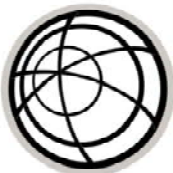


# PURCHASING, SERVICING AND MAINTENANCE OF SCIENTIFIC EQUIPMENT IN WESTERN AFRICA



International Workshop  
University of Buea, Cameroon  
November 5-9, 2002

Report edited by Cecilia Öman and Jenny Lidholm

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**PURCHASING, SERVICING AND MAINTENANCE  
OF SCIENTIFIC EQUIPMENT  
IN WESTERN AFRICA**

**International Workshop**

**University of Buea, Cameroon**

**5-9 November 2002**

**Cecilia Öman & Jenny Lidholm**

**International Foundation for Science (IFS)  
Stockholm, Sweden**

## SUMMARY

In the age of the global knowledge economy, the sustainable development of a country is closely linked to scientific research. Properly functioning scientific equipment is an indispensable component of research. Nevertheless, in many developing countries scientists lack an operating research infrastructure. As a response to this situation, a workshop on the purchasing, servicing and maintenance of scientific equipment was held at the Buea University in Cameroon, November 5-9, 2002.

The overall objective of the workshop was to promote high-level scientific research that could help solve development problems. The purchasing, servicing and maintenance of scientific equipment is an important component of this objective. The initiative was taken in order to bring together the region's stakeholders, organisations with previous experience, donor organisations and suppliers in order to clearly identify the most important problems, to review problems experienced by various parties, to consider the various initiatives that have already been taken, and discuss new approaches.

There were two types of sessions at the workshop: plenary sessions with presentations, and group sessions during which the substance of the presentations made at the plenary sessions were discussed by three groups. The conclusions of the group sessions were reported at the plenary sessions and developed into the workshop output.

The plenary sessions comprised presentations by representatives of the organisers and donor agencies, country delegations, organisations and networks tackling these issues, and suppliers. Country presentations were made by participants from Benin, Burkina Faso, Cameroon, Ghana, Mali, Nigeria, Senegal and Togo. Three groups composed of representatives from neighbouring countries were formed to propose action plans as follow-up activities to the workshop.

The outcome of the workshop was a compilation of problems identified by technicians, researchers and policy-makers separately, and agreements on plans for follow-up activities at the institutional, national and regional levels. Firm and long-term action plans for Western Africa were suggested to involve the formation of a regional network, the creation of databases for information sharing, meetings and workshops on equipment issues, training courses addressing hands-on equipment repair, the creation of service centres and research centres, and the development of policies and guidelines as well as stakeholder participation.

It was concluded from the workshop that the expected output had been well met. Problems experienced by technicians, researchers and policy-makers had been identified separately, and firm plans on follow-up activities at institutional, national and regional levels had been suggested and agreed upon. Moreover, it could be concluded that the collaboration between all the participants had been fruitful. It was recognised that ultimately the overall success of the workshop would depend on how each participant implemented the results of the workshop in his/her respective working environment.

## RÉSUMÉ

Le développement d'un pays dépend de la recherche scientifique et celle-ci dépend d'un équipement scientifique en bon état de fonctionnement. L'état du matériel scientifique dont dispose les chercheurs dans certains pays est cependant loin d'être satisfaisant. C'est pour tenter d'apporter des réponses à cette situation qu'un atelier sur l'acquisition, l'utilisation et la maintenance de l'équipement scientifique s'est tenu à l'Université de Buea au Cameroun du 5 au 9 novembre 2002.

L'objectif de l'atelier était de promouvoir la mise en œuvre d'activités scientifiques de haut niveau afin d'aider à résoudre les problèmes de société et pour améliorer la qualité de la vie en contribuant aux besoins essentiels de la communauté. L'acquisition, l'utilisation et l'entretien du matériel scientifique font partie intégrante de cet objectif. Dans le cadre de cette initiative, il s'agissait donc de déterminer avec les parties prenantes de la région, avec les organisations expérimentées, avec les bailleurs de fonds et les fournisseurs d'équipement, quels étaient les problèmes les plus importants, quelles expériences pouvaient être décrites, quelles initiatives avaient déjà été développées, et de suggérer des solutions nouvelles.

L'atelier a été organisé selon deux types de sessions: (i) des séances plénières avec des présentations, et (ii) des groupes de travail (trois) au cours desquels les questions de fond soulevées lors des présentations faites en séance plénière ont été discutées. Les groupes de travail ont présenté leurs conclusions en séance plénière, conclusions qui ont ensuite été compilées pour former la synthèse des travaux de l'atelier.

Les communications des séances plénières ont été présentées par des représentants d'institutions et organismes donateurs ayant parrainé l'atelier, des délégations des pays, des organisations et réseaux intéressés par toutes ces questions et des fournisseurs d'équipement. Les exposés nationaux ont été présentés par des participants du Bénin, du Burkina Faso, du Cameroun, du Ghana, du Mali, du Nigéria, du Sénégal et du Togo. Les participants à l'atelier ont formé trois groupes de travail composés de représentants de pays voisins chargés de formuler des plans d'action pour assurer les activités de suivi de cet atelier.

Les résultats attendus de cet atelier sont une compilation des problèmes identifiés tant par les techniciens, que par les chercheurs ou les décideurs politiques et l'adoption de plans d'action de suivi des activités au niveau institutionnel, national ou régional. Un plan d'action solide et de long terme a été proposé afin de mettre en place un réseau régional, une base de données pour le partage des informations, des séminaires ou atelier portant sur les développement du matériel, des "formations à la maintenance du matériel scientifique", la création de centre de services et de recherche, et le développement de politique et de directives associant toutes les parties prenantes.

Les participants ont conclu au succès des objectifs qui avaient été fixés à la tenue de l'atelier. Les problèmes rencontrés par les techniciens, les chercheurs et les décideurs ont fait l'objet de listes établies séparément tandis que des plans d'action de suivi bien précis ont été proposés et convenus au niveau institutionnel, national et régional. Il ressort en outre qu'une collaboration fructueuse a pu être instaurée entre tous les participants. Les participants ont aussi noté que le plein succès de l'atelier se mesurerait, en dernière analyse, à l'une des actions que chacun d'entre eux engagerait pour assurer le suivi des résultats dans son environnement de travail spécifique.

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## Preface

This report is the product of an international workshop on the purchasing, servicing and maintenance of scientific equipment in Western Africa which was held from 5 to 9 November 2002 at the Buea University in Cameroon. The workshop was organised by the International Foundation for Science (IFS) in collaboration with the Buea University in Cameroon, the International Science Programme at Uppsala University (ISP), the Third World Academy of Science (TWAS), the International Organization for Chemical Sciences in Development (IOCD), the Organization of the Islamic Conference's Standing Committee for Scientific and Technological Cooperation (COMSTECH), l'Institut de Recherche pour le Développement (IRD), and the Organisation for the Prohibition of Chemical Weapons (OPCW). The workshop was also funded by the International Center for Theoretical Physics (ICTP), the Wellcome Trust, Bruker Biospin SA, and DNA Global Projects.

The report is composed of an introductory paper, a keynote paper, and papers describing the situation in eight Western African countries together with papers describing how four networks from other regions have already tackled and solved some of the identified constraints.

All the papers presented during the workshop are included in this report. The papers have been edited for language, and the layout has been standardised. Authors have been given the possibility to comment on the changes.

The workshop addressed issues in Western Africa, but the report can be extrapolated to other regions in similar situations. It is, obviously, not possible to generalise since regional disparities always need to be considered and defy universal. Actions and programmes must take into account the specificities of each region, each country, each institution, as well as the researchers themselves.



## Préface

Le rapport qui suit porte sur les travaux réalisés au cours d'un atelier international sur l'acquisition, l'utilisation et la maintenance de l'équipement scientifique en Afrique de l'ouest qui s'est tenu du 5 au 9 novembre 2002 à l'Université de Buea au Cameroun. La Fondation internationale pour la science (IFS) a organisé la tenue de cet atelier en collaboration avec l'Université de Buea (Cameroun), le Programme international pour la Science (ISP) à Uppsala, l'Académie des sciences du Tiers Monde (TWAS), l'Organisation internationale des sciences chimiques pour le développement (IOCD), le Comité permanent pour la coopération scientifique et technologique de l'Organisation de la Conférence islamique (COMSTECH), l'Institut de Recherche pour le Développement (IRD), et l'Organisation pour l'interdiction des armes chimiques (OIAC). L'atelier a également bénéficié du concours financier du Centre international de Physique théorique (CIPT), du *Wellcome Trust* et de la société *Bruker Biospin SA* et *DNA Global Projects*.

Divisé en plusieurs chapitres, le rapport comprend: une introduction, le texte de la communication principale présentée à l'atelier, des exposés décrivant la situation existante dans huit pays d'Afrique de l'ouest et plusieurs autres présentations sur la façon dont quatre réseaux d'autres régions ont déjà abordé et résolu certaines des contraintes identifiées.

Toutes les communications présentées à l'atelier ont été incluses dans le rapport. Le texte de certaines d'entre elles a été abrégé mais n'en a été exclu que ce qui ne concernait pas directement le thème de l'atelier. Les textes ont été revus et corrigés et la présentation a été normalisée. Les auteurs des communications ont eu la possibilité de faire part de leurs commentaires sur les modifications apportées.

La région ciblée par l'atelier est l'Afrique de l'ouest mais les résultats et conclusions du rapport peuvent être extrapolés et appliqués à d'autres régions confrontées à des situations similaires. Il n'est évidemment pas possible de généraliser puisqu'il existe toujours des disparités échappant à ce type de catégorisation d'une région à l'autre. Il faudra donc que les spécificités de chaque région, pays et institution soient non seulement prises en compte dans les actions et programmes engagés mais aussi par les chercheurs eux-mêmes dans leurs travaux.

