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

Ghana National Scientific Equipment Policy Workshop

CSIR-STEPRI Auditorium
Accra, Ghana
31 March – 1 April 2014

Contents

Acronyms

AAS	African Academy of Sciences
AAU	Association of African Universities
ARI	Animal Research Institute
AU	African Union
AUC	African Union Commission
BRRI	Building and Roads Research Institute
COMEDAF	Conference of Ministers of Education in Africa
CRI	Crop Research Institute
CSIR	Council for Scientific and Industrial Research
ECOWAS	Economic Community of West African States
EPA	Environmental Protection Agency
FARA	Forum for Agricultural Research in Africa
FASDEP	Food and Agriculture Sector Development Project
FDA	Food and Drugs Authority
FORIG	Forest Research Institute of Ghana
FRI	Food Research Institute
GAAS	Ghana Academy of Arts and Sciences
GAEC	Ghana Atomic Energy Commission
GETF	Ghana Educational Trust Fund
GMet	Ghana Meteorological Agency
GNA	Ghana News Agency
GSA	Ghana Standards Authority
GSGDA	Ghana Shared Growth Development Agenda
IAEA	International Atomic Energy Agency
ICT	Information and Communication Technology
IFS	International Foundation for Science
IGF	Internally Generated Funds
IIR	Institute of Industrial Research
ISO	International Standards Organization
KNUST	Kwame Nkrumah University of Science and Technology
LDP	Livestock Development Project
LIPREC	Livestock and Poultry Research Centre, University of Ghana
MDA	Ministries Departments and Agencies
MESTI	Ministry of Environment, Science, Technology and Innovation
MOFA	Ministry of Food and Agriculture
MOTI	Ministry of Trade and Industry
NEPAD	New Economic Partnership for Africa's Development
NLSP	National Livestock Services Project
NMIMR	Noguchi Memorial Institute for Medical Research
OPRI	Oil Palm Research Institute
PGRRI	Plant Genetic Resources Research Institute
PPA	Public Procurement Authority
RPI	Radiation Protection Institute
S&T	Science and Technology
SARI	Savanna Agriculture Research Institute
SRI	Soil Research Institute
STEPRI	Science and Technology Policy Research Institute
STI	Science, Technology and Innovation
TCPD	Town and Country Planning Department
TWAS	The World Academy of Sciences
UCC	University of Cape Coast
UDS	University for Development Studies
UG	University of Ghana
UNDP	United Nations Development Programme
UNCTAD	United Nations Conference on Trade and Development
WAAPP	West African Agricultural Productivity Programme
WRI	Water Research Institute

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) are continuing their collaboration through the implementation of the MacArthur Foundation-funded project on scientific equipment policy development and change, along with partner organisations in Ethiopia, Ghana and Kenya.

A description of the background to this year-long project can be read in the IFS Briefing Document 1/2012: *Addressing Equipment Challenges in Development-related Scientific Research in Africa*[1].

Project Process

Informed by the discussions and outcomes of the Inception Workshop held in Nairobi on 4-5 November 2013, these project activities are following (with tentative timings indicated):

- Country studies with national co-facilitators in Ethiopia, Ghana and Kenya to review the effectiveness of science equipment policies [2] of key organisations in relation to organisational structures and systems; and to map the national and regional research and policy landscape (January – March 2014)
- National Scientific Equipment Policy Workshops in Kenya, Ethiopia and Ghana [schedule in Appendix 1] (one-and-a-half days each, back-to-back, March-April 2014)
- Preparation of briefing and recommendations document (April – June 2014)
- Share project outcomes (by July 2014)

Workshop Participants

Invited participants (Appendix 2) to the workshop include:

- Representatives from partner organisations in Ghana
- Representatives of policy-making entities in Ghana
- Representatives from interested academies, associations, commissions, institutes, networks and universities in Ghana and across Africa

[1] http://ifs.modx.kaigan.se/IFS/Documents/Publications/Briefing%20Documents/IFS%20Briefing%20Document%201-2012.pdf

[2] or practices, procedures and guidelines, where policies do not exist

Opening Session

Welcome and introductory remarks were made by Dr George Essegbey of STEPRI, Dr Nighisty Ghezae of IFS, and Prof Francis Allotey of GAAS.

Dr George Essegbey, Director, STEPRI

Distinguished guests from the African Academy of Sciences and the International Foundation for Science, colleagues from the science fraternity in Ghana, ladies and gentlemen:

Once again we have assembled here in the STEPRI Auditorium for an important purpose. Over two days we shall engage in discussion of a subject of national significance. The driver of good science in every nation boils down to the scientific equipment available in the laboratory and the functionality of that equipment. It does not matter what level of science we engage in nor does it matter what particular discipline. Scientific equipment available in the scientific institutions will determine the quality of their outputs. But let me not preempt the presentation of the study we have assembled to discuss.

I am happy to be your host during the period of the workshop. The Science and Technology Policy Research Institute (STEPRI) was established for providing research inputs for policy formulation and implementation to facilitate national development. We see the study conducted on scientific equipment as one of the studies in line with our mandate and we hope that the deliberations here at the workshop will enable Ghana to strategize effectively towards improving the equipment situation in our scientific institutions.

I welcome you all, especially our guests from abroad. We say Akwaaba.

Dr Nighisty Ghezae, Head of Programme, IFS

Professor Francis Allotey, President of the Ghana Academy of Arts and Science and Vice President for Western Africa of the African Academy of Sciences, the Director of STEPRI, Dr George Essebey, distinguished delegates and guests, ladies and gentlemen,

It is an honour and a great pleasure to welcome you on behalf of the International Foundation for Science to this IFS-AAS initiated project on "Developing an enabling scientific equipment policy in Africa" and the opening of the two-day Ghana National Workshop. I am particularly honoured to be joined in this event by the President of the Ghana Academy of Arts and Sciences, Professor Francis Allotey, a distinguished scientist of our continent. Prof Francis, thank you for joining us.

