be distributed to 180 secondary schools in 34 districts in 9 regions (Nov 2010). MSK packs included some macro items. There was a formal hand-over to MoEVT on 27 May 2011. 50% of pilot schools got MSKs by Nov 2011; 20% only got them in late 2013. Training in the use of MSKs was provided for 24 trainers and 15 inspectors, and then 372 science teachers.

For the evaluations in 2014, consultations and discussions were held with UNESCO and MoEVT staff and district education officers, along with focus group discussions and school visits (23 urban and rural schools in six regions; principals and 55 science teachers were interviewed; 454 student questionnaires were completed).

The evaluation outcomes were that there should be three science teachers in each secondary school but most (of the 23) had fewer; four had none. Twenty science teachers (of the 55) had received MSK training. An inspector of one region reported on 20 pilot schools: 22% were making effective use of MSKs; 22% were not using MSKs at all; 87% of teachers had received no MSK training.

The pilot challenges were shortage of science teachers and district education officers; delayed distribution of MSKs; inadequate training of teachers; lack of power and reproduction facilities in schools; lack of storage facilities in schools; and inappropriate handling of kits.

The pilot successes were positive views from interviews and focus group discussions; science teachers motivated; enhanced student curiosity and interest in science; girls responded positively, gained confidence; and improved performance in national exams.

Evaluator recommendations were more science teachers to be recruited; ensure retention of trained teachers; examining body (NECTA) to advise on use of MSKs in national exams; Teacher Training Colleges to get MSKs and include in their curricula; pilot project to be scaled up to include many more schools; set up national MSK Centre; and budget for more monitoring and evaluation.

The second part of the presentation was given by Prof James Cosentino, Millersville University of Pennsylvania, International Organization for Chemical Sciences in Development (IOCD).

To date, UNESCO, in association with RADMASTE, has demonstrated the concept in over 70 countries with acceptance and enthusiasm. But the program always died after the demonstrations.

Challenges to implementing micro-scale science include:

1. Teachers have time and administrative constraints.
2. MoEd support: In many schools, teachers feel that the MoE is not supportive enough of performing practical laboratory work.
3. National importance: Teachers and schools must believe that they will be assisted and supported.
4. Science books: Show traditional sized equipment, so teachers may feel they cannot use micro-scale equipment.
5. There is a practical examination for learners when they complete secondary schooling and this still requires only traditional sized equipment to pass their examinations.
6. There is a lack of long-term implementation of microscience experiments. Indeed teachers cannot do this. MoEd are the only ones that can alter the secondary education syllabus to include microscience techniques.
7. Practical examination: Still requires only traditional sized equipment to pass their examinations.
8. Thus, no long-term implementation of microscience experiments: Only MoEd can alter the secondary education syllabus to include microscience techniques.

Our approach:

- 1st off: It’s not OUR approach …
- We arranged a meeting at the African Academy of Sciences with the following stakeholders to see what their challenges are and how they might be addressed: Kenya Ministry of Higher Education, Science and Technology; Kenya National Academy of Sciences; National Council for Science and Technology; Network of African Science Academies; and African Virtual University.

Policy Approaches – The Way Forward:

- Scientists interested in science equipment policy should include school equipment policy in their scope.
- Implementing any school science equipment policy, including the "microscience solution", will disappoint if the professional needs of teachers are not taken into account.
- In our experience, science teachers see the exciting opportunities that the microscience approach offers, and professional scientists generally agree it is a solution that deserves to be tried. Ministries of Education may acknowledge this but still fail to act. The teachers cannot do this. It is up to the MoEd. Of course there are many urgent educational needs and never enough money, so one understands the predicament. So what is the logical way forward?

Suggestions for the way forward:

- School equipment policy: Interest in science equipment policy should include school equipment in their scope.
- Teachers: Professional needs of teachers in any school science equipment policy need be taken into account.
- MoEd: Microscience solution provides exciting opportunities for teachers. MoEd sets policy and curriculum.

Pilot Project in Tanzania in 2010:

Microscience kits (MSK) were distributed to 180 secondary schools in 34 districts in nine regions. Training in the use of MSKs provided for 24 trainers and 15 inspectors, then 372 science teachers. We modified the approach for Kenya as a pilot project in selected schools.