## Acknowledgements

We would like to thank Dr Dorothy L. Njeuma, Vice Chancellor of the Buea University for hosting the workshop. We gratefully acknowledge Professor Vincent Titanji and the local organising committee for making the local arrangements.

The following co-organisers are gratefully acknowledged for supporting this workshop: the International Science Programme in Uppsala (ISP), the Third World Academy of Science (TWAS), and l'Institut de Recherche pour le Développement (IRD) for helping to conceptualise the workshop, the International Organisation for Chemical Sciences in Development (IOCD) for increasing the visibility and establishing contacts, ISP, IRD, IOCD and the Organisation for the Prohibition of Chemical Weapons (OPCW) for suggesting and supporting participants, IOCD for providing CD disks to be distributed during the workshop, Ghirma Morges for sharing information on the 'Chemistry in Africa' web-site, Bruker Biospin SA and DNA Global Projects for providing information on manufacturers and suppliers, and ISP, TWAS, IOCD, IRD, OPCW, Organisation for Islamic Conference Standing Committee on Scientific and Technological Cooperation (COMSTECH), International Center for Theoretical Physics (ICTP), the Wellcome Trust, Bruker Biospin SA, and DNA Global Projects for supporting the workshop financially.

We also want to thank the Network of Users of Scientific Equipment in Eastern and Southern Africa (NUSESA), the Network of Instrument Technical personnel and User scientists of Bangladesh (NITUB), the Soil and Plant Analytical Laboratory Network of Africa (SPALNA), and the Network for Analytical and Boiassay Services (NABSA) for sharing their experience on networking, and all the participants representing eight countries in West and Central Africa for sharing their experiences and for their hard, well-focused work to reach the expected outcome of the workshop. Special thanks go to Professor Marian Addy and Professor Karniyus Shingu Gamaniel for serving as rapporteurs throughout the meeting. We also want to stress the very friendly and positive atmosphere which contributed so much throughout the meeting.

Ms Tilly Gaillard and Ms Elisabeth Auger-Benamar are to be acknowledged for editing the language and translating certain parts of this report, Ms Katja Lundén for designing the report cover, and Ms Tanja Lundén at IFS for the report layout, designing the workshop logo and for preparing material for the workshop. A final thanks goes to Prof. Thomas Rosswall for having initiated this activity.

Michael Ståhl, Jenny Lidholm and Cecilia Öman  
International Foundation for Science (IFS)

## Remerciements

Nous tenons à exprimer notre gratitude à Mme Dorothy L. Njeuma, Vice-Recteur de l'Université de Buea pour avoir accueilli l'atelier dans les locaux de cette institution. Nous remercions aussi vivement le Professeur Vincent Titanji et le comité d'organisation qui ont pris toutes les dispositions nécessaires sur le plan local pour le bon déroulement de l'atelier.

Nous adressons tous nos remerciements aux organismes et centres dont les noms suivent pour l'appui qu'ils ont apporté à l'organisation de cet atelier: le Programme international pour la science (ISP) à Uppsala, l'Académie des sciences du Tiers Monde (TWAS) et l'Institut de Recherche pour le Développement (IRD) qui nous ont aidé pendant la phase de conceptualisation, l'Organisation internationale des sciences chimiques pour le développement (IOCD) qui nous a permis de renforcer la visibilité de l'atelier et d'élargir la liste de nos contacts, l'ISP, l'IRD, l'IOCD et l'Organisation pour l'interdiction des armes chimiques (OIAC) qui ont avancé le nom de participants éventuels et appuyé leur participation à l'atelier, l'IOCD pour avoir fourni des CD-rom à distribuer pendant l'atelier, Ghirma Morges pour les informations qu'il nous a fournies sur le site Internet 'Chemistry in Africa', la société *Bruker Biospin SA* et *DNA Global Projects* pour les renseignements donnés sur les différents fabricants et fournisseurs et, aussi, l'ISP, la TWAS, l'IOCD, l'IRD, l'OIAC, le Comité permanent pour la coopération scientifique et technologique de l'Organisation de la Conférence islamique (COMSTECH), le Centre international de Physique théorique (CIPT), le *Wellcome Trust*, la société *Bruker Biospin SA* et *DNA Global Projects* pour leur contribution financière..

Nous souhaitons en outre remercier les représentants des réseaux *Network of Users of Scientific Equipment in Eastern and Southern Africa* (NUSESA), *the Network of Instrument Technical personnel and User scientists of Bangladesh* (NITUB), *the Soil and Plant Analytical Laboratory Network of Africa* (SPALNA), et *the Network for Analytical and Boiassay Services* (NABSA) qui nous ont fait partager leur connaissance de ces activités, et tous les participants représentant huit pays d'Afrique de l'ouest et d'Afrique centrale qui nous ont enrichi de leurs expériences et n'ont pas ménagé leurs efforts pour produire un document bien ciblé répondant aux résultats escomptés de cet atelier. Nous adressons des remerciements particuliers aux Professeurs Marian Addy et Karniyus Shingu Gamaniel qui ont accepté d'être les rapporteurs des séances de travail pendant toute la durée de la réunion. Nous tenons à souligner le climat très amical et positif qui a prévalu tout au long de l'atelier et qui a tant contribué au bon déroulement des travaux.

Tous nos remerciements aussi à Tilly Gaillard et à Elisabeth Auger-Benamar qui nous ont aidé à corriger le texte du rapport et en ont traduit certaines parties, à Katja Lundén pour la couverture du rapport, et à Tanja Lundén (IFS), qui a préparé le matériel nécessaire à la tenue de l'atelier et en a dessiné le logo. Merci enfin au Professeur Thomas Rosswall qui a été l'initiateur du projet.

Michael Ståhl, Jenny Lidholm et Cecilia Öman  
Fondation Internationale pour la Science (IFS)

## Introductory Paper

# Strengthening the scientific equipment infrastructure in Western Africa

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### Summary

In the age of the global knowledge economy, the sustainable development of a country is closely linked to scientific research. Properly functioning scientific equipment is an indispensable component of research. Nevertheless, in many developing countries scientists lack an operating research infrastructure. This situation has to be acknowledged as one of the reasons to why scientific output from certain developing countries only represents a fraction of the global scientific output. The unbalanced distribution of scientific activity generates serious problems not only for the scientific communities in the developing countries, but for development itself.

This paper offers a response, and aims to summarise discussions and conclusions from the international workshop held at the Buea University in November 2002, the papers presented during the workshop, and suggestions by the authors. A variety of processes related to scientific equipment have been identified to mitigate constraining factors such as funding, selection of equipment, purchasing and transport, installation, climate, power supply, maintenance, servicing, policies and guidelines. The paper asserts the need for new, firm, long-term initiatives on improved scientific infrastructure that involve devoted stakeholders and receive support from national authorities and international aid organisations.

Solutions have been proposed to each identified problem, and firm action plans have been developed for Western Africa including: i) formation of a regional network, ii) creation of databases for information sharing, iii) meetings and workshops addressing the issues identified in this report, iv) training courses addressing hands-on equipment repair, v) creation of service centres, vi) creation of research centres, and vii) development of policies and guidelines on purchasing, installation, servicing, maintenance, use, and stakeholder participation.

It was finally concluded that considering the great human resources and the opportunities existing in Western Africa, appropriate support to scientific infrastructure should contribute to a significant advance in high quality scientific results.

### Résumé

Le développement d'un pays dépend de la recherche scientifique et celle-ci dépend d'un équipement scientifique en bon état de fonctionnement. L'état du matériel scientifique dont dispose les chercheurs dans certains pays est cependant loin d'être satisfaisant. Dans le document qui suit, les auteurs tentent d'apporter une réponse à ce problème en formulant quelques suggestions et, à cet effet, ont entrepris de résumer les travaux ainsi que les communications présentées et les conclusions issues de l'atelier international qui s'est tenu à l'Université de Buea en novembre 2003.

Dans ce document, les auteurs mettent l'accent sur la nécessité de lancer de nouvelles initiatives - dont les objectifs soient bien définis et à long terme - pour améliorer l'infrastructure scientifique, avec la participation de parties prenantes pleinement impliquées dans le processus, l'appui des autorités nationales

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\* Corresponding author

et le concours d'organismes d'aide internationale. Y sont aussi mentionnées diverses procédures relatives à la mise en place de cette infrastructure et qui devraient permettre de remédier à des contraintes telles que celles ayant trait au financement, au choix de l'équipement scientifique, à l'achat, au transport et à l'installation du matériel, au climat, à l'alimentation électrique, à la maintenance, à l'entretien courant, aux politiques et directives à respecter. Dans leurs conclusions, les auteurs proposent des solutions pour tenter de remédier à chaque problème identifié et formulent des plans d'action bien déterminés.

Les plans d'action proposés pour l'Afrique de l'ouest comportent les éléments suivants: i) création d'un réseau régional, ii) élaboration de bases de données pour faciliter l'échange d'informations, iii) convocation de réunions et d'ateliers pour examiner les problèmes relevés dans le rapport, iv) organisation d'ateliers et de cours de formation pratique et dépannage pour réparer le matériel scientifique, v) mise en place de centres d'entretien et dépannage, vi) création de centres de recherche, et vii) formulation de politiques et directives régionales, nationales et/ou institutionnelles relatives à l'achat, l'installation, l'entretien courant, la maintenance, l'utilisation, et la participation des parties prenantes.

Les participants ont conclu que, compte tenu du capital humain et besoins importants existants en Afrique de l'ouest, un soutien adéquat des infrastructures scientifiques et des moyens techniques, devrait permettre d'obtenir des résultats scientifiques de haute qualité.

## **Preface**

This introductory paper is based on i) discussions and conclusions from the International Workshop on Scientific Equipment held at the Buea University in November 2003, ii) papers presented during the workshop, and iii) suggestions and conclusions made by the authors. The paper addresses Western Africa, but can obviously be extrapolated to other regions in a similar situation.