Recognising the urgency of addressing the problem of scientific equipment and the need to develop and implement sound scientific equipment policy, IFS and AAS have continued collaboration through implementing this MacArthur Foundation funded project along with partner organisations in Ghana, Ethiopia and Kenya. In follow-up to the project's Inception Workshop held at AAS in Nairobi from 6-7 November 2013, three teams in each of Ethiopia, Ghana and Kenya were requested

by IFS and AAS to conduct Country Studies, to better understand about the policy environment that affects how scientists get and use scientific equipment. Specifically the studies were to:

- *Review the effectiveness of science equipment policies of key organisations in relation to organisational structures and systems, and*
- *Map the national and regional research and policy landscape*

I would like to thank you for joining us today to discuss the Ghana Country Study that is of great interest to us all. Today's workshop is an important part of the evidence gathering process. You all have something to bring to this discussion, so I hope you will all contribute actively to achieve the intended outcomes of these two days, namely to:

- *Document existing management procedures and available manpower and maintenance for scientific equipment in selected target institutions, and*
- *Recommend policies and guidelines for scientific equipment acquisition, operation, maintenance and disposal*

I am sure you will be most successful in this endeavour. IFS is at your side as you embark on a new journey for the cause of the people of your country. We await with great anticipation the results of your deliberations so as to strengthen the cooperation among IFS, AAS and Ghana.

At this point, I would like also to thank the Director of STEPRI, Dr George Essegbey, for the work that he and his staff have put into this study but also for making it possible for this workshop to be held and for managing to assemble an impressive mix of policy-makers, researchers and experts in the field.

Ladies and gentlemen, in concluding, I wish you a stimulating seminar and I hope there are many interesting contributions that will feed into our deliberations. I am confident that the exchanges among participants during these two days will raise awareness about why it is important to share widely the needs related to science equipment and to facilitate policy mechanisms required to enliven scientific research in Ghana. I believe that the design of policies and practices may be enhanced by improved interactions among those who gather and share rigorous data and research evidence, those charged with making policy and those who would be the beneficiaries of their efforts.

I would also like to sincerely thank the MacArthur Foundation for funding this workshop. Thank you.

Prof Francis Allotey, Vice President for West Africa of AAS

The Director of STEPRI, Dr George Essegbey, the IFS team Dr Nighisty Ghezae and Mr William Savage, distinguished researchers and policy makers, partners from the media, invited guests, ladies and gentlemen. It is a pleasure for me to be here and say a few words of welcome to you.

The African Academy of Sciences is a Pan African Scientific Organisation of all knowledge. At the AAS, there is high acknowledgement for interdisciplinary and transdisciplinary approaches to solving problems, and hence, since its establishment in 1985, it has been an academy of all knowledge – Physical Sciences, Natural Sciences, Social Sciences, Engineering. Our Fellows range from Mathematical Physicists, Theologians, Lawyers, Civil Engineers, Educationists, Geologists, Information Scientists, Phytochemists and all branches of knowledge one can imagine. Our vision is to drive sustainable development in Africa through applications of transdisciplinary knowledge and Innovation. The mission of the academy is to mobilize the entire African science and technology community for sustainable development. The academy intends to attain its mission and vision through four main activities:

1. *Recognising Excellence – AAS confers fellowships to the best African scientists and researchers and non-Africans contributing to the scientific development of the continent. It also recognizes excellence through various competitive prizes run by the Academy.*
2. *Tasking our Fellows to undertake reviews as well as forecast studies and using the information generated by these studies to give advice to governments as well as regional bodies.*
3. *Developing quality and relevant programmes to promote science for development.*
4. *Mentorship and training for young scientists on the continent in order to prepare them to take charge of their future through engagement in science, technology and innovation in Africa.*

In 2013, the AAS developed a new strategic plan that indicates the direction it intends to take for the period 2013-2018. The Plan outlined the interventions, programmes, activities and projected outcomes of AAS and also guides the relationship between AAS and its key stakeholders which includes the Academy's Fellows, partnering organizations and policy makers. The academy identified these six thematic areas to concentrate its efforts during the five-year period:

- *Water and sanitation*
- *Sustainable energy*
- *Food security and nutritional well-being*
- *Health care and well-being*
- *Science, technology, engineering and mathematics*
- *Climate change*

No success or meaningful impact can be made to achieve sustainable development through science if the right equipment to do the research is not available. We are, therefore, fully committed to ensure the creation of enabling environments for the production, procurement, usage, sharing, transfer and disposal of science equipment that will promote high quality and relevant research.

The AAS, IFS and MacArthur Foundation started the discussion on science equipment policy some three years ago, which resulted in a gathering of scientists from Africa in June 2012 at the AAS secretariat in Nairobi to discuss "Getting and Using Equipment for Scientific Research". The recommendations from that meeting

are what is being worked on and has brought us to this stage of the journey in "Developing an enabling scientific equipment policy in Africa". The Kenya workshop on this same theme ended on Saturday 29 March 2014 and we are here to learn the results of the Ghana study. On 3-4 April, the Ethiopian study will also be presented at a similar workshop in Addis Ababa. The African Union Commission, a partner in this project, participated in the Inception Workshop in Nairobi and will be present at the meeting in Addis Ababa. Already, effort is on-going to take the messages from Kenya, Ghana and Ethiopia to the whole continent through the African Ministerial Council on Science and Technology. The Executive Directors of AAS and IFS are meeting with the AUC tomorrow on this process.

AAS as a continental organization always works with partner organisations, especially National Academies, and we are happy that our working relationship with the Ghana Academy of Arts and Sciences (GAAS) has been formalized with the signing of an MoU late last year. We are also happy with the IFS who continues to partner with AAS and scientists on the continent. I also thank STEPRI for their hard work on this project in Ghana. The relationship between AAS and STEPRI has started well and we believe, together with the Ghana Academy of Arts and Sciences, that we can achieve a lot in promoting science, technology and innovation for sustainable development in Ghana and Africa as a whole.

I wish all of us a fruitful workshop.

Prof Francis Allotey, President, Ghana Academy of Arts and Sciences

Mr Chairman, distinguished guests, ladies and gentlemen, the Ghana Academy of Arts and Sciences is gratified to be part of this all-important event, which I am afraid in the grand scheme of things, has not received ample attention as it should.

The Academy was established by an Act of Parliament of 1959 with the mission to encourage the creation, acquisition, dissemination and utilization of knowledge for national development through the promotion of learning. The Council for Scientific and Industrial Research (CSIR) was split from the Academy by NLC Decree 291 of 1968.

Mr Chairman, the three major development goals that have been articulated by African leaders in recent time include improvement of the quality of life of every African, economic integration of the region, and improved trade and linkages with the global community. At various fora, our leaders have made pronouncements and declarations that the above stated goals can only be achieved through the utlilization of research, science, technology and innovation.