A network of participating entities in a country or region of countries is established with the purpose of conducting substantial pilot projects with:

- full support from MoEs and their curriculum development and inspectorate staff
- university science education researchers involved in monitoring and evaluation
- continued participation by representatives of the professional scientific community

For the pilot project in selected schools, those involved are a network of entities:

- full support from MoEs and their curriculum development and inspectorate staff: KICD (curriculum development), KNEC (examination council), and CEMASTEA (teacher training)
- university science education researchers involved in monitoring and evaluation
- continued participation by representatives of the professional scientific community
- external agency, for funding, and might ensure a substantial and objective trial

The pilot project stage would have a duration of one year but setting up the network and reaching agreement on plans may add months to this. External agency funding might ensure a substantial and meaningful overall trial. (The outcomes will be of interest not only throughout Africa, but on other continents too.) It is of critical importance that teachers and schools involved know that the project is of national importance and therefore that they will be assisted and supported throughout. It will be imperative for each Ministry of Education involved to make changes to examination requirements to ensure these include the new scale of practical laboratory activities.

In terms of economic development, beyond the pilot stage there could be keen interest in local production of microscience equipment. This would certainly seem appropriate if a group of countries were planning to implement the "microscience solution" nationally. Whilst flexibility in meeting specific requirements of different national curricula can be anticipated, there could be a basis of commonality that would warrant manufacturing investment.

The immediate goals are:

- Determine the viability of the program; note benefits and pitfalls (e.g., Tanzania)
- Infusion of microscience into teacher training curricula and testing at university level
- Modify secondary education syllabus to include micro-scale science into curricula
- Establish pilot approach in selected schools to determine the viability of the program and modify the required experiments as needed, liaising with the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) to introduce microscience into teacher training curricula and testing
- Disseminate to teachers through training programs at university level

Science education is the mainstay of a developing nation. The project has value because it will increase the interest of young people in science so as to promote gender equality and scientific literacy, and provide a new level of science education and choice of a scientific career.

Discussion on Scientific Equipment Policy Themes

From the discussions and comments throughout the day, the key themes were noted, and then shared and discussed with the group. The following fifteen themes emerged:

1. Scientific equipment / research and development / national development

2. Entry points into existing frameworks: national (STIs) / regional / continental (STISA) / global (SDGs). Which parts of which policies should be taken forwards and by whom? Resources are limited but our desires (societal needs) are unlimited, can we link our research with SDG priority areas and then assess which equipment we need for those efforts.

3. What are the bodies / commissions that advise policy-makers? … the ones who "consult widely"

4. Evidence (quantitative) base for equipment needs and training needs, and for the effectiveness of policies

5. What do we want to see in a policy, such that when we follow it up through indicators, it will stimulate the importance of scientific equipment?

6. How to demonstrate the impact of research? What investments will bring benefits to a country's progress? What are the pieces that are "doable" in the view of policymakers?

7. What are some success stories of a healthy scientific equipment life-cycle? Can we gather some case studies?

8. Scientists speaking out … to whom? … through whom? … about what?

9. Learning how to work within and change "the system" … "follow the paper trail"

10. Devolution processes from national to (e.g.) counties, their research institutions and universities, and how to engage with local government in policy advocacy

11. "Seizing the moment" and developing relationships with international research organizations present in countries

12. Sharing, and policy aspects and mechanisms to support equipment sharing

13. Microscience and introducing children to science, inclusion of microscience within the curriculum

14. Domestically produced scientific equipment

15. Considering a gender lens applied to equipment needs

Channels of Advocacy for Scientific Equipment Policy Change

The participants selected the themes in which they had most interest and considered which themes lent themselves to merging for further discussion. This process resulted in three key themes for group discussion: Microscience; Impacts of research; and Frameworks and bodies. Gender was highlighted as a crosscutting theme. In small groups, the themes were discussed, and any thoughts were added that were considered to be important. Then, suggestions were sought regarding the channels of advocacy for policy change on scientific equipment, and finally about who needs to work together in policy change advocacy.