## **Background**

Science has contributed immensely to human progress and to the development of modern society. At the same time Kofi Annan, Secretary General of the United Nations (Annan, 2003), states that the way in which scientific endeavors are pursued around the world is marked by clear inequalities. Developing countries generally spend less money on scientific research than richer countries (in relation to gross domestic product), and the number of scientists is smaller (in relation to population). The recruitment of new scientists in Africa for example, has been very low during the last years. According to Mohammed Hassan, Director of the Third World Academy of Sciences (Hassan 2002), the number of PhD holders of African descent living and working outside their home countries exceeds by far the total number of Africa-born scientists with PhDs working in Africa.

As a result of the uneven distribution of the resources to build and maintain scientific capacity in the world, a large part of the new science is created by researchers from industrialised countries, and much of that science neglects the problems that afflict most of the world's population. This unbalanced distribution of scientific activity generates serious problems not only for the scientific communities in the developing countries, but for development itself.

In developing the technical level of a country one of the most important factors besides trained staff is properly functioning equipment (Selin Lindgren, 2001). Unfortunately, a number of laboratories in developing countries are under-equipped and poorly maintained. Some institutions have used their hard earned funds into buying capital equipment, only to discover that the equipment cannot be used, for a variety of reasons. The number of technicians is often very low in relation to the number of researchers at many universities and institutions in certain developing countries (UNESCO, 1985; Gaillard and Ouattar, 1988; Gaillard and Tullberg, 2001) and the servicing and maintenance of equipment is often accorded low priority (Kundishora and Chimsoro, 1992). For repairs, researchers in certain countries have to rely on foreign expertise; this means either sending the equipment to a foreign supplier or requesting a foreign technician to come and carry out repairs, which may be very time-consuming. As a consequence, scientific equipment may remain idle for long periods of time. Moreover, it is often difficult to purchase spare parts in developing countries (Kundishora and Chimsoro, 1992). In some cases, experience has shown that

purchasing new equipment is easier than repairing the existing pieces, even when taking into consideration that many developing countries have limited funds to purchase new equipment.

As a consequence of the lack of properly functioning equipment, research output is often less than expected and intended. Moreover, the universities and institutions in developing countries cannot train manpower in science and conduct research at a level comparable to that of other similar institutions worldwide. This is one of the major reasons to why scientific output from certain countries only represents a fraction of the global scientific output.

The importance of properly functioning scientific equipment has been demonstrated in a previous survey identifying the main factors holding back scientific results for researchers in Africa (Gaillard and Tullberg 2001). Through questionnaires, 2000 researchers identified the main constraints, and the results showed that following lack of funds, lack of access to functioning scientific equipment was identified as the main constraint to scientific research (Figure 1). The lack of competent technicians and support staff was identified as the fourth major constraint to scientific research.

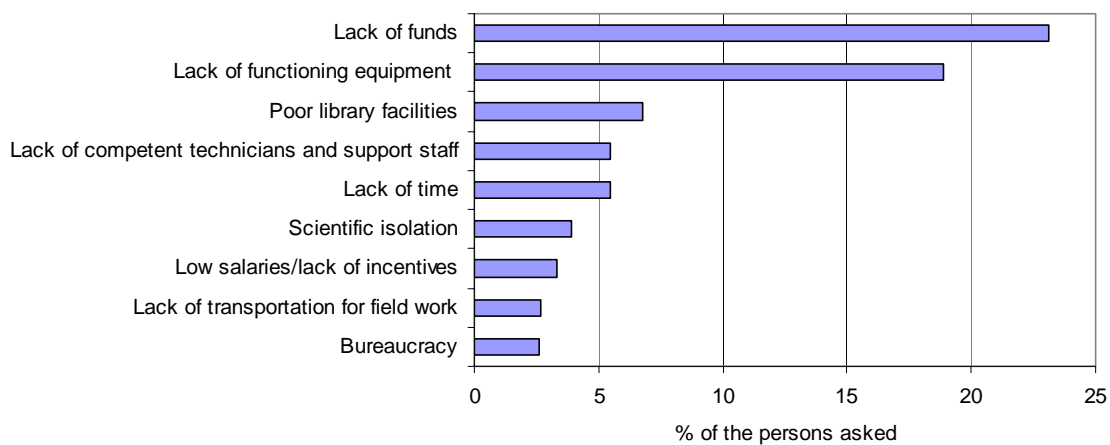


Figure 1: Main constraints on scientific research in natural science disciplines in Africa (Gaillard and Tullberg, 2001)

Consequently, it is of great importance to improve the scientific infrastructure in developing countries so that scientists can conduct advanced research in their home countries. Despite this situation, very few donor organisations provide adequate servicing and maintenance support for scientific equipment (Gaillard and Ouattar 1988).

As positive examples of the situation in Western Africa, it should be mentioned that in Ghana, the purchasing of equipment poses almost no problem (provided that funding is available) as the Ghana Government has instituted the “Ghana Supply Commission and Project Management Unit of the Ministry of Education” for purchasing scientific equipment, and the universities have established purchasing units within their finance offices to procure scientific equipment. Moreover, to ensure maintenance and servicing of scientific equipment, the government of Ghana has set up the “Scientific Instrumentation Centre”, and the universities arrange “Electronics Workshops”. In Nigeria, equipment procurement is also done centrally, under the “Committee of Vice Chancellors” and a university collaborative programme. Moreover, in Nigeria a system of coordination of the purchasing, servicing and maintenance of research and teaching equipment at the universities has been formed through the establishment of “Equipment Maintenance Development Centers” and “Equipment Maintenance Centers”.

The condition of scientific equipment in developing countries, obviously, is closely linked to the economic situation. Hence, as African economies recover, the situation can be expected to improve.

### ***The objective of this report***

The objective of this report is to promote high-level scientific activity to solve development problems. The purchasing, servicing and maintenance of scientific equipment is an important aspect. Mention has already been made of the need for more information and better co-ordination of activities in order to improve the use of scientific equipment in the region. Several workshops and conferences have previously been held on scientific instruments, some of which have had long-term results. The aim here is to provide a platform for long-term initiatives, this time addressing Western Africa. This paper aims to clearly identify the most important problems, to suggest solutions to them, and to develop sound, long-term, demand-driven action plans.

### **Identified problems and proposed solutions**

A variety of processes related to scientific equipment have been identified as constraining factors, including lack of funding, selection of equipment, purchasing and transport, installation, climate conditions, power supply, maintenance, servicing, policies and guidelines. Solutions have been proposed to each identified problem, and firm action plans have been developed.

Lack of adequate priority to servicing and maintenance of scientific equipment is, in sum, a major overall problem. Other serious constraints to research that were identified and mentioned included insufficient involvement of relevant stakeholders in the purchasing, lack of servicing and maintenance procedures as well as inefficient management of equipment-related logistics and excessive bureaucracy.

### ***Funding***

It is generally agreed that the available funds for purchasing, using, servicing and maintenance of equipment are too small.

#### *Solutions:*

Every effort should be made to sensitise politicians to the fact that investments in scientific infrastructure are necessary precautions for sustainable development. The establishment of national funds for purchasing, operating, servicing and maintaining equipment do significantly improve the scientific infrastructure. The funds should be released in a rapid and timely fashion, and the process should be transparent. Administrative and financial disbursement procedures should be streamlined. Furthermore, the possibility of attracting private sector funds should be explored for projects of mutual benefit.

### ***Purchasing***

A number of areas of constraints have been identified in relation to the purchase of equipment:

- i) It is difficult to find information on available equipment before making decisions. Access to product information and even to general information about scientific equipment is often lacking.
- ii) Customs duties on equipment, spare parts and related items purchased and imported from abroad are high.
- iii) Post-purchase interaction with manufacturers is often insufficient and warranties are lacking.

#### *Solutions:*

- i) Product information handbooks need to be made easily available for technicians and researchers, and subscriptions to equipment magazines should be encouraged, especially when Internet connections are not available.
- ii) Government authorities should be encouraged to grant customs exemptions to equipment for research and teaching.
- iii) Maintenance contracts and long-term warranty agreements should be negotiated with the manufacturers when new equipment is being purchased. Manufacturers may offer different kinds of support in connection with equipment purchased, such as: demonstration of new equipment, equipment repairs, service training for technicians, and telephone services. It is preferable to buy scientific equipment from manufacturers and suppliers who provide service manuals, enough spare parts, etc.

### ***Harmonisation of equipment brands***

In laboratories that have equipment manufactured by several different suppliers, maintenance and repair becomes unnecessarily difficult.

#### *Solutions:*

In order to increase flexibility and interchange of spare parts, equipment and other laboratory items should be purchased from a limited number of manufacturers. Countries within a given region should be encouraged to buy similar equipment and other items from the same manufacturer. This would also encourage technicians from a manufacturing company to move around the region to service and maintain their company's equipment.

### ***Climate and power supply***

Scientific equipment has inherent sensitivity to environmental conditions, and if used in an inappropriate environment can produce erratic results. Most of the equipment is manufactured for temperate weather conditions, but the weather in tropical and sub-tropical regions to which the equipment is delivered can be hot and humid and, at certain times of the year, the air can be very dusty. The equipment is often not well protected against inhospitable climatic conditions, and sometimes gets damaged.

Moreover, the equipment is manufactured for conditions with a stable electric power supply; erratic electric supply in certain countries contributes to much of the damage in the equipment's power supply units. Cases of blown fuses, and burnt transformers and switching devices are common. Minor as it may seem, blown fuses can cause delays if the spare parts are not readily available. Moreover, sector damage in the computer hard disk may be caused by sudden power outages while the computer is operating.

#### *Solutions:*

Appropriate infrastructure and premises should be used in order to protect the equipment from dust, heat, humidity, and unsteady power supply. Provisions should be made for dust safe environments, air conditioning, de-humidifiers during the rainy season, and power supply units, including voltage stabilisers, and UPS units.