In order to effectively attain an operational capacity in science, technology and innovation, it is a necessary perquisite that scientists are provided with adequate infrastructure in the form of human resources and equipment. Modern science, technology and innovation enterprise is expensive but a necessary investment for the future. Gone are the days when a single scientist in an attic of a laboratory using simple wires, instruments and wax costing a few dollars could perform a Nobel winning experiment. In our contemporary world, to make a meaningful scientific and technological breakthrough requires several scientists using sophisticated and

expensive equipment which sometimes could cost a few hundreds to millions of US dollars.

Advanced countries like the USA, Europe, Brazil and Russia have national and regional equipment centers for their scientists, places like CERN in Switzerland, Argonne National Laboratory in the USA, and Dubna in Russia. They pool their expensive infrastructure together for national and regional use. In Ghana, for example, the Laser and Fibre Optics Centre (LAFOC) at Cape Coast University and the Reactor and Gamma Radiation Facilitaties at Ghana Atomic Energy Commission could be designated and used as national research centres.

It should be mentioned here that multinational corporations operating in Ghana do not conduct R&D in the country. Their R&D is done outside. They must be encouraged with correct tax incentives for them to undertake some of their R&D in Ghana. In fact it is being suggested here that before the Ghana Government signs any major agreement with a multinational company to operate in the country, it should be requested that they do some of their R&D in the country as appropriate. In the advanced countries both the government and private industries fund and promote research. This is not the case in many countries in sub-Saharan Africa with the exception of South Africa.

The theme of the workshop, "Developing an Enabling Scientific Equipment Policy in Ghana," therefore is important and timely. The issue of the need for scientific equipment policy in Ghana has occupied the minds of the Academy and we wish to thank and congratulate the organizers of the workshop. We are proud to be associated with it. It is our desire that out of this meeting will emerge a concrete, coherent and effective policy position that government will find imperative to adopt and execute to ensure that Ghana is counted among the league of nations at the cutting edge of the use of the most innovative ideas of scientific equipment usage and management to help Ghanaian scientists to utilize sciences for rapid social and economic development.

We wish all the participants fruitful deliberations. Thank you for your attention.

Background of the Project

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

IFS has been committed to addressing the equipment challenge since its establishment in the early 1970s. It has already supported over 7,600 early-career scientists in 105 countries throughout Africa, Asia-Pacific and Latin America, with research grants and capability-enhancing support, including training on good laboratory practices. More than 80,000 scientists have benefited from using IFS-funded equipment.

In May 2012, IFS and AAS organized a conference on Getting and Using Equipment for Scientific Research in Africa. Its specific objectives were to:

- Learn lessons about and from implementation of the MacArthur Foundation-funded project on equipment procurement
- Consider two other approaches to scientific equipment provision from:
    - IFS, with particular reference to early-career scientists and collaborative teams
    - Biosciences Eastern and Central Africa (BecA), which provides opportunities in Africa for scientists to utilize well-equipped laboratory facilities
- 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 of the efficacy of various approaches to scientific equipment provision. The resulting Briefing Document (see footnote 1) was shared with other research institutions and funding organizations.

Nine key learning points arose 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 proper clearing and forwarding agents and lobby for simplified procedures for importing and forwarding scientific equipment.
- Face-to-face meetings are best to understand long-term needs and equipment upgrade paths.
- Develop standard procedures for efficient use, since burdensome paperwork and regulation in institutions and universities can limit the use of installed equipment.
- Centralization enables pooling of resources, efficient management, adequate security, infrastructure, and utilities.
- Negotiate collaboration around expensive equipment within a country or region.
- Discourage personalization of equipment (the opposite of collaboration).

Additional learning with Pan-African significance included addressing the problem of scientific equipment with the urgent development and implementation of sound policy, and concrete actions that are necessary to influence it.

IFS and AAS are continuing their collaboration with partner organisations in Ethiopia, Ghana and Kenya. An Inception Workshop took place on 6-7 November 2013 on the AAS campus in Nairobi, with intended outcomes of familiarization of participants with scientific equipment and policy issues, the project and each other; contribution of participants to the project design and process; and a project work plan.

The overall purpose of the project is to understand how science equipment policy changes that benefit the scientific endeavor might be accomplished across Africa. To this end, country studies will be carried out in the three pilot countries of Ethiopia, Ghana and Kenya, to get national understanding about the policy environment that

affects how scientists get and use scientific equipment. The specific objectives are to review the effectiveness of science equipment policies of key organisations in relation to organisational structures and systems; and to map the national and regional research and policy landscape

The studies should review:

- Existing national frameworks as entry points for scientific equipment policy development and change
- Current research priorities
- Status of current policies, guidelines and legislation concerning scientific equipment
- Scientific equipment policy precedents in other sectors
- Presence or absence of policies and procedures that, among other issues:
    - Provide ways of lifting or minimizing duty on research equipment, particularly donated items
    - Simplify the acquisition and clearance of equipment
    - Accelerate procurement of urgently needed and perishable equipment and supplies
    - Include provisions for sharing, standardizing and calibrating equipment
    - Promote the manufacture and production of equipment, especially for schools

The studies should consider:

- Institutional, national and regional levels
- Case institutions, in terms of their scientific equipment management, budgeting, manpower, maintenance
- The relevant ministries with which to engage in discussions about scientific equipment policy, including the Ministry of Finance
- Regional equipment facilities and services
- The role of the private sector

The studies should map (or identify):

- Formal and informal links and channels among users, champions, influencers and policy-makers
- The potential of the media to influence policy change
- The level of national awareness and access to regional policy influences, e.g., African Union Commission

The draft Country Study report is to presented and discussed in the two days of this national workshop.

Comments and Questions

- The Procurement Act determines all matters concerning acquisition and disposal of scientific equipment.

- Sharing of equipment within and among institutions should be encouraged.
- It is important to develop and maintain inventories of equipment so that as many people as possible know of the existence and location of equipment they require for their research.
- Maintenance is an issue if there is no budget.
- TWAS has grants for maintenance.
- We should be looking at establishing centers of excellence and model laboratories.
- Does IFS or the researcher buy the equipment in their grants? *Both approaches are taken.*

Ghana Country Study – Presentation and Discussion

Stephen Awuni, CSIR-STEPRI, presented the Ghana Country Study on "Developing an Enabling Scientific Equipment Policy in Africa".