The outputs of the three groups were as follows:

Group 1: Microscience (addressing themes 13, 14 and 15)

The group comprised David Otwoma, James Cosentino, Truphena Oduol, Benjamin Gyampoh, Abreham Assefa, Jean-Paul Ngome Abiaga, Abebayehu Mamo, John Bradley, Crucifixa Makunda, Stephen Awuni, Antoine Affokpou, Tapsoba Issa and Njeri Mburu.

On setting up a microscience pilot project in Kenya:

- Pilot project within Kenya and any other in the region to have regional scope
- six months to set up and one year to run
- 32 schools spread within the original Kenyan provinces
- Identifying two lead science teachers for training
- Quality assurance officers (inspectors)
- Local researcher to oversee the M&E
- Local production of equipment – e.g., SEPU, Cameroon
- Continued workshops spread out

Various bodies to be involved would be Ministries of Education; Science and Technology; and Agriculture; national academies of sciences; AU; gender agencies; UNESCO; and AAS.

It is in the pipeline for KNEC to have assessment at the school level which would be good for this project. We can borrow this for monitoring at school level.

For the regional focus, think of other countries in the region, pilot at secondary level in Kenya, meet with other ministries in the region for discussions. Some countries already have some local production.

Microscience kits promote gender equality (example of Ghana and the region with low enrolment). There is a general drop in girls education up the ladder. Girls already have “micro- kitchen” and this is exciting for them. There is a lack of role models for girls and this needs to be balanced in the training. Female education researchers can be included in the study at the university.

Channels of advocacy for policy changes include:

- MOEST
- NGO
- NACOSTI
- Gender agencies
- Academies of science
- UNESCO
- Incentives
- Science events in school, such as international year of chemistry that attracted global interest and such events can bring in microscience; science week; science and engineering fairs; exhibitions
- Public-private partnerships, e.g., KARI, ILRI
- Media
- NEPAD
- AU
- ECOWAS
- UNDP
- AUF
- Government representatives

Questions and Answers

For advocacy, what mechanisms do we have to show concrete examples as evidence-based for packaging and presenting to policy makers? *There is such information in research reports including from Africa, but they need to be prepared and compiled for presentation to government. There have been eight international symposia on microscience.*

This is a way to use low cost materials for students to engage with science.

This is one way of building the best practice and M&E can inform wider take-up.

This approach introduced some students to science and they can be advocates.

This approach starts with forms 1 and 2 but ultimately can move to primary schools.

Zimbabwe revolutionised its rural education in the 1980s and this approach was missing. They came up with some successful efforts and there may be things to learn from that experience.

Group 2: Impact of Research (addressing themes 1, 4, 6, 7 and 12)

The group comprised Nadir Hashim (Chairman), Moses Ndotone, Julius Osaso, David Chiawo, Achille Assogbadjo, Kassahisu Tesfaye, Christopher Antwi, Ereck Chakaya, Ramandandraibe Sohangry, Yonli Djibril, Ketoh K Gillaume, Dourma Marra, Aissetou Yaye and Nina Dudnik.

Points discussed:

- Human resource mobilization and capacity building
- Linking research and society needs and SDGs. The question is how to do this.
- Need to provide incentives for research work, for example, provision of research funds
- Need for collaborations and linkages
- Noted that there is a lot of research but little on development
- Experiences at Strathmore University on industry linkage: one success story of industry-driven, problem-based, needs-based research and development
- There is need to translate research into products
- Inventory of equipment
- Needs assessment
- Capacity building, human resources development
- Strategic plans
- Linkage within and between institutions
- Strategic capital investments
- Need to centralize science equipment
- Engage policy-makers on contract of research
- Need to communicate science findings: case study of NACOSTI
- Poor communication channels locally – evidenced by poor turnout at local conferences
- Need for communication platforms that link all stakeholders

The following are doable to policy-makers: leakage of money, contribution to DG's justification of, e.g., 2% of GDP for research based on R&D from universities and research institutions

What are some contributions of science to national development? Spin-offs, e.g., CERN – need to learn from Europe and USA; improved crop varieties

Some needs are for:

- impact assessment
- increased funding
- tax rebates
- interesting government in science
- governments to see the relevance of science to development
- scientists to be proactive to attract funding.
- sharing equipment
- policy on science equipment
- overseeing of processes like procurement, running and disposal
- sound asset management policies
- training of technicians
- national policy on science equipment that should incorporate risk management and equipment disposal

A success story is the case of BAKER – an initiative of AU and ILRI – funded by Canada to refurbish the lab and make it accessible to regional scientists. The science equipment is accessible to all scientists in the region. The institution has two main programs: research and capacity building. They host fellows from Africa.