### ***Installations***

The installation of newly purchased equipment is not always well planned. Lack of technical staff can also make it difficult to set up a new piece of equipment properly. In some cases the instruments become defective and the warranty period expires even before installation.

#### *Solutions:*

Already when purchasing new equipment, technicians have to identify who are to be put in charge of installation, maintenance and servicing. The technicians should be involved as of the equipment selection stage.

### ***Manuals, spare parts and servicing tools***

The lack of user manuals, service and maintenance manuals, spare parts, and servicing tools makes it difficult to efficiently use, service and repair the equipment. Moreover, order-to-delivery time is often long.

#### *Solutions:*

A number of items need to be made easily available for technicians and researchers including:

- user manuals
- service and maintenance handbooks
- electrical circuit diagrams
- spare parts
- servicing toolboxes and other test and calibration equipment

Procurement of these items may involve purchases, ordering free items from manufacturers, inventories of already existing items, and systematisation of items delivered together with purchased equipment.



Technicians could contact their counterparts in other organisations to request spare parts, either new or retrieved from obsolete equipment. Photocopies of particular manuals could be made available to colleagues upon request.

In some cases, manufacturers feel their service manuals for sophisticated computerised equipment are too complicated for anyone but the company's service personnel, why the manufacturers may chose not to distribute these types of service manuals.

### ***Career paths and training of technicians***

A career Profile for technical staff is often missing, and health and safety issues are often insufficiently addressed. Furthermore, the technicians are not always offered the training needed for equipment installation, maintenance and servicing.

#### *Solutions:*

Career paths including salary scales should be defined for technicians in those countries where they do not already exist. Safety and health issues should be more strongly addressed.

Training and retraining of technicians and users should be arranged, preferably in collaboration with the manufacturers. Trained technicians could train other technicians. Re-training should be periodic and be linked to equipment and facilities already in place. This would mean regular training of local maintenance crews to keep them abreast of changing technologies. As a complement to the training, technicians should be encouraged to attend equipment fairs and exhibits. Internet access needs to be facilitated for the technicians, and consultations through on-line advisory websites would be helpful.

The establishment of a regional science equipment maintenance centre could be encouraged to minimise duplication of efforts and maximise the use of human and material resources. Expertise at given levels could then be shared and include routine maintenance at the local level, and repair and advanced maintenance at the regional level.

### ***Policies and guidelines***

Lack of policies and clear procedural guidelines for the purchase, installation, use, maintenance and servicing of scientific equipment is often a problem.

#### *Solutions:*

Policies and guidelines for the purchase, installation, use, maintenance and servicing of scientific equipment should be developed on institutional, national and regional levels. Moreover, Standard Operating Procedures (SOPs) for the use of the equipment and Good Laboratory Practices (GLPs) should be implemented.

## **Firm action plans**

The identified problems and proposed solutions have been compiled into firm action plans. The strategy is long term, and its implementation will need support from a number of stakeholders. The firm action plans include formation of a regional network, creation of a database, arrangements of meetings, workshops and training, formation of service and research centres, and development of policies and guidelines.

### ***Formation of a regional network***

It would be very useful to form a regional network on the purchasing, servicing and maintenance of scientific equipment in Western Africa. The workshop agreed to initiate the network by organising sub-regional meetings; co-ordinators were appointed for these meeting. Networks like the Network of Users of Scientific Equipment in Eastern and Southern Africa (NUSESA), the Network of Instrument Technical personnel and User scientists of Bangladesh (NITUB), the Soil and Plant Analytical Laboratory Network of Africa (SPALNA), and the Network for Analytical and Boiassay Services (NABSA) have generously offered to support the new network by sharing their information and experiences.

The overall objectives of the network would be to address important issues related to scientific equipment as described in this report. The specific objectives and activities of the new network should be worked out in detail. The creation of a newsletter and a web-site is being can provide information on network activities.

The network would have the possibility to promote information sharing between relevant stakeholders including: policy-makers at both institutional and government levels, department heads, laboratory managers, users, technicians/service engineers, purchasing authorities, suppliers, customs authorities, freight companies, donors, and organisations already dealing with these issues and others.

### ***Creation of a database on scientific equipment and technical expertise***

Bringing stakeholders together in a Western African network will make it possible to develop a comprehensive database on scientific equipment and technical expertise. The database could cover existing equipment, the status/condition of the equipment and its location, sources of supplies and spare parts, and contact addresses of manufacturers and their service personnel. The database could also compile information on ongoing research projects, and the participating scientists, technicians and other resource persons.

### ***Meetings, workshops and training programmes***

Meetings and workshops should be held to address different issues related to the purchasing, servicing and maintenance of scientific equipment, as described in this report. These events should involve all relevant stakeholders, and the related reports should be circulated as appropriate.

Moreover, training programmes should be arranged for technicians and users addressing trouble shooting, servicing, maintenance and repair of equipment. The training should be hands-on and be based on prevailing situations and processes that accommodate new trends and new equipment. One successful workshop design, arranged by SPALNA, provides for the actual repair of equipment during the sessions. The participants to the SPALNA training courses even receive a repair kit with basic tools like screwdrivers, spanners, multimeters, soldering/desoldering tools.

### ***National and regional service centres***

National and regional service centres should be developed addressing service and maintenance of scientific equipment. These centres can be reference centres to which repair persons can turn for information on changing trends in the manufacturing sector, the availability of spare parts and specific repair equipment. The centre could maintain a stock of spare parts and also specialised repair equipment. Manufacturers, salesmen, scientists and repairpersons should contribute to such service centres by sharing information on the state of scientific equipment. Moreover, libraries should be set up to offer collections of useful books, service manuals and data on new and obsolete, functional and broken-down equipment.

The centres could also provide support for the installation, servicing and maintenance of equipment. They could try to form a pool of technical personnel to repair instruments and offer technical services, and further, if possible, to procure the services of foreign technical experts. The centres should charge fees for their technical services, i.e. their instrument repair programme, which, hopefully, would become self-financing. The centres could also conduct training courses on different types of scientific instruments for technical personnel and user scientists. Each country could select technicians for additional training. These technicians should train other technicians on their return.

A positive example of a national service centre can be found in the Scientific Instrumentation Centre of the Industrial Research Institute in Ghana, which already services equipment. This centre might even be upgraded to serve the West Africa subregion.

### ***National and regional research centres***

University faculties could set up instrumentation laboratories where special expensive equipment would be housed to serve the various departmental research and teaching programmes. The central science laboratory serving the Nigerian universities, for instance, has research equipment that is too expensive for individual departments to buy, but is needed for high quality research. The laboratory is kept in a special building that

has a steady power supply, and the necessary assortment of chemicals and consumables. User groups participate fully in the daily operations of the laboratory and are represented on its Management Board. The users are charged a token sum for laboratory services.

Regional research centres that optimise expertise and capacities from several countries at a time could serve as a framework for promoting scientific research in Western Africa. These centres could set up instrumentation laboratories where special expensive equipment would be housed to serve researchers from the region. Such research centres would also promote cooperation between different countries. In Eastern Africa, the NABSA network has already acquired considerable experience in sharing existing equipment.

### ***Development of policies and guidelines***

Policies, including written guidelines and procedures on equipment purchasing, installation, use, servicing and maintenance, should be formulated to address and facilitate the solution of constraints identified in this report. One advantage with developing policies is that they can be used to increase awareness about the importance of properly functioning equipment and the actions needed to ensure this. Policies and guidelines may have to be developed on an institutional, national and regional basis.

Policies at the institutional level may include issues such as:

- *Purchasing policies*: standardisation of equipment brands, prioritisation of equipment complementary to the existing equipment, prioritisation of manufacturers who deliver without delay, requests for quotations from manufacturers and comparison with local prices, agreements with suppliers on after-sales service, etc. (A tentative check list for the ordering of scientific equipment is proposed in Appendix 7)
- *Installation policies*: installation directly upon arrival, etc.
- *Servicing and maintenance policies*: training and career paths for technicians, routines for servicing and maintenance, etc.
- *Equipment use policies*: “Standard Operating Procedures” (SOPs), “Good Laboratory Practices” (GLPs), etc.
- *Stakeholder participation policies*: involving technicians in purchasing and installation, sharing decision making and responsibilities, collaboration and networking, etc.

Policies at the national level may include issues such as:

- General national investments in scientific infrastructure;
- Prioritisation of funds in the national budget for the purchasing, running, servicing and maintenance of scientific equipment;
- Development of national service centres;
- Development of national research centres.

Policies at the regional level may include issues such as:

- Regional possibilities for synergetic solutions;
- Development of regional service centres;
- Development of regional research centres.

### ***Funding and stakeholder involvement***

Actions could be divided into three categories reflecting the funding situation and type of stakeholders to involve:

**1. Immediate actions** would include the development of national and institutional policy documents and guidelines and the establishment of national networks, etc.

**2. Actions requiring additional funds** would benefit from the involvement of national and external donor organisations. These actions include the establishment of a regional network, servicing and research centres, technician training programmes, etc.

**3. Actions at the governmental level** - for example, issues connected to customs duties, taxes and national investment programmes.

## **The role of international donor organisations**

Even though the ultimate responsibility for the scientific capacity building of a country lies with the country itself, and the most important roles in improving unsatisfactory situations have to be played by national authorities and organisations, international donor organisations can and should assist developing countries in strengthening their research infrastructure. Hence, donor organisations are encouraged to more strongly address issues related to the proper functioning of equipment in their scientific capacity-supporting programmes. The action plans presented here could be used for guidance on important areas where support are sometimes needed including the establishment of funds for spare parts, accessories and consumables, training programmes for technicians and users, and the establishment of service and research centres.