Background

The scientific endeavor in Africa and the developing world is saddled with challenges, one of which is scientific equipment. The nature of the challenge broadly spans deficiency of policies and frameworks that enable procurement and change of science equipment, management systems for maintenance, to the availability of trained manpower. The urgency of the task will require continuous support, and will contribute to securing affordable food, water and energy for the rising population. This is dependent on the hardware conditions that scientists work with. IFS and AAS initiated the project "Developing an enabling scientific equipment policy in Africa" to help develop effective policy to overcome the challenges in the sector.

Currently Ghana does not have a National Science Equipment Policy. There is a National STI Policy, which was adopted at the cabinet level. The goal of the STI policy is to harness the nation's science and technology capacity to achieve national objectives of poverty reduction, competitiveness of enterprises, sustainable environmental management, and industrial growth. The specific objectives of the sector ministry, MESTI, include infrastructure and plant/equipment development through appropriate policies and legislation.

The scientific equipment policy study is a follow-up to the project's Inception Workshop held at AAS in Nairobi from 6-7 November 2013. The study aims to understand the prevailing situation of scientific equipment in Africa generally. The three pilot countries in the study are Ethiopia, Ghana and Kenya. In Ghana the study aimed at presenting the scientific equipment situation and formulating recommendations for amelioration.

Objectives

The overall purpose of the study is to understand how scientific equipment policy can facilitate scientific endeavour across Africa. The specific objectives are:

- Reviewing the effectiveness of science equipment policies (if available) of key organisations in relation to organisational structures and systems, and
- Mapping the national research and policy landscape.

Methodology

Data collection was based on the workplan agreed between IFS and STEPRI in February 2014. It consisted of desk research and an interview guide administered to 25 institutions and organisations. One version of the guide was administered to the Ministries of Finance, Ministry of Education and MESTI. The other one was administered to scientific institutions. The interview guide had three sections. The ministries responded to the policy aspect of the survey, whilst the scientific institutions responded on scientific equipment. Sampling was purposively drawn and focused on academia, research institutions, universities and polytechnics.

Results

Procurement of scientific equipment and role of organisations/institutions

It was found that the ministries are primarily meant to facilitate policy formulation and implementation, and monitor and evaluate in definitive sectors of the economy. Ministries exercise oversight responsibilities over public agencies, e.g., Education, Finance and MESTI. The NDPC is the constitutional body established for planning the country.

Process

- Competitive bidding
- Sole-sourcing
- Identifying specifications and contacting known suppliers/dealers to submit quotations
- Recommendations to the procurement committee.
- Procurement through partners in research programmes, projects and donations

Table 1: Process of procuring scientific equipment by institutions

Institution	Procurement process
OPRI	a) Identification and specification b) Contacting known suppliers/dealers to submit quotations c) Submission of quotations with recommendations to procurement committee
GMet	a) Direct from manufacturers outside the country b) Permission through PPA
ARI	a) Obtained through projects and donations
SRI	a) For most foreign research equipment, scientific equipment catalogues or the internet is used b) For locally available field equipment, market surveys / collection of pro forma invoices from local equipment dealers

Table 2: Organisations/projects/donor agencies that provided scientific equipment to scientific institutions

Organisation/project/donor agency	Institution that benefited
WAAPP-World Bank, DANIDA, CORAF/WECARD-Mexico, GCP-Japan, EU, MDA (to be separated later)	CRI, WRI, GAEC
JIRCAS-Japan, JICA-Japan	NMIMR, SRI, Accra Polytechnic: School of Applied Science and Arts, and School of Engineering
GETFUND-Ghana	Accra Polytechnic: School of Applied Science and Arts, and School of Engineering
Spanish Grants	Accra Polytechnic: School of Applied Science and Arts, and School of Engineering
Ghana Poultry Farmers Association	ARI
AGRA	SRI
IAEA	GAEC
Forestry Commission, Ghana	SRI

Procurement of science equipment

In some instances equipment are procured directly from manufacturers since it is difficult to find local dealers, e.g., GMet. Procurement is done by obtaining permission from PPA to use single-source method of procurement.

In academia, e.g., School of Applied Science and Arts, and School of Engineering of Accra Polytechnic, the department does its needs assessment and includes them in the department's annual budget. When the need arises a formal request is made to the Rector. If the amount is less then GH¢ 5,000, procurement is done by the procurement office using the specifications provided. If the amount is greater than GH¢ 5,000, it goes through the normal procurement process (tender).

Generally, there are no processes that simplify the acquisition and clearance of equipment. Efforts are made to adhere to the procurement law. There were no specific agencies tasked at any point in time to supply or provide equipment.

Manufacturers of scientific equipment

Scientific equipment manufacturers were mainly overseas companies such as Varian (Australia), Wagtech Int. Ltd (UK), Foss/Tecator (Sweden) and Buchi (Switzerland), among others. There is an absence of local manufacturers. This has serious implications for sustainability in the use of the equipment.

National frameworks for scientific equipment policy development and change

From MESTI, there are various national policy documents and plans that provide some guidance on acquisition of scientific equipment. Examples are national infrastructural plan, national STI policy and development plan, and Ghana shared growth development agenda. MESTI is aware of the national frameworks and the scientific institutions' roles in line with their scientific mandate.

Regional scientific equipment policy

According to MESTI, there is no specific regional science equipment policy but there were a few related ones such as an ECOWAS STI policy, and an AU plan of action 2007-2008 which stated that at least 1% of GDP of member countries should be set aside for science.

Policies on lifting or minimizing duty on research equipment

MESTI reports that there are no specific policies on lifting or minimizing duty on research equipment but there are guidelines for tax waiving. Customs has its own policies on duty minimization and exemptions. For example, GAEC benefits from exemption of duty through IAEA projects. GAEC secures exemption of duty through the local UNDP office.

Provision for manufacture of science equipment

For schools, the response from the majority of institutions was negative. The response from IIR was however positive. It has a provision that promotes the production of school science equipment and glassware. The School of Applied Science and Arts has an idea for the promotion and manufacture of equipment as one of their research areas, and published an article entitled "Portable Wooden Box Electric Dehydrator and Comparative Performance Assessment to an Electric Laboratory Oven", in the *International Journal of Engineering Research & Technology*, Vol 2, Issue 5, May 2013.

Replacement and maintenance of science equipment

The institutions do not usually replace scientific equipment unless there is an opportunity for new equipment acquisition. They are discarded when they become unusable. When there is any need for maintenance, experts are called for that purpose. The IIR of the CSIR also plays a role by maintaining some equipment of some sister CSIR research institutes. The expenses incurred in the maintenance are borne by the institutes concerned.