Group 3: Frameworks and Bodies (addressing themes 2, 3 and 8)

The group comprised Tichaone Mangwende (South Africa), Edward Yeboah (Ghana), Roseanne Diab (South Africa), Charles Recha (Kenya), Stephen Situma (Kenya), Michelle Ratsinbasom (Madagascar) and Abebe Mekuriaw (Ethiopia).

Thoughts on frameworks and bodies:

- Fitting into the existing agenda
- Sustainable Development Goals (SDG)
- Agenda 2063
- Common African Position Post 2015
- STISA 2024
- African Peer Review Mechanism (APRM); 33 members now
- Indicators for STIs: policies to support infrastructure; equipment should not been seen in isolation but to be discussed within a framework, e.g., government contributing 1% of GDP to STIs; model research in line with existing frameworks
- Countries align their policies to continental frameworks

Channels of advocacy and advice on policy change for scientific equipment:

- National science technology and innovation policies
- National strategy for STI
- Implementation plans
- Programmes and projects

Who needs to work together in policy change advocacy and advice:

- National science academies
- National research systems
- African Academy of Sciences (AAS)
- Regional bodies such as CORAF, ECOWAS, SADC, EAC and FARA

Comments

We lack policies for scientific equipment; one issue is disposal and adopting equipment marked for disposal elsewhere.

We must not forget the need for *blue skies* research and the role for equipment policy in this context, e.g., astronomy investment in South Africa.

Making Informal Commitments

All colleagues wrote down and read out informal commitments that they would aim to take forwards from this meeting.

Help convene university leaders and researchers and combine Seeding Lab's knowledge of what equipment we have placed where to develop open inventories of equipment to facilitate sharing; work with groups interested in establishing core/shared facilities to try to provide needed core equipment; looking for partners with whom to carry out these commitments. (Nina Dudnik, Seeding Labs)

South Africa has a national equipment policy that is part of an R&D strategy. It is run by our National Research Foundation. So there is not much I can do at country level. However, as a representative of an academy we often engage other academies in our region (SADC) to disseminate such products as policy briefs to other countries in the region in order to influence policy. So I would be willing (dependent on funding availability) to host such a meeting to disseminate with southern Africa and possibly broader. (Rosanne Diab, Academy of Science of South Africa)

Provide for a comprehensive policy environment for science, technology and innovation in Africa; Africa needs policy, program and social entrepreneurs. (Tich, NEPAD Agency)

I believe that inclusion of science (hands-on) in the general education is one fo the most sustainable ways to induce a policy improvement in science in general, and scientific equipment in particular. Thus I engage UNESCO's IBSP to work with AAS, IOCD, RADMASTE and different partners in Kenya and in the region in view of the establishment of a Regional Microscience Program, starting by a pilot project in Kenya. I also commit seed funds for this microscience project. This is more a formal commitment than an informal one, as the responsible officer for microscience in UNESCO. (Jean Paul Ngome Abiaga, UNESCO, IBSP)

Influence Egerton University to put in place a scientific equipment policy, the specifics of which should be needs assessment, use (inclusive of sharing), service and maintenance, disposal. (Charles Recha, Chair and Lecturer, Department of Geography, Egerton University)

As an engineer in the field of scientific equipment, I am committed to provide technical services in every aspect of the scientific equipment life-cycle supporting scientific research. As an involved individual in scientific equipment, I will be knocking every door until scientific equipment policy is realized. (Abebayehu Mamo)