Organisations purchasing equipment for developing countries are urged to encourage the preparation of installation, servicing and maintenance plans connected to the purchase. For research projects, for example, funds could be made available to pay for the servicing and maintenance of project-related scientific equipment and spare parts. Before delivery, donors may also want to have discussions with the institutions on the use and completion of the range of equipment.

The international donor organisations are also encouraged to support new initiatives launched by the universities and research institutes in developing countries when national funds are not available or do not suffice.

It is often preferable to have the administration of programmes funded by donor organisations managed by national or regional organisations and networks. NUSESA, NITUB, SPALNA and NABSA, for instance, have already well established experience in this.

## **Conclusions**

Despite the importance of scientific research for the development of a country, universities and institutions in developing countries often lack properly functioning scientific equipment. These universities and institutions cannot train manpower in science and conduct research at a level comparable to that of other similar institutions worldwide if the essential instruments, equipment and facilities are unavailable or are not maintained. This situation has to be acknowledged as one of the major reasons to why scientific output from certain countries only represents a fraction of the global scientific output. The unbalanced distribution of scientific activity generates serious problems not only for the scientific communities in the developing countries, but it also undermines development efforts.

This situation has been discussed for more than thirty years, and some actions have been taken. Surveys have been carried out, and workshops and conferences have been held. It is therefore concluded that new initiatives in this field have to be firm and long-term. It is also concluded that devoted stakeholder participation has to be involved for new activities to be successfully implemented and that certain initiatives need support from national authorities and international aid organisations.

Firm and long-term action plans for Western Africa would have to involve: the formation of a regional network, the creation of databases for information sharing, meetings and workshops on equipment issues, training courses addressing hands-on equipment repair, the creation of service centres and research centres, and the development of policies and guidelines as well as stakeholder participation. A comparison of different countries in Western Africa indicated that some constraints were common to the countries, and that certain identified constraints had been solved in some countries but not in all. This situation enforces the need for regional cooperation.

Moreover, a number of constraints have been tackled and solved by NUSESA, NITUB, SPALNA and NABSA, which explains why their contribution to a regional cooperation initiative is extremely important. It was finally concluded that considering the great human resources and the opportunities existing in

Western Africa, appropriate support to scientific infrastructure could contribute to a significant advance in high quality scientific results.

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## Key-note Paper

### An optimistic look at the future

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#### Introduction

We are often told that the science produced in Africa is a very minute fraction of what is produced in the so-called “developed world” or “technologically advanced countries”. Quantitatively you may be told that “low-income countries” produce only 5% and Africa’s contribution in the latter is only 6%. What we are not told straight away is if this is significant. You will also have to find out for yourself what the inputs and outputs are. According to a report published some ten years ago, and based on UNESCO statistics, Africa’s 20,000 S&T personnel receive a very minute fraction of available resources. The report concludes that the level of science produced is small but *not insignificant*. Important issues related to scientific equipment and scientific capacity building are presented below.

#### Procurement and maintenance are knowledge intensive processes

I have been working on scientific activities since completing my PhD studies (30 years ago). When I received my PhD I had very little experience in procurement procedures and in setting up a research laboratory, etc. I simply wanted to create the kind of laboratories I had seen. Those of you who trained somewhere and returned to set up your own research labs faced similar problems. I think many of you have also found out that in low-income countries we pay more money for an item of equipment than our counterparts in Europe and USA. Many instrument suppliers sell you a piece of equipment, walk away with your money and do not support you at all once you have paid them. These agents want to make quick money and become rich fast. The identification of the most appropriate piece of equipment, ensuring that acquired equipment is fully capable of fulfilling the intended purposes and at the same time is compatible with other existing equipment, and preventive maintenance and repair have become knowledge intensive processes. It is in this regard that a workshop like this one can play a very important role in developing sound, coherent approaches to solving the problem.

#### Scientists alone are not enough

Scientific progress does not only require the training of scientists and the setting up laboratories, but also a balanced, integrated human resource capacity building program, where the key stakeholders are not wrongly assumed to be composed solely of the scientists, since the technical support personnel, including those in management and administration, are also involved. Somebody in leadership should look clearly at the integrated “big picture” that shows how the training of the scientist, the technician and the manager fit together to achieve good medium- to long-term scientific progress in the institution.

#### Regional approach is novel

The concept of regional workshops embracing many institutions, not only in one country, but in the region; many regional networks, such as NABSA, NUSESA, SPALNA, NITUB, etc. ; many organisations devoted to scientific capacity building - ISP, IFS, TWAS - has very noble attributes and should send many messages.

One that I feel I should refer to is the need to better embrace the concept of working together. We should note that each institution in a country, or each country in a sub-region, need not develop the full range of capacities for its scientific endeavours, a task that would require phenomenal inputs in human and material resources. A division of labour approach, *with a will and commitment* to cooperate with and inter-depend on each other offers a viable alternative to the present problems facing many institutions in our region.

### **Conclusion: Let us look at the future optimistically**

Looking at the African landscape 30 years ago and today, I have reasons to be optimistic. During the last 40 years the number of universities in Africa has increased from 10-12 (depending on how you count between) to nearly 200. Compare the improvement in communications: ICT have improved considerably together with physical communications. Many countries in different regions have created viable economic and political groups – SADC, ECOWAS, and COMESA, etc. Moreover, now there is the NEPAD initiative.

Donors have experimented on us again and again, committed many mistakes, but, hopefully, have learned their lesson and “will facilitate our effort to reach our goals, instead of diverting us from them”.

## Summary of workshop activities

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### Introduction

This paper summarises the major activities during the workshop.

### Opening of the workshop

The Host, Dr Dorothy L. Njeuma, Vice Chancellor, University of Buea, delivered the welcome address and urged delegates to come up with strategies for a realistic approach to the problems of Purchasing, Servicing and Maintenance of Scientific Equipment in the region (Appendix 2). She thanked IFS and the other collaborating organisations for coming up with and supporting the programme. His Excellency the Minister for Scientific and Technical Research, Mr Zacharie Pervét, declared the workshop open (Appendix 3). The Minister also emphasised the need for cooperation among countries of the region to foster greater partnership between scientific technical research and teaching. An opening speech was also delivered by Professor Vincent P.K. Titanji who pointed out that the scientist's mind is the most important equipment in a laboratory (Appendix 4). Prof. Berhanu Abegaz and Dr Cecilia Öman delivered the keynote speeches.

### Workshop activities

There were two different sessions at this workshop: (i) plenary sessions during which presentations were made, and (ii) group sessions during which the substance of the presentations at the plenary (scientific) sessions were discussed by three groups and the consensus reached reported to all participants at the plenary sessions. The outputs of the workshop have been derived from these reports.

The plenary sessions comprised presentations by representatives of the organisers and the donor agencies, country presentations, presentations of activities of organisations and networks and presentations by suppliers. Full papers of presentations can be found in the next section of this report.

### Country Presentations

Presentations were made by participants from Benin, Burkina Faso, Cameroon, Ghana, Mali, Nigeria, Senegal and Togo. There were four presentations from Cameroon, two from Nigeria and one each from the other countries.

#### *Benin*

The presentation from Benin highlighted the problems associated with the purchasing and use of equipment. For purchases, the problems included little or no funding, money transfer and transportation, bureaucracy, delays in administrative procedures, resulting in a paucity of scientific equipment in the country. Problems with the little equipment that existed came from the harsh environment in which it is placed and, hence, its quick deterioration. For maintenance, the problem was the difficulty in finding qualified technicians as well as lack of money for maintenance.

The remedial measures proposed were creating awareness about the fact that university teachers must also do research, and therefore must have the means to buy and maintain equipment, and providing a separate budget line for servicing equipment. It was also proposed that technicians ought to be well trained and should attend refresher courses.



### ***Burkina Faso***

The major problem highlighted in this presentation was the inadequacy of the infrastructure to house the small amount of scientific equipment purchased, thus creating a situation where the research and the teaching laboratory were one and the same. The good laboratories are the ones which have external funding. There was also the problem of outside donors placing a limit of only 20% of the project funds for equipment, which made purchasing of equipment rather difficult. There is no budget for training and maintenance and therefore no preventive maintenance. Among the suggestions made to solve the problems was the provision of adequate space and a correct environment to receive equipment ordered, partnership between the North and the South, and a budget line for servicing and maintenance.

### ***Cameroon***

The first presentation emphasised the difference between theoretical and experimental research, the latter relying heavily on equipment, which may be simple or sophisticated. The conditions under which the equipment is purchased and used, – climatic, technical, economic, personnel, information – and the attendant problems were highlighted and found to arise from the economic situation in the sub-region. Recommendations focused on Professional training of technical personnel for the equipment, databases on the equipment, negotiations for different (lower) prices for Third World countries, a list of basic or essential equipment and a policy on manufacturing/producing simple equipment locally.

The next paper was on a survey to collect data on equipment maintenance. The data indicated problems such as: too many types and manufacturers of equipment, non-availability of spare parts, equipment support such as electricity, poor contact with suppliers, climatic conditions, costs of maintenance, maintenance management, unnecessary bureaucracy and lack of harmonisation. The presenter advocated preventive maintenance and the need to train technicians on the proper use of the equipment purchased. There is also a need to improve communications between the equipment buyer and users to ensure that the appropriate equipment is obtained.

The third paper presented the point of view of a repair person, who maintained that a lot of equipment that was lying fallow could be repaired and used. Mention was made of problems such as little regard for the technician and his/her role, remuneration levels and lack of specialised training. There were also communications problems: lack of service manuals and routine maintenance schedules, and very little understanding of what the researchers do as well as problems of communications between the scientist and the repair person, no in-house policy on repairs, and problems due to unnecessary bureaucracy. The recommendations were that technicians be trained and re-trained, routine maintenance schedules be prepared, national and regional service centres be established with facilities such as stocks of spare parts (for both the short and the long term) and specialised repair equipment.