There are planned maintenance schedules in some institutions but lack of logistics sometimes prevents them from being carried out. In GMet, equipment are maintained by trained technicians at its own cost. The engineering division carries out regular maintenance of equipment used. Faults are reported to the maintenance section and approval is sought from the Chief Executive. There are trained technicians for installation and maintenance but some require specialists from outside the country.

Some institutions that maintain equipment

- GSA
- IIR of CSIR: maintenance is done solely by the Institute's staff
- School of Applied Science and Arts, and the Engineering Department of Accra Polytechnic have their own maintenance staff
- Scimed Instruments Ltd
- F Malawi
- MES Equipment Ltd

Table 3: Some institutions and maintenance agencies

Institution	Maintenance agency
CRI	IIR or a private individual
OPRI	IIR
WRI	Scimed Instruments Ltd, F Malawi, MES Equipment Ltd
Accra Polytechnic, Applied Science and Engineering	Use the services of their maintenance teams
GAEC	Have built local capacity through international training to maintain and repair equipment
NMIMR	Have built local capacity through international training to maintain and repair equipment

Budgeting for maintenance and procurement

In some of the institutions, there is a component in the institutional budget for procurement and maintenance but the funds rarely come. Some have no budget for procurement and maintenance. In WRI, there is a management system for maintaining scientific equipment but it is currently not being applied. Part of the IGF of the various divisions is used for procurement and maintenance. GAEC also uses part of their IGF to procure and maintain some necessary scientific equipment.

Mass media and organisations

The organizations do have linkages with the mass media, especially when they have a particular interest in them. Ghanaian mass media is not really interested in scientific equipment. The mass media assist agencies such as GMet to disseminate its public weather information through TV and radio broadcasts. GNA circulates seasonal forecasts to media houses to be publicized. Some institutions, however, have partial linkages with the media, e.g., OPRI, CRI, WRI, and GAEC.

Potential of the media to influence science equipment policy change

Generally the institutions were optimistic. The mass media have the potential to popularize technology and its transfer. The mass media can influence scientific equipment policy change if the awareness is created with the media. Others were of

the view that the scientific institutions within the sector ministry and the Ministry of Education can influence science equipment policy change.

Scientific equipment policy precedents in other sectors

Ghana has sectoral policies in agriculture (FASDEP), industry (Industrial Policy), and ICT (National ICT Policy).

Input of science and manpower

Most of the institutions had scientists and technicians who use scientific equipment in their work. Most of the institutions did not have the technical expertise for the maintenance and repair of the equipment.

Table 4: Institutional staff strength and number trained on scientific skills and use of scientific equipment

Institution	Staff strength	Number trained
ARI	8	2
GMet	466	350
OPRI	633	20
CRI	760	3
WRI	247	148
SRI	312	45
NMIMR	400	200
GAEC	83	61

The scientific staff turnover ranged from high to low. Reasons were due to poor conditions of service, inadequate equipment and lack of training opportunities, compulsory retirement and appointment with foreign and local institutions. Whatever the cause of the turnover, it affects the use of scientific equipment in the institutions.

Most institutions and organizations indicated their research priorities, and provided inventories of available science equipment. Some provided lists of equipment available and those urgently needed.

Challenges

The study shows that there are challenges, including:

- Inadequate funds budgeted for scientific equipment
- No exemption of duty on research equipment, which could help simplify clearance
- Inadequate logistics
- Obsolete scientific equipment which do not provide reliable data
- Inadequate training of scientific staff on maintenance and use of scientific

equipment
- Almost no local content and local manufacturers of scientific equipment, especially for schools

Conclusion

Ghana has built a fairly solid science and technology system to facilitate national development. The institutional framework for research and development has been structured over the years. The acquisition and use of scientific equipment make it difficult for the realization of the dream of facilitating national development through STI. This must be a priority national concern.

Recommendations

1. Provide adequate funding for research science equipment
2. Exemption of duty on research science equipment
3. Training of scientific staff on scientific skills, maintenance and use of scientific equipment
4. Encourage local production of laboratory research equipment, especially for schools

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Comments and Questions

Feedback on the Report

- For the ARI, there is a need to correct the response numbers. The Ministry of Agriculture had a project in the 1990s and 2000s. There is more information than what came from the survey that needs to be incorporated.
- Does the study cover from elementary through secondary and tertiary into research institutions? Is this a research versus teaching question? What about science resource centers and micro-science laboratory boxes?

- Sweeping statements like there are no local manufacturers need to be questioned.
- Where are the universities and polytechnics, and the EPA?
- Give exact numbers rather than saying such things as "most." *At this point, 15 of 25 institutions have replied.*
- On the objectives, are we talking about both explicit and implicit policies, or that might be guidelines or procedures? What is meant by mapping? *Identifying key actors and their functions and how they work together.*
- On the methodology, there was a short amount of time, so the study was fast-tracked to make contacts. It did not look at Ghana Standards Authority, Food and Drug Authority or EPA.
- We need to be provided with a copy of the questionnaire.

On the National Science, Technology and Innovation Policy

- Are there specific recommendations on scientific equipment policy? Is it embedded in STI? Is it possible to have one policy on scientific equipment that covers all institutions and organizations? Do we need to craft a scientific equipment policy so that it covers all contexts?
- Where in the NSTI policy is embedded issues of scientific equipment?
- In section 3.2.3, what is already in the STI?
- What are the gaps in NSTI policy? There is a need for a separate scientific equipment policy so that we can advocate for change.
- An assumption is that we all know about the STI but STI does not go into specifics on scientific equipment; this report can identify this gap.

On a Scientific Equipment Policy

- There is a need for a clear policy on scientific equipment through the life-cycle.
- Are there blueprints from other countries than we can learn from?

On Procurement

- There are issues in procurement in terms of length of time.
- Also on procurement, when institutions buy the equipment directly, they can apply for an exemption.
- Institutions must have needs assessments and scientists need to be involved in procurement so that appropriate equipment is acquired.
- In section 3.1 on procurement, scientists should be involved in the identification of need. Procurement requests need to be written properly, and consider the realities of acquiring a particular piece of equipment. In section 3.1.1, Ministry of Trade needs to be included.
- Consider issues of waivers and exemptions.
- We need to consider how to ensure quality, value for money, and so encourage sole-sourcing.
- Donations need to be exempt from duties, and there is an issue with quality of donated equipment.
- We need to follow up on procedures to expedite processes.