Involving policy-makers in research during reporting and communicating of research outcomes; introducing or initiating the development of policies on equipment usage and maintenance to research team members within institutions which can later be upscaled; initiating equipment inventory in my institution and publishing a database on the institution's website. (Christopher Antwi, IFS alumni, lecturer at KNUST, Ghana)

Advocate for a policy on maintenance and disposal of obsolete science equipment in secondary schools in Kenya; disseminate a report on the workshop especially giving emphasis on the possibility of incorporating microscience in the curriculum for regions in dire need of science equipment in Kenya. (Truphena Odour)

Enhance the assessment of science practical skills; a role model for girls in science to further scientific research. (Crucifixa)

Work with AAS, IFS and ANAFE Member Institutions to take the message from this project to various institutional leaders and policy-makers; promote, develop and apply relevant policies on scientific equipment in the ANAFE efforts towards curriculum reforms. (Aissetou Drame Yaye)

Promote interest in microscience ; act as a resource of knowledge and experience in the use of microscience. (John Bradley, RADMASTE Microscience Project, University of the Witwatersrand)

Highlight and try to popularize the approach of facilitated advocacy in the context of policy change to progress this kind of consultation and the processes of change that can flow from it. (Graham Haylor)

Incorporate microscience techniques into primary and secondary schools with the MoEs, AAS and UNESCO. (James Cosentino, IOCD)

Request the Ethiopian Academy of Sciences to take the issue of providing evidence-based advice to the Ministry of Science and Technology to address the issue of scientific equipment policy. Propose consultative discussions on the outcomes of the IFS/AAS study at national level. Take the agenda of microsciences to the Academy. (Abebe Mekuriaw)

Convince my DG of the necessity to institute exemptions to the regulations ruling the general procurement procedure when it is for scientific equipment. Work on the way to improve sharing of scientific equipment strategy between and within research institutions. (Antoine, Benin)

Use my experience after the training to talk about the need to make a policy.

Share information from this Consultative Meeting to contribute to the ongoing process of research policy elaboration in Togo; formalize the Togo IFS alumni association.

As a regional INSET provider, I commit myself to be at the frontline in an activity-based teaching and learning where the learner is at the center of learning with practical activities drawn mainly from the immediate environment.

Engage in research in line with national development agenda and that responds to needs of the society; communicate research results at different levels, beyond journal articles, to policy-makers and community; use IFS alumni platform to advance mentorship of early-career scientists and research collaboration; engage with policy-makers.

Use contacts within national systems to push for science equipment policy in Ghana (Benjamin Gyampoh)

Appoint working committee on scientific equipment; hold meetings of the committee; come up with a draft policy for scientific equipment; get stakeholder feedback; present report to policy-makers (David Otwoma, NACOSTI)

Facilitate to improve the inventory and sharing system of science equipment in my institution; strengthen the link of IFS alumni in the country. (Abreham Assefa)

Give a written report of the meeting; organize a sensitization meeting on the scientific equipment of my office; advocate for the same to be introduced as soon as possible. (Situma Stephen, NACOSTI)

Generate an inventory of what we have that can be shared in the region; promote the sharing of the same in a sustainable manner.

Contact the Direction of Research in the Ministry of Technology; report on the main points discussed during this meeting; in keeping with national strategy of research, implementation of this national strategy (three PDRs), including equipment policy in the implementation of this strategy which is not clearly stated.

Share with colleagues the need to develop a science equipment policy in kline with the goals of the organization and institution; borrow what is already existing policy on management and purchasing and fit in with equipment framework; a personal goal to address this gap. (Julius Osago, BecA, ILRI)

Set up specific law regarding the procurement and disposal of scientific equipment; map research centers and inventories of scientific equipment; submit a report of this meeting to our government to alert it on scientific equipment issues; share the outputs of the meeting to IFS alumni in Burkina; commit myself to sensitize my colleagues about sharing and use of scientific equipment. (Yonli Djibril)

Contribute to the inventory of scientific equipment available through IFS alumni; contribute to a national inventory of existing scientific equipment in Burkina Faso through my position at the Ministry of Scientific Research; submit an official report to the Council of Ministers to highlight the need for support for scientific equipment acquisition. (Tapsoba Issa, Burkina Faso)