The last paper from Cameroon made a distinction between what happened with equipment purchase and maintenance before and after 1990, mostly because of the post-1990 economic crisis. Prior to the crises, at the University of Yaoundé the scientists decided on which equipment to buy, there were maintenance officers, equipment functioned, technical engineers were trained by the polytechnic institutions and went abroad for additional training, they were well paid and well motivated. After 1990, the University of Yaoundé was decentralised and six universities were created. There was a structural arrangement within the university to manage scientific equipment, which did not always include the views of the users, the researchers. Technicians' salaries came from the research budget, were inadequate and therefore the well qualified technicians left for the private sector which paid better. There were also administrative problems with research equipment, such customs duties and foreign currency transfer. The paper proposed exemptions for customs duties on research equipment, better training and conditions of service for technicians, a standardised system for purchasing equipment within the sub-region, and the creation of a network on the use and maintenance of scientific equipment.

### ***Ghana***

According to the presentation from Ghana, the problems associated with purchasing and maintenance are inconsequential compared to the problems associated with servicing and repairing broken down equipment. The presentation lists the organisations which had laboratories and takes note of the scientific equipment

available. The major problems highlighted had to do with manufacturers/suppliers and specialised training and motivation of service engineers. Some successful interventions as solutions to the problems were provided. Suggestions for the future which were of relevance to the workshop included the upgrading of a UNDP initiated Scientific Instrumentation Centre originally planned to serve the West Africa sub-region. Other suggestions concerned a reduction in the number of manufacturers and models of equipment, the choice of reliable manufacturers and suppliers, better remuneration for technicians, training of service engineers at manufacturers' sites, and common instrumentation laboratories to house special equipment.

### ***Mali***

In Mali, scientific research is done in the national research institutes and the university. Each research institute belongs to a different ministry and has its own rules and regulations. The Centre for Science and Technology, an independent body, coordinates the activities of these research institutes. There is an open tender for equipment costing over ten million CFA, and there is a problem with quality when equipment is supplied through the tendering system. There is no training for maintenance staff. For equipment purchased through large grants from multinational and bilateral donors, it is the donor agencies that decide where the equipment should come from. There is therefore a large number of suppliers and most of them produce manuals in English although Mali is a French-speaking country. People come from outside the country to do the maintenance work on the equipment purchased with these large grants. Suggestions made to address the problems included pooling resources to facilitate group purchasing, training and in-service training of technicians, and information sharing among researchers and technicians for effective use of equipment.

### ***Nigeria***

The first presentation from Nigeria referred to some of the problems already stated by previous speakers and highlighted a weak maintenance culture as a major problem. There was once a good purchasing policy and a good tradition of maintenance, with maintenance units within universities and with smaller units within departments but both traditions have been lost. There is a need to look into the method of procurement and come up with standards for purchasing procedures. It was also deemed important to find a way of ensuring that the sub-region not become a dumping ground for phased-out equipment from the North. The problems with harsh environment, shortage of spare parts and relationships with donor agencies were noted. This presentation highlighted the work being carried out at the five equipment maintenance centres in Nigeria. Technicians trained by manufacturers serve as trainers of trainers by running workshops at the centres. These technicians get incentive packages calculated as a percentage of their regular salary. There is also the Central Science Laboratory where user groups for particular delicate/sophisticated pieces of equipment offer services. A user group is made up of a technician or engineer, a researcher and a post-graduate student.

The second presentation from Nigeria drew attention to research needs related to development through local research and development (R&D). The presenter stated that research is the springboard for science and technology. Research data provide the tools for national growth and development. Local research and development are the most noble means of advancing technology, as they create new processes, products and technologies locally, thereby satisfying the needs and aspirations of the local communities while ensuring that essential expertise is developed and maintained. The role of R&D in fostering national development has been recognised in Nigeria, and adequate policy structures have been put in place to bolster rapid economic advancement. However, a number of factors restrain the country's desire to achieve technological strides forward. One key factor is the defective policy on purchasing, servicing and maintenance of scientific equipment for R&D. Problems: governmental efforts are thinly spread across a large number of institutions, poor funding, state of facilities and staff motivation, bad management of resources, bureaucracy that sometimes makes government create barriers to its own work, lack of continuity in programmes, etc.

Difficulties faced by policy-makers, researchers and technicians, and the efforts made to overcome them were specifically discussed. Issues such as the poor maintenance culture, poor coordination, inadequate training, lack of good communication and cooperation were mentioned. The establishment of specialised equipment maintenance centres and management committees for research institutes, similar to the "Equipment Maintenance and Development Centres" in Nigerian Universities, was advocated. The paper

also stressed the need to adopt the principles of Good Laboratory Practices (GLP) in the purchasing, servicing and maintenance of scientific equipment.

The presenter pointed out that there were many national research institutes and each institute was "doing its own thing", and that hence, their system was not as efficient as the one in the universities. Various institutions such as National Agency for Science and Engineering Infrastructure (NASENI), and the Project Development Institute (PRODA) that dealt with scientific equipment, were listed, and some of the problems encountered were enumerated. The comments following this presentation enjoined the participants to take note of the importance of Good Laboratory Practices (GLP).

### ***Senegal***

This presentation noted the national priorities as being health, food and the sustainable use of natural resources. Since the purchase and use of scientific equipment are related to the aforementioned priority fields, and not left to one organisation, they are handled by three ministries (Health, Agriculture and Education), which explains the need for coordination. Because little scientific equipment is purchased by the state, and there is no research budget for the universities, purchases are made through multinational and bilateral projects, which means that the control of such purchases is not in the hands of the researchers. With regard to maintenance, since the suppliers are not the manufacturers the equipment installation and maintenance can become a problem when there are no manufacturers' agents in the sub-region.

Another problem was that poor wages convince trained technicians to leave to join the private sector. It was suggested that some of the problems could be overcome by including training and service contracts in purchase agreements for sophisticated equipment. Other suggestions concerned in-service training for technicians in order to keep pace with the rapidly changing technology, the formation of a sub-regional network, and the creation of centres of excellence in Africa in order to overcome the problem of the brain-drain, the pooling of resources and efforts, and contributions to the global scientific output.

### ***Togo***

This presentation drew attention to the idea of scientists as tools in the development of a scientific culture. The problems were viewed in terms of human resources and therefore, what we are able to do with scientific research for sustainable development. Togo has many scientific institutions within the ministries, but there are no links between them. Perhaps one solution would be to privatise research since the cost of equipment keeps going up. Scientists need technicians who have been trained to do specialised jobs with equipment. Comments that followed the presentation stressed the idea of privatisation of research and the need to work in a team to get to know each other nationally before getting to know each other internationally.

## **Networks**

### ***Network of Users of Scientific Equipment in Eastern and Southern Africa (NUSESA)***

This presentation covered the history, membership, past and present activities of the network, which grew out of an IFS survey in the 1980s that indicated the low priority given to maintenance of equipment. IFS then started a series of training workshops and NUSESA was formed at one such workshop, with the aim of providing a forum for exchange of information and proper use, maintenance and installation-of equipment. The network depended on IFS for organisation and finance. In 1996, a regional headquarters was established in Harare, Zimbabwe.

The network, which started with five member countries, now has fifteen, and Mauritius wants to become a member. Each local or national member develops its own structure and programmes. Past activities have included workshops, at least once a year, on various topics, from electronics to health and safety, to procurement procedures and laboratory management. NUSESA has received direct funding for country nodes (establishment and maintenance), its secretariat, publicity, training, the organisation of national/regional workshops and regional meetings. There is also a fund for spare parts. Future activities are planned to address issues of regional importance such as providing a code of conduct for the members. Involvement of all stakeholders and the development of a maintenance culture for all equipment users were some of the recommendations that were made.

### ***Network of Instrument Technical Personnel and User Scientists of Bangladesh (NITUB)***

This presentation covered the formation, activities and future plans for NITUB which was formed in order to find solutions to problems faced by IFS grantees and IPICS (International Program In Chemical Science) Fellows in Bangladesh. Two workshops relating to instrument maintenance and repair were held, and at the end of the second workshop it was recommended that a network be formed. The objectives of NITUB, launched in 1994, included the fabrication of equipment for teaching and research. Network activities have included training programmes on specific groups of scientific instruments, instrument repair and installation, and the training of local personnel on equipment installed. NITUB plans to extend its activities to cover medical equipment, scientific instruments in universities and regional cooperation. The network is now recognised throughout the region.

### ***Network for Analytical and Bioassay Services (NABSA)***

The concept underpinning NABSA is the promotion of intra-African cooperation in the chemical sciences. The network was founded in 1992 during the 5th International Chemistry Conference in Africa (ICCA). NABSA participating laboratories are from Ethiopia, Botswana, Madagascar and Kenya. NABSA was sponsored, for a period, by IPICS, IOCD, USAID and UNESCO. Currently, the network provides analytical services using NMR spectra and mass spectrometry. NABSA has two units, i.e. the NMR Centre and the Mass Spectrometry Laboratory, housed within the University of Botswana. These services are an important contribution, given the scarcity of the equipment for this type of analyses on the continent. The equipment is in use all the time and because of the volume of requests from Tanzania, a workstation in Tanzania has been negotiated. The sharing of capital equipment at regional levels was recommended, especially equipment requiring dedicated technicians, such as high resolution NMR (>500 MHz), X-ray diffraction equipment and various mass spectrometers. There were also recommendations on holding regional consultations prior to purchasing capital equipment and on training users on equipment operating methods and preventive maintenance.