On Equipment Needs and Inventory

- We need to categorize and catalog so that equipment can be accessed and shared.
- What are the basic pieces of scientific equipment that are needed in each institution?
- In section 3.2.8 these priorities represent a sketch rather than a comprehensive list. If we go into any particular institution, we will be able to assess whether they have an appropriate inventory to address the priorities.

On Manufacturing, Installation and Maintenance

- For maintenance, there is a need for training so that repairs can be done locally.
- In section 3.1.4 on local manufacturers, the policy should encourage local manufacturing, installation and servicing. How can we get overseas manufacturers to have local presence, technicians and agents?

Further Enrichment to the Country Study

Terms of Reference

Participants were reminded of the Country Study's terms of reference and asked to self-select into each of three groups to further discuss and report back on:

- Formal and informal links and channels among users, champions, influencers and policy-makers, in scientific equipment
- The potential of the media to influence scientific equipment policy change
- The level of national awareness and access to regional policy influencers, e.g., African Union Commission, regional groupings

Formal and Informal Links

There are users, champions, influencers and makers, both formal and informal. Users are the scientific community, institutions and research personnel who need to share equipment. Meetings and workshops are often their links, as are electronic media, publications and associations. There are also direct links across institutions in research projects.

Are we assuming that there are links? Or are we to identify them and nurture them? What are links within the groups and also among them? There is much north-south collaboration, but we need to strengthen south-south.

Champions are practitioners, e.g., Prof Allotey, heads of labs and project investigators, who tend to have the same links as users, both formal and informal.

Influencers are at higher levels such as directors, who also have links such as directors meetings, CSIR, which can also be informal or formal. Others are lobbyists, paramount chiefs, public relations offers of institutions, vendors and private labs.

Policy-makers take us away from the domain of the scientific communities, although we still have Prof Allotey, party “big wigs”, politicians and parliamentarians.

A recommendation is to refine these links and channels. There needs to be a national repository or database to keep track of how to navigate them. There needs to be a repository of these kinds of resources, a central network so that everyone will be aware. STEPRI can take the lead on this.

Potential of the Media

The media inform, educate and entertain through their channels, workshops, open days, radio stations, TV talk shows and other ways.

The local radio stations have an influence and how can we reach them?

How can we train media people on the issues of scientific equipment? How can we get or buy air time? Science festivals are one way.

We need to capture the interest of policy-makers through parliament committees on science and technology and get the media to report on these. Within the 1% of GDP, make equipment a highlight.

We are looking at the policy-maker level and how can they be influenced through the media. We need to link the issue of equipment with what happens in society. Scientists must learn how to communicate with the people through the media. There are examples of scientists who call the media to tell them what they are doing. The problem is two-sided. It is scientists who share information and they are hesitant to speak. Scientists need to take up the fight. There is a need for a media strategy or road map.

Scientists are not running away. They are not good communicators. It is about time that we learn how to convey the messages. There was a case of journalists leaving a GMO workshop more confused than when they arrived.

Recommendations include having a national database on equipment and publicizing this, and also publishing a science newspaper, but who will pay for it and who will read it? How can we popularize science?

Awareness and Access to Policy Influencers

The AUC, through its umbrella committees, will be a key influencer at the continental level, and also its organs AMCOST and COMEDAF, FARA, and the Association of African Universities.

Internationally, there is UNESCO and UNDP.

Sub-regionally, we have ECOWAS and the ECOWAS Parliament, and CORAF (CORAF/WECARD - West and Central African Council for Agricultural Research and Development).

At a national level, there is Parliament and its Sub-committee on Science and Technology, and MESTI, and the Ministries of Finance and Education.

At the institutional level, there are the vice-chancellors in Ghana, who can influence the type of equipment that is procured. There are also the management teams of research institutions such as CSIR and Ghana Atomic Energy Commission.

Other stakeholders are GAAS, the Chamber of Commerce and Industry, the Chamber of Mines, and the Association of Ghana Industries.

Individual champions are esteemed scientists such as Prof Allotey, and also the current minister of science and technology, former ministers, and other prominent professors and researchers, for example:

- Prof Ellis Otoo, Vice-Chancellor of Kwame Nkrumah University of Science and Technology
- Prof Ernest Aryeetey, Vice-Chancellow of University of Ghana, Legon
- Prof Agyeman Badu-Akosa
- Prof Kwabena Frimpong Boateng
- Dr Omane Boamah, former Deputy Minister of MESTI
- Ms Sherry Aryitey (current Minister of Health)
- The current Minister of MESTI

Equipment Life-Cycle

Using the framework of the life-cycle of equipment, participants generated sets of important policy concepts, messages and pronouncements for policy-makers and influencers. The purpose of this discussion was to link the findings of the Country Study with the eventual output of a Policy Brief.

Needs Assessment

- Link needs to research priorities
- Budgeting for the needed equipment and its servicing and maintenance
- Identify the type of equipment needed and its specifications
- Think about human resources needs and capacity-building
- Efficiency and effectiveness of donated equipment
- Consider the quality of equipment
- Standardisation
- Where does the standards authority fit into the picture?

Procurement

- Need to know about clearance or procurement processes
- Reduce time and bureaucracy to go through procurement

- Value for money is essential
- Specifications must be clear
- Total exemption for science equipment from taxes, including demurrage
- Clarity on exemption requirements
- Government needs revenue
- Timely release of funds for procurement
- Foreign companies with local representatives and agents should be the ones to procure from
- Local manufacturers should be considered
- Relationships between institutions and providers of equipment must be improved
- Relationships between users and procurement officers should be improved
- Warranties

Installation

- Purchasing of equipment and installation should come together with the cost of the equipment
- Timely installation
- Expertise in installation
- Calibration of equipment
- Local technicians must be involved
- Training of personnel or technicians
- Standardisation (e.g., voltage rating)
- Standards authority: Where do they fit into the picture?
- Location: Is there adequate space, consumables, and accessory materials?
- Maintenance manuals and supporting documentation

Use

- Standard operating procedures
- Logbook and database of users
- Sharing of equipment
- Collaboration with other users
- Training (certified users)
- Know voltage
- Is there a national database of different equipment categories? Found on the Ghana Education Trust Fund

Servicing

- Regularity of service
- Maintenance contract should be in place
- Training of technicians
- Capacity-building of users
- Data on servicing (logbooks)
- Who pays for the cost of servicing? Is it budgeted?
- Generate income from use of equipment to support servicing
- User and manufacturer relationship