Share outcomes of the scientific equipment policy with colleagues; explore having quantitative data on existing science equipment policy in Ghana; in line with SDGs, develop proposals on scientific equipment (Edward Yeboah, IFS alumni, Ghana)

We need this network to enhance exchange and communication between different countries to develop research in my country and to ask about the current situation in my country, according to what was said during this meeting. (Ramanandraige Voahangy)

Use my position to push for equipment policy dialogue at university level; include the issue of equipment policy in my presentations and talks at national conferences and workshops; bring this issue to the attention of members of the Ethiopian Biotechnology Society and OFAB Ethiopia Chapter; open the institute facility for shared use and develop guidelines for its proper use and maintenance; open my lab for others for improved and efficient use. (Kassahun Tesfaye, Addis Ababa, Ethiopia)

The mandate of my institute also includes advising government on research issues related to STI. I will use my position as a research scientist to work together with my director (Commissioner at NDPC) to push the issues of scientific equipment to the National Development Planning Commission for effective policy formulation. (Stephen Awuni, CSIR-STEPRI, Ghana)

Mapping the existing equipment at university level and propose to my vice chancellor a technical note related to rules and policies to support sharing; inform colleagues, young scientists and researchers about equipment issues for research development. (Achille Assogbadjo)

Actively participate in the formulation and implementation of policy on scientific equipment at the institutional and national levels as required. (Nadir Hashim)

Equipment inventory; indicators on sound research management including scientific equipment management; conduct a pilot study of the needs for biosciences equipment in the SADC region (policy and use). (Ereck Chakanya, SANBIO)

AAS will pursue advocacy role to persuade governments and institutions in them to develop clearly articulated guidelines for the procurement, manufacture, installation, shared use, operation and maintenance of scientific equipment, including microscience equipment. I see our reference to “equipment policy” as guidelines for equipment within a national STI policy and within a national procurement policy. (Berhanu Abegaz, AAS)

Closing Remarks

The director of IFS thanked all for taking the time to attend the consultation meeting and commended the participants on their contributions and especially their commitments to carry forward this issue. He said that this project has run for the past two years and is now beginning in many ways to try to raise its findings up to the policy level. He referenced how encouraged we are by the constructive proactive comments from the Chief Minister yesterday. However he stressed that this is not a Kenyan issue it is not even a pan-African issue, but a global one. He thanked AAS Director Professor Berhanu and his dedicated staff, for collaborating on the project and for hosting the meeting and hoped everyone would join him in thanking William Savage for facilitating the meeting.

Appendix 1 Schedule

Day One – Thursday, August 20		
Session		**Speakers**
0900-0925	Welcome and introductions	• Prof Berhanu Abegaz, AAS • Dr Graham Haylor, IFS • Dr Jean-Paul Ngome Abiaga, UNESCO • Dr Moses K. Rugutt, NACOSTI
0925-0940	Official opening	• Prof Isaac O Kibwage, Principal of the College of Health Sciences, on behalf of Prof Jacob Kaimenyi, Cabinet Secretary, Ministry of Higher Education, Science and Technology
0950-1005	Background of the project	• Dr Nighisty Ghezae, IFS
1005-1030	The briefing document	• Dr Benjamin Gyampoh, AAS
1030-1100	Break	
1100-1230	Country experiences from Ethiopia, Ghana and Kenya	• Mr Abebe Mekuriaw, EAS, and Mr Abebayehu Mamo, NMIE, Ethiopia • Mr Stephen Awuni, STEPRI, Ghana • Dr Hashim Nadir, Dr David Otwoma and Mr Stephen Situma, NACOSTI, Kenya
1230-1400	Lunch	
1400-1500	Experiences of early-career scientists	• IFS alumni representatives
1500-1530	Statement on microscience, scientific equipment, and policy approaches	• Prof John Bradley, RADMASTE Centre • Prof James Cosentino, IOCD
1530-1600	Break	
1600-1700	Facilitated roundtable discussion on scientific equipment policy and programs	• Everyone