### ***Soil and Plant Analytical Laboratory Network of Africa (SPALNA)***

SPALNA was formed to provide solutions to constraints in obtaining good quality data for agricultural research. Its priority areas are equipment maintenance, quality assurance, infrastructural development and training of personnel. The activities of the network include equipment maintenance, training courses in fabrication of equipment, soil, plant and water analysis, Good Laboratory Practices and information management. It also deals with pre-owned equipment donations and acts as a regional reference laboratory for sample exchanges. Activities in equipment maintenance are sited in areas where resource persons can be recruited. SPALNA activities have been decentralized, and countries now write proposals on what they would like to do. At the last workshop on equipment fabrication held in Nigeria, pH meters and colorimeters were fabricated. The challenges that were noted included the large number of manufacturers and models of equipment, absence of service manuals, log books and standard operating procedures, lack of spare parts and other supplies, personnel not properly trained, and lack of funds for equipment upgrading. Suggestions were made on the standardisation of equipment, and the need for a network in the sub-region. Other suggestions concerned the establishment of a maintenance crew at local, national and regional levels and the development or manufacture of small equipment at the local level. A request was made for countries to identify training needs for which SPALNA could develop programmes.

### **Technical working groups**

Three technical working groups, namely, the Technicians, the Researchers, and the Policy-makers, were formed to discuss and propose possible solutions to the problems highlighted in the presentations, from their respective perspectives. The problems identified and the solutions proposed by the three groups are presented below.

## ***Technicians Group***

### *Problems identified*

- All the important stakeholders, viz. technicians, researchers and policy-makers, are not sufficiently involved in the purchasing, servicing and maintenance procedures.
- Stakeholders do not always appreciate the important contributions that can be provided by technicians. Consequently, the technicians are often by-passed in the whole process of equipment procurement and installation.
- Technicians do not always have the necessary training for the installation, servicing and maintenance of the equipment.
- There are no standards for laboratory equipment, therefore various equipment from a number of different manufacturers are found in the laboratories. This situation makes maintenance and repair unnecessarily difficult.
- The overall infrastructure is often inadequate.
- Often, there is no after-sale interaction between equipment manufacturers and the laboratories.
- Spare parts are often lacking.
- Service manuals and servicing tools are often lacking.
- Warranties are often lacking.
- Lack of access to information and databases.
- Health and safety issues are not sufficiently addressed.

### *Solutions proposed*

- Technicians should be involved in the purchasing process.
- Long term warranties should be negotiated with manufacturers of sophisticated and expensive equipment.
- Purchasing policies should make provision for the training of technicians.
- Refresher training should be organised for the technicians.
- The trained technician should train the other technicians.
- Technicians should be encouraged to attend equipment fairs and exhibitions.
- Regional training and retraining with different manufacturers should be arranged.
- A specialised training center should be established in the sub-region for equipment maintenance and use.
- Persons sent for training should have the appropriate background and qualifications to benefit from the training.
- Career paths for technicians should be defined in those countries where this does not exist.
- Equipment should be standardised to increase flexibility and interchange of spare parts.
- Where equipment are not tropicalised, provisions should be made for air conditioning, voltage stabilisers and UPSs.

## ***Researchers Group***

### *Problems identified*

- Funds for purchasing, servicing and maintenance of laboratory equipment are limited.
- The important stakeholders such as technicians, researchers and policy-makers are not sufficiently involved in the purchasing, servicing and maintenance procedures.
- The management of logistic and commercial problems is inefficient.
- The training and retraining of technicians in servicing and maintenance of equipment is often lacking.
- Equipment and infrastructure are often not standardised within the laboratories and therefore a great diversity of items is bought from a number of different manufacturers.
- Spare parts are often lacking.

### *Solutions proposed*

- A clear purchasing policy should be formulated.
- A good manager should be employed to assist in the selection and ordering of scientific equipment.
- Maintenance contracts should be negotiated with the manufacturers to include service training for technicians and repair of the equipment.
- Training and retraining of technicians should be arranged. Specialised training centers should be created in the sub-region for equipment maintenance and use.
- Research proposals that can lead to marketable results should be developed.
- Research proposals should as much as possible be linked to national development plans.
- The possibility of attracting private sector funding should be explored for mutually beneficial projects.
- A network should be created to publicise information on good proposal writing, equipment needs, Standard Operating Procedures (SOPs), all of which form part of Good Laboratory Practices (GLPs).
- Regional cooperation and communications should be reinforced through the exchange of good quality used equipment and through the creation of a database on scientists, technicians and equipment.

### ***Policy-makers group***

#### *Problems identified*

- Important stakeholders such as technicians, researchers and policy-makers are not sufficiently involved in the purchasing, servicing and maintenance procedures.
- There is too little training and retraining of technicians in servicing and maintenance of equipment.
- Motivation and career paths for technical staff are often lacking.
- Clear procedures for installation and commissioning are often not available.
- Clear instructions on the use of specific equipment is often not available.
- Purchasing policies are often not available.
- Verification and preliminary checks of equipment are often insufficient.
- Funds for purchasing are too limited.
- Policies for managing price fluctuations are inadequate.
- Customs duties and taxes are very high.
- Bureaucracy is often excessive.
- Deliveries are often delayed.

#### *Solutions proposed*

- Maintenance and servicing of equipment should be prioritised in order to prevent break-downs.
- Guidelines and procedures must make stakeholder participation mandatory.
- Decisions on purchasing should be decentralised.
- The equipment to be purchased must be appropriately selected. Projects should be linked to the already available equipment, and newly selected equipment should represent a wise complement. A minimum portfolio of equipment should be selected per programme.
- Contacts should be maintained with a variety of suppliers, and the most appropriate suppliers should be selected.
- To avoid delayed deliveries, credible, experienced, well-established suppliers should be used. Orders for equipment should be made at the appropriate times, e.g. orders from Europe should be placed between September and April.
- For heavy duty or capital equipment, requests for quotations should be received directly from manufacturers. Before purchasing, these prices should be compared with local prices.
- Funds should be earmarked for service and maintenance. Equipment purchasing should be open to competition. Funds should be released in a rapid and timely fashion, and the whole process should be transparent. Administrative and financial procedures for disbursement of funds should be streamlined.
- A recurrent budget for running the equipment and the acquisition of spare parts should be put in place.
- Re-training of technicians should be linked to equipment and facilities, and should be periodic. This should also involve personnel at the user's end.
- Career paths for technicians should be defined.
- Safety and health issues should be more strongly addressed.

- For capital equipment, installation and commissioning should be arranged on the spot, and appropriate structures for installations should be put in place.
- The existence of Standard Operating Procedures (SOPs) for the use of the equipment should be verified.
- Logbooks for the equipment should be maintained.
- Inventories should be made of, i) equipment components, ii) product information handbooks and user manuals, and iii) electrical circuit diagrams.
- Documentation on service and maintenance e.g. handbooks on electronic parts as well as toolboxes and other test and calibration equipment, should be made available for technicians and researchers.
- Appropriate infrastructure to suit local climatic conditions and use (ventilation, heat, humidity) should be installed.
- Access to Internet should be increased.
- The state should grant customs exemptions for research and teaching equipment. Where exemptions do not exist, the state should adopt the necessary legislation.

## Neighbouring country working groups

Three neighbouring country groups made up of 1) Cameroon and Nigeria, 2) Benin, Ghana and Togo, and 3) Burkina Faso, Mali and Senegal, were formed to propose action plans as follow-up activities to the workshop. The groups used the solutions proposed above as the basis for their discussions. A summary of the action plans for the three groups are presented below, with more detailed results from two of the working groups presented in Appendix 5 (in French, the Burkina Faso, Mali, Senegal group) and Appendix 6 (the Benin, Ghana, Togo group).

As a result of the workshop a tentative check list for the ordering of scientific equipment was developed (Appendix 7).

## Output

### *Problems identified*

The problems identified by the three technical working groups were pooled and summarised in the following list:

- Lack of clear policy on the purchase of scientific equipment;
- Non-involvement of all stakeholders in the purchasing process;
- Limited communication among stakeholders;
- Lack of access to relevant information/databases on scientific equipment;
- Limited funds for purchasing, servicing and maintenance;
- Need for standardisation of scientific equipment;
- Inadequate infrastructure and harsh environment;
- Lack of well trained technicians;
- Inefficient management of logistics,
- Commercial problems including warranties;
- Custom duties and taxes;
- Verification and preliminary checks on receipt of scientific equipment;
- Installation and commissioning;
- Lack of Standard Operating Procedures (SOPs) and Good Laboratory Practices (GLPs);
- Lack of motivation and career structure for technical staff;
- Lack of service manuals and spare parts;
- Inadequate monitoring and evaluation of purchasing, servicing and maintenance process;
- Excessive bureaucracy and delays in delivering supplies.

### *Action plans*

The three technical groups proposed a number of measures to address the identified problems, which the three neighbouring country groups used to propose the following action plans:

- Prepare a policy document that will be used as a guide in the purchasing, servicing and maintenance of scientific equipment in the sub-region.
- Provide written guidelines and procedures for the purchasing, servicing and maintenance of scientific equipment at the national and/or institutional level.
- Prepare a code of conduct for researchers and technicians with respect to the use of scientific equipment.
- Make training in Good Laboratory Practices (GLPs) mandatory.
- Establish a network to stimulate information exchange among technicians, researchers and policy-makers. Appoint a network coordinator for the sub-region. Form both national and regional working groups to organise and manage the network.
- Have the regional network identify people from different countries skilled in writing good proposals which will attract funding;
- Organise externally-funded national/regional workshops to teach researchers how to write good proposals.
- Provide a database on research projects, expertise, and the status of equipment and research institutions after making national surveys to obtain the information needed for the creation of the database.
- Create a newsletter for exchanging information.
- Create a regional website.
- Encourage technical cooperation and the exchange of scientists and technicians among laboratories.
- Encourage cooperation on training opportunities in the sub-region.
- Conduct two hands-on training workshops on equipment trouble shooting, servicing, maintenance and repair within the next three years.
- Have each country identify technicians qualified for additional training in specialised laboratories in order to upgrade their skills; on their return, have them become trainers of trainers. Such training activities could be initiated by researchers, suppliers or the network, depending on need. Sponsorship may be required for the training.
- Identify sources of funding.
- Create an independent funding mechanism that can ensure immediate release of scientific equipment funds.
- Provide a budget line for spare parts, servicing and maintenance of scientific equipment in the research proposals.
- Involve ministries, customs, freight companies and purchasing authorities in all workshops and seminars on Purchasing, Servicing and Maintenance (PSM).
- Disseminate the proceedings of this workshop to other countries that were not present.
- Have each participant, on his/her return, use existing communication channels to bring together policy-makers, technicians and researcher who should formulate an institutional equipment purchasing policy that will address problems relating to the full stakeholders participation, customs duties, and the commercial and logistical aspects of equipment purchasing .

### **Closing of the workshop**

The meeting was closed by the Host, Dr Dorothy L. Njeuma, the Vice Chancellor of the University of Buea. Dr Njeuma pointed out that this workshop could be of major importance to the University of Buea and to other universities. She generously stated that she would actively contribute to the implementation of the workshop results at the University of Buea. She felt that the workshop had been meaningful.

Deputy Vice Chancellor, Professor Vincent Titanji, expressed his gratitude to the entire group, and mentioned how certain issues could immediately be implemented.

Dr Cecilia Öman expressed her sincere gratitude to all the participants and noted that each and every person had contributed immensely to the success of the workshop. Dr Öman strongly emphasised the need to act on the suggested follow-up activities, and said that IFS would be supportive of initiatives taken according to these lines.



## Country presentations

Problems and successes with purchasing, servicing and maintenance of scientific equipment in eight Western Africa countries were reviewed. Approaches taken to tackle the identified problems were presented, and new actions for the future were suggested.

### **BENIN p. 32**

#### **Acquisition, utilisation et maintenance des équipements scientifiques en République du Bénin**

*Francois Alapini<sup>1</sup>, Henri Soclo<sup>2</sup>, and Léonce Firmin Dovonon<sup>3</sup>*

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### **BURKINA FASO p. 35**

#### **Rapport de l'Université de Ouagadougou**

*Yvonne L. Bonzi-Coulibaly and Dr Bintou Sessouma, Université de Ouagadougou*

### **CAMEROON p. 39**

#### **Problems of purchasing and using scientific equipment: The Cameroon perspective**

*Nzumbe- Mesape Ntoko and Vincent Titanji, University of Buea*

#### **Problèmes de gestion de la maintenance des équipements de recherche dans les écoles de formation**

*César Kapseu, Université de Ngaoundéré*

#### **Purchasing, servicing and maintenance of scientific equipment in Western Africa: The situation in Cameroon**

*Bonaventure T. Ngadjui, University of Yaoundé 1*

#### **The experience of maintaining and servicing scientific equipment in Cameroon (Problems, current trends and recommendations)**

*Thomas M. Langdji, Institute of Agricultural Research for Development (IRAD)*

### **GHANA p. 50**

#### **Purchasing, servicing and maintenance of scientific equipment in Ghana**

*Marian E. Addy and Francis Bosompem, University of Ghana*

### **MALI p. 53**

#### **Politique d'acquisition, d'entretien et de maintenance des équipements scientifiques au Mali**

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### **NIGERIA p. 56**

#### **Purchasing, servicing and maintenance of scientific equipment for research and development in Nigeria: Problems and prospects**

*Karniyus Shingu Gamaniel, National Institute for Pharmaceutical Research and Development (NIPRD)*

#### **A review of problems in purchasing, servicing and maintenance of scientific research equipment in the Nigerian universities**

*Isac I. Egbujoh, O. O. Osasona and Clement O. Adewunmi, Obafemi Awolowo University, Ile- Ife*

### **SENEGAL p. 67**

#### **Problématique d'une infrastructure scientifique au Sénégal**

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### **TOGO p. 70**

#### **Achat et maintenance des équipements scientifiques au Togo**

*Kossi Honoré Koumaglo, Kokouvi Dotse and Messanvi Gbeassor, Université de Lomé*

## BENIN

### Acquisition, utilisation et maintenance des équipements scientifiques en République du Bénin

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#### Summary

During this workshop we shall have a close look at:

- a few problems with purchasing of scientific and technical equipment and with the maintenance of these equipments in order to secure an optimal life of the equipment in Benin and its sub-region
- a few suggested solutions and actions to put things right
- a few approaches (or visions) to improve the situation in the near future taking into account the number of possibilities linked to the geographical position of Benin.

#### Résumé

Au cours de cet exposé, nous allons examiner :

- quelques difficultés liées à l'acquisition du matériel scientifique et technique et à la maintenance de ces équipements pour leur assurer une durée de vie optimale dans le contexte du Bénin et de la sous-région;
- quelques tentatives de solutions et mesures correctives;
- quelques approches (ou visions) susceptibles d'améliorer la situation dans un avenir assez proche eu égard aux nombreuses possibilités liées à la position géographique du Bénin.

#### Introduction

Indépendant depuis 1960, le Bénin, comme tous les autres pays du Tiers Monde, recherche un développement harmonieux sur le plan économique, politique et social en vue d'un mieux être pour ses populations. Le développement scientifique et technologique préconisé par les autorités politico-administratives vise à doter le pays d'infrastructures pour un développement durable. Les écoles, les universités, les instituts et les laboratoires de recherches scientifiques et techniques devraient donc bénéficier tout particulièrement d'investissements conséquents en vue de résultats efficaces. Mais que constate-t-on ?

Quels sont les équipements scientifiques et techniques dont dispose le Bénin ?

Y a-t-il une priorité réelle accordée aux sciences et techniques ?

Les investissements en la matière sont-ils judicieux ?

Quelle est la politique de gestion du personnel et quels sont les acquis, si modestes soient-ils ?

## Obstacles à l'acquisition de matériel et d'équipement scientifique

- Les crédits disponibles sont insignifiants.
- Le coût du matériel est assez élevé, que ce soit le petit ou le gros matériel de mesure, d'investigations ou de recherches pointues. L'indisponibilité de matériel sur le marché béninois, les opérations bancaires de transfert de fonds à l'extérieur et les expéditions par voie maritime et/ou aérienne sont autant de facteurs qui contribuent au renchérissement des coûts du matériel à l'achat au Bénin.
- Il est difficile, sinon impossible, de faire des commandes directes de gros matériel : il faut passer par le marché public. Or le circuit administratif et financier de recherche de crédits est souvent marqué de lourdeurs administratives (perte de temps, délai de validité des factures proforma d'un à deux mois,...) et les formalités durent habituellement six (6) mois. Une fois le principe d'octroi de crédit acquis au niveau du trésor public, il faut réactualiser les devis, ce qui n'est pas toujours évident au niveau des fournisseurs, surtout étrangers.
- Effectuées par l'intermédiaire de représentants commerciaux peu avertis, les commandes passées pour le marché public ne sont souvent pas respectueuses des exigences de qualité et de précision. Les risques de livraison incomplète et inadéquate (surtout pour les produits chimiques et les appareils de mesure) sont nombreux. Le matériel disponible sur place ou dans les pays voisins n'offre pas toujours les qualités et garanties suffisantes. Une fois les commandes passées, les délais de livraison peuvent être longs, souvent plus de trois (3) mois. En outre, les achats sont rarement groupés, ce qui ne facilite pas le déplacement des experts qui assurent le suivi du matériel dans les unités d'enseignement ou de recherche. Les ressources existantes ne sont pas toujours mises en commun ni le matériel effectivement mis à la disposition de toutes les unités concernées. L'inventaire général fait apparaître un potentiel national quasi inexistant en matière d'équipement scientifique.

## Problèmes d'installation et de démarrage

- Les locaux devant abriter les équipements sont, soit en nombre insuffisant, soit mal dimensionnés;
- Les normes de sécurité insuffisantes et l'instabilité du secteur électrique et des réseaux d'alimentation en eau courante (coupures fréquentes de courant et d'eau) n'assurent pas une utilisation optimisée et durable des équipements.
- Le fort taux d'humidité de l'air et les températures élevées du milieu ambiant contribuent à une rapide détérioration du matériel scientifique, ce qui pose le problème de la tropicalisation des équipements.
- Le personnel (chercheurs ou techniciens) n'est pas formé à la maintenance de l'équipement, ce qui constitue un frein à une utilisation efficiente et durable du matériel.

## Difficultés de maintenance

Les difficultés de maintenance sont de plusieurs ordres :

- Absence de techniciens qualifiés ou d'agents chargés de la maintenance;
- Manque de structures de formation spécialisées pour la maintenance du matériel scientifique, absence de programmes de stages et de cours de recyclage;
- Pénurie de documentation technique et d'outils (clés spéciales, etc.);
- Aucun répertoire décrivant les composants électroniques et leurs équivalents, ce qui rend difficiles la réparation ou la maintenance des équipements sur place;
- Le faible montant des allocations financières aux laboratoires ou structures de recherche ne permet pas de prévoir un chapitre budgétaire destiné à la maintenance des équipements scientifiques;
- Le manque de locaux aménagés constitue également un frein au développement des services de maintenance;
- L'inexistence de fiches signalétiques ne permet pas de suivre la durée de vie des équipements;
- L'inexistence d'un service de contrôle des normes de sécurité, et même d'un suivi médical systématique, entraîne des risques graves pour le personnel technique exposé parfois aux rayonnements et/ou aux produits toxiques.

## **Quelques mesures correctives mises en œuvre au niveau de certaines structures et limites de ces mesures**

Les différentes structures concernées par les problèmes d'équipement scientifique, en particulier les institutions universitaires, ont tiré la sonnette d'alarme en ce qui concerne les travaux pratiques et prôné la nécessité d'encourager la recherche scientifique et technique.

- Un grand nombre de projets de recherches sont soumis au Conseil scientifique de