Maintenance

- Availability and affordability of spare parts
- Budget for maintenance
- Repair
- Generate income by charging fees

Disposal

- Regulation on how equipment should be disposed
- Environmental health implications of disposal
- Risk assessment of disposal
- Replacement options for obsolete equipment
- Competent personnel to handle disposal
- Salvage of parts of obsolete equipment
- Donation of old equipment when new ones are brought in

Next Steps

Dr George Essegbey outlined the next steps following the Ghana National Workshop as:

1. Complete the report to reflect the true situation of scientific equipment in Ghana.
2. Distribute the report to stakeholders.
3. Get the recommendations captured into a policy framework.
4. Engage with media champions from the beginning.
5. Identify the specific champions we want to team up with to promote the recommendations, link up with them, provide the Policy Brief.
6. With the sector ministry for science and technology, in 2009 we had a team from UNCTAD who did a review, along with a World Bank team. Then they sat with the Minister with the findings, and after they became convinced, we ended up with the STI policy. If we decide to do a similar thing for scientific equipment, then we can follow a process like that.
7. Beyond the sector ministry, we need to identify related ministries, such as education and trade.
8. Outside of the government sector, we should engage with prominent scientists, as this removes the political matters, and brings in champions outside of government.
9. We should also contact or propose science policy advisors to the government and President.

Workshop Evaluation

At the end of the workshop, participants were asked to spend a few minutes writing their thoughts on what worked well and what could have been done differently. Their responses are in Appendix 3.

Appendix 1 Schedule

Day One		
Session		**Facilitators**
0900-0945	Welcome and introductions by Dr George Essegbey, Dr Nighisty Ghezae and Prof Francis Allotey (Vice President for West Africa of AAS) Remarks from Ghana Academy of Arts and Sciences (GAAS)	Mr Stephen Awuni Prof Francis Allotey
0945-1030	Background of the project	Dr Nighisty Ghazae
1030-1100	Break	
1100-1230	Presentation of the Country Study	Country Study group
1230-1400	Lunch	
1400-1530	Discussion of the Country Study	Dr Benji Gyampoh
1530-1600	Break	
1600-1700	Discussions on further enrichment to the Country Study	Mr William Savage
1900	Workshop dinner	

Day Two		
Session		**Facilitators**
0900-1030	Discussion on next steps with a focus on engaging with national and regional policy-makers and -influencers	Mr William Savage
1030-1100	Break	
1100-1230	Workshop evaluation and closing remarks	Mr William Savage
1230-1400	Lunch	

Appendix 2 Workshop Participants

1.	Y Acquah	Ministry of Education
2.	Prof R K Adaboh	Faculty of Science, University of Ghana
3.	Eric Owusu Adjei	CSIR-Soil Research Institute, Kumasi
4.	Charles Afriyie-Debrah	CSIR-Crops Research Institute, Kumasi
5.	Matilda Akonor	CSIR-Animal Research Institute
6.	Prof F K A Allotey	Ghana Academy of Arts and Sciences
7.	Edmund Ameko	School of Applied Science and Arts, Accra Polytechnic
8.	B Amisigo	CSIR-Water Research Institute, Accra
9.	Dr Ben Aniwa	Veterinary Services, MOFA, Accra
10.	Francis P Ankrah	Ghana Academy of Arts and Sciences, Accra
11.	Dr Christopher Antwi	IFS-Faculty of Agriculture, KNUST
12.	Dr A A Appiah	Centre for Scientific Research into Plant Medicine
13.	Daniel Kwasi Asare	Biotechnology and Nuclear Agriculture Institute, GAEC
14.	Dr Henry Asare-Anane	University of Ghana Medical School
15.	Dr Ruby Asmah	CSIR-Water Research Institute
16.	Stephen Awuni	CSIR-Science and Technology Policy Research Institute
17.	Ransford Bekoe	Association of African Universities
18.	Kate O Boateng	PPMD, Ministry of Agriculture
19.	Dr Samuel Boateng	CSIR-Plant Genetic Resources Research Institute
20.	Ransford Cofie	Ministry of Education, Accra
21.	A K B Deyang	Agricultural Engineering Services Directorate, MOFA
22.	Prof Dominic Edoh	Centre for Scientific Research into Plant Medicine
23.	Dr Daniel Dzidzienyo	University of Ghana, School of Agriculture
24.	Ben Folitse	CSIR-Inst for Scientific and Technological Information
25.	Kodwo Ennin Fynn	Animal Production Directorate, MOFA
26.	Dr George O Essegbey	CSIR-Science and Technology Policy Research Institute
27.	Dr Godfred Frempong	CSIR-Science and Technology Policy Research Institute
28.	Emmanuel Osadu Ghartey	Ghana Irrigation Development Authority
29.	Dr Nighisty Ghezae	International Foundation for Science
30.	Dr Benjamin Gyampoh	AAS
31.	Dr Rosemary Keatley	MEDLAB
32.	Boohene Kwam	University of Cape-Coast, Library
33.	Rev Joana Koranteng	Science Resource Centre, Ghana Education Services
34.	Ebenezer N Kotey	CSIR-Institute of Industrial Research, Accra
35.	Dr Beatrice Mensah	CSIR-Institute of Industrial Research
36.	Winfred Nelson	National Development Planning Commission, Accra
37.	Daniel Ninson	Crop Services Directorate-MoFA
38.	Andrew Nkansah	Ghana Meteorological Agency
39.	Dr Kennedy O-Afriyie	CSIR-Forest Research Institute of Ghana, Kumasi
40.	M K Obeng	Radiation Protection Institute, GAEC
41.	Dr Mary Obodai	CSIR-Food Research Institute, Accra
42.	Dr Michael Ofori	Noguchi Memorial Institute for Medical Research
43.	Ifidon Ohiomoba	Forum for Agriculture Research in Africa, Accra
44.	Emmanuel Oman	School of Engineering, Accra Polytechnic

45.	J K Sarfo	School of Biological Sciences, University of Cape-Coast
46.	William Savage	International Foundation for Science
47.	Dr Eric Timpong-Jones	LIPREC, University of Ghana
48.	Omane Twumasi	Ghana Standards Authority
49.	Dr Ray Voegborlo	College of Science, KNUST, Kumasi
50.	Dr George Kojo Yawson	CSIR-Oil Palm Research Institute, Kade
51.	Francis M Zakari	Environmental Protection Agency, Accra