Day Two – Friday, August 21		
Session		**Speakers**
0900-1030	Channels of advocacy on scientific equipment policy change	• Small groups with whole group report back
1030-1100	Break	
1100-1200	Making informal commitments	• Everyone
1200-1230	Consultation meeting evaluation and closing remarks	• Dr Graham Haylor • Prof Berhanu Abegaz
1230	Farewell lunch	

Appendix 2 Participants

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Appendix 3
Statement on Microscience, Scientific Equipment and Policy Approaches

John D Bradley, RADMASTE Microscience Project, University of the Witwatersrand
James Cosentino, IOCD

The "Microscience Solution"

The school education system prepares future citizens for participation in society. As regards science it aims to provide scientific literacy for the majority and a basis for scientific and technological careers for a minority. Both these aims require an understanding of how science gains its insights and how these enable so many beneficial contributions to sustain society. This understanding is most likely to be gained by hands-on, personal scientific experiences.

To have these experiences does not necessarily mean using the same equipment as current researchers; it means choosing versatile equipment that is easy to use and maintain and that allows for scientific processes, principles and thinking. This does not mean that one simply takes whatever was used before and assumes there is no better choice. On the contrary, although one would not seek out the latest tools of research, one would not sensibly ignore general trends in equipment and methods, if they have benefits in the educational context.

These remarks provide background to the claims for the potential benefits of microscale science equipment in science education. Such equipment is versatile and easy to use, and reflects the general trend in science practice towards small-scale work. This trend is undoubtedly driven by considerations of cost, environmental impact and safety. Further valuable cost reductions are achieved by, for example, using plastics rather than glass as a material of construction. And finally the microscale methods do not require a purpose-built laboratory and substantial storage facility traditionally expected in a school context. Setting this requirement aside means an enormous initial cost-saving, whilst at the same time making science less of an elite reserve and more a part of general education.

All this then is the "microscience solution" for some entrenched educational problems that affect the good health of the greater scientific enterprise.

The Problem of Practical Work in Schools and How Microscience Offers a Solution

What then are the problems? In school science curricula around the world, practical activity invariably has a mention. An overwhelming majority of role players believe such activity is an essential part of science education. Yet it is a minority of real school classrooms that witness this. Mostly there is neither equipment nor consumables; sometimes there was but it is broken; sometimes there is and it is still in the boxes in which it was delivered. Often there is no laboratory; if there is, it may be used for a range of other purposes. The general conclusion, especially in less-developed countries, is that practical work in school science is not experienced by the majority of students. It follows that science education is weak and uninspiring in most schools! This is not just a result of lack of the physical resources, although this is one important contributor. The other major contributor is often the science teachers, who lack the knowledge and skills needed to use the physical resources successfully and the technical assistance to support them in preparation, maintenance and waste disposal. Reports emanating from the earlier stages of the IFS-AAS Project on Scientific Equipment Policy also identify these and other problems in school practical science.

Microscience offers a solution, using student kits in the form of a plastic lunchbox, with a variety of components to be used in conjunction with a plastic micro-well plate. These can be used by individual students or small groups of students (for example in Cameroon, the standard formula was six students at one small desk per kit in a regular classroom). Care and maintenance of the kits is intended to be assigned to the students. A source of water somewhere in the school is necessary, but electricity is sourced from cells or batteries (which may be of renewable type). Chemicals are not included in the student kits but held and controlled by the teacher. Quantities required for chemically-based activities are typically drops, or less than 1 ml of liquids, important from the viewpoint of cost, safety, environmental impact and waste disposal.

Students react positively to hands-on practical science activities, motivating the science teacher to capitalize on this and achieve better learning. With these activities as a regular focus, teachers will naturally adopt learner-centred teaching strategies which are generally considered more effective than chalk-and-talk.

Attempts to Implement the "Microscience Solution"

Over more than 20 years, the RADMASTE Centre (University of the Witwatersrand), UNESCO (Basic Sciences), IOCD, IUPAC and other organizations have worked to introduce the idea of a "microscience solution" to countries that seem in desperate need of a solution. The main active component of this introduction has been two- or three-day workshops for educators – usually a mix of officials, teachers and teachers trainers. More than 80 countries have had this kind of event and invariably the message has been "this is the solution to problems we thought could not be solved!" In some countries (in Africa – Cameroon, Cote d'Ivoire, Rwanda, Angola, Ethiopia) there has been follow-up, for example a national teacher training event with a hundred teachers over three days, sponsored by the Ministry of Education (sometimes with UNESCO support).

Clearly an intention existed somewhere to begin implementing microscience practical activity in schools. But almost invariably nothing further happened! Instances of meaningful uptake around the world are few: in Africa, Cameroon stands out; in the Caribbean, Guyana stands out. A UNESCO-sponsored pilot project started in Tanzania in 2011 and ran for three years; an independent evaluation report submitted to UNESCO towards the end of 2014 found several benefits (for example in learner motivation, examination results and participation by girls) and recommended expansion of the microscience-based project to more schools. We need more pilot projects in different countries, where the microscience approach can be tried and evaluated in typical schools with typical teachers in the context of the different national curricula. Such pilot projects would engage local university science education researchers in observation and evaluation, so that the best possible insights are gained about how to advance the implementation or to abandon it. A small pilot project of this nature is beginning in Mozambique currently.

Scientists have a vital role to play in moving forward this agenda from discussion to action. Ambitious plans for development in Africa will be badly handicapped if we cannot do better. The interest that AAS has taken in this campaign is a great asset and we look forward to continuing cooperation.

Policy Approaches

Scientists interested in science equipment policy should include school equipment policy in their scope. In any national or regional consensus on policy it is in the better interests of scientists to do so. National and regional recognition of the importance of scientists empowers them to speak out on the needs of the school system, as well as their own direct needs. Scientists will agree however that getting equipment for research and development is of little value if there are not sufficient capable and creative people to use it effectively. Similarly in the school system, simply getting equipment of any scale is of little value if the teachers and their professional support are lacking. Thus implementing any school science equipment policy, including the “microscience solution”, will disappoint if the professional needs of teachers are not taken into account.

In our experience, science teachers see the exciting opportunities that the microscience approach offers, and professional scientists generally agree it is a solution that deserves to be tried. Ministries of Education (MoEs) may acknowledge this but still fail to act. Of course there are many urgent educational needs and never enough money, so one understands the predicament. So what is the logical way forward?

1. A regional grouping of countries sees promise in the “microscience solution” and decides that there could be advantage in working together, to firstly explore and then to implement it.

2. A network of participating entities in these countries is established with the purpose of conducting substantial pilot projects with (i) full support from MoEs and their curriculum development and inspectorate staff, (ii) university science education researchers involved in monitoring and evaluation, and (iii) continued participation by representatives of the professional scientific community.

3. The pilot project stage should be completed in one year, but setting up the network and reaching agreement on plans may add six months to this. External funding might be motivated to ensure a substantial and meaningful overall trial. (The outcomes will be of interest not only throughout Africa, but on other continents too.)

4. For the pilot stage, existing microscience equipment should be used and all effort should be devoted to adaptation of existing teaching and learning resources (e.g., learner worksheets, teacher guides). The equipment itself is versatile so individual countries can fully adapt existing resources and/or introduce their own preferred practical activities. It is of critical importance that teachers and schools involved believe that the project is of national importance and therefore that they will be assisted and supported throughout. This is especially the case because during the pilot project, it would be premature to make other major changes such as the textbooks.

5. Should the overall outcome be disappointing, further joint effort towards the “microscience solution” should be abandoned. Individual countries and MoEs would of course be completely free to do as they decide. Should the overall outcome be promising, there could be discussion as to the desirability of continued joint efforts. There are clear potential benefits of joint efforts, but the wider the implementation in different countries, the more national curriculum differences may come to the fore. Hence one might anticipate that some will want to go forward independently and others will decide to continue close collaboration. Either way it will be imperative for each Ministry of Education involved to quickly make changes to textbooks and examination requirements to ensure these reflect the new scale of practical activities in the classrooms.

6. Beyond the pilot stage there could be keen interest in local production of microscience equipment. This would certainly seem appropriate if a group of countries were planning to implement the “microscience solution” nationally. Whilst flexibility in meeting specific requirements of different national curricula can be anticipated, there could be a basis of commonality that would warrant manufacturing investment.