Media

52.	Christabel Addo	Ghana News Agency (GNA)
53.	Jerry Akornor	TV3
54.	Lawrence Akpalu	Ghanaian Times
55.	Michael Ayeh	Ghanaian Times
56.	Dela-Doe	Information Services Division (ISD)
57.	Ridwan Mohammmed	TV3
58.	Nana Ama Omari	GBC Radio
59.	Clara Oteng	Radio Ghana
60.	Effum Prince	TV3
61.	Solomon K Tetteh	Information Services Division (ISD)
62.	Evans K Yeboah	Pink FM

Secretarial Staff

63.	Selina Lawer-Angmler	CSIR-STEPRI, Accra
64.	Ofosu Linda	CSIR-STEPRI, Accra
65.	Nutsukpo Pamela Setorwu	CSIR-STEPRI, Accra
66.	Asafu-Adjaye Stephanie	CSIR-STEPRI, Accra

Appendix 3 Evaluation Responses

[Note: Responses with the same number are from the same person. Dashes (--) signify that the person did not have a comment.]

What worked well?

1. Workshop was well organized; Presentations and discussions were well articulated; Logistics were okay
2. Presentation and facilitations were clear; Facilitators engaged the audience
3. Good auditorium; Frank discussions; Time management for the various presentation; Cordial relationship; Good snacks
4. Everything worked well and I am impressed about time schedules except means of speeches by participants
5. The entire program was well focused and not jam-packed. Accordingly the discussions went well and good conclusions could be reached; The meals were also good
6. Facilitation and discussions were good; Group discussions and presentations were on point
7. Good facilitation; Interactive; Good initiative; Good workshop materials
8. Time was kept well; Program was not packed so output was better; Snacks and food was good; Right persons attended seminar
9. Organization of the workshop was done well; Facilitation and facilitators did well; Participation was good
10. Participants contribution was good; Great diversity of participants
11. Agenda was followed well; Time was also adhered to; Discussions were agenda based; Sitting arrangement was good as we all have the opportunity to see and hear each other
12. The timing was good and the interaction was wonderful; The discussion was deep and interesting
13. Materials given were good; Food was good in quality and quantity; Sessions were not too long; Workshop discussions in groups was well participated
14. Presentation; Interactions; Questions and answers; Group discussions; Experiences from other institutions; Food was good; Accommodation was good; Transportation was good
15. Resource persons were good; Food was good; Dinner was good; Timing was perfect; Not using so many work groups
16. The programme presentations and discussion were good; Snacks and food was all on time
17. Topics for the day was good; Excellent presentation
18. The presentations were good; The interactive nature of the workshop was excellent; The catering services were adequate; The choice of participants were well thought out; The environment for the workshop was serene
19. Organizational preparation; Members participation participation (enthusiasm)
20. Content of the programme; The programme was well planned; Programme schedule was followed according to plan; Venue was ok
21. The facilitators were good; The presentation was good; The group discussions and interaction were good; Time allocation was good
22. Time management was excellent; Workshop content was well articulated; Discussions were well coordinated

23. Coordination of participant contribution and comments; General organization; Time management and control; Overall scoring I will give 95%.; Good team work!!! Kudos!!!
24. The workshop was well organised and timekeeping was good
25. Organization was good; Resource persons presented their parts well; Delegates were appropriate; Prior examples from other counties was good
26. Discussions were well organised
27. Focused discussion or theme; Good logistics; Good time allocation management; Good facilitation
28. The development of an enabling scientific equipment policy in Ghana is a laudable idea; It engaged stakeholders from different background to ensure a holistic and cogent policy
29. Facilitation; Group discussion
30. The presentation of the report and the discussions worked well
31. The team work and the contributions were good
32. Group meetings and summing up was good
33. Moderation of the sessions; Breakout sessions; Session on the life cycle of scientific equipment
34. Group meeting well organized; Good workshop materials
35. Presentation and study group discussions went well
36. Questions and discussions were good; Logistically well-organized meetings
37. Good program content; Central location of program; Good organization; Food facilitation was good
38. Group discussions was good; Well defined action plan
39. Presentation was well; Discussions went well; Logistics was good
40. Presentations were good; Group discussions were good; Interactions

What could have been done differently?

1. None I can think of
2. Questionnaires not to institutes needs to be well explained to the recipient so the right information can be retrieved
3. Late opening of workshop; Dinner should have been held just after closing on the first day
4. Faculty for making speeches; Easily accessible microphones should have been provided
5. Options for accommodation arrangement should have been communicated to participants well in advance before getting here
6. Questionnaires for science policy should have gone to the various faculties or departments in institutions than one sent to a whole institution
7. Ensured that MESTI would have been around; Some importers of equipment should have come (even CEPS); Dinner was too far away
8. Timing of the dinner could have been earlier due to location and non-worthy residential welfare
9. Responses from the respondents of questionnaires was not impressive
10. Ghana's S&T policy should have been availed; Some contributions were too personalised
11. –
12. –
13. Dinner should have been held at a place closer or during the first day's activities

14. Sitting place for lunch and snacks
15. Workshop leaders to write on papers
16. Sitting arrangement must be such that all can sit and write comfortably
17. Presenters should in future project their presentation
18. The survey/study on science equipment situation was hurriedly done; There were no handouts; Communication equipment's especially the speakers were not good
19. More media participation content
20. –
21. Opening ceremony
22. Data capture from various institution; Workshop dinner
23. Participants for the workshop – industry should have been included; Mondays are not good days for workshop if participants are management staff. Please remember most organizations have management meetings on Mondays
24. We should have been given copies of the report discussion days before the meeting. It would have given as the opportunity to scrutinise it better.
25. Survey should have been done earlier and Ghana draft report written better with imperials
26. Not all participants got the materials of the workshop before coming
27. Findings could have been presented more scientifically; Maybe the study should have been concluded to give better indication; Could this be referred to as pre-study review and are we to expect a final one?
28. Some laboratory technicians from the various research institutions should have been invited to make their inputs
29. –
30. The discussion on "an enabling scientific equipment policy in Africa" could be linked to chemicals and consumables
31. –
32. –
33. –
34. Group meetings should have taken place in syndication rooms and not in the open hall
    The presentation of the report – the response rate used to write the report was on the low side. Hope it can be enriched
35. The time was short for most of the discussions; The draft should have been ready
36. –
37. Too much food; Some participants were informed late
38. –
39. The time for the dinner was too late for most of participants in Accra because of the traffic situation
40. Dinner was too late and far; Background data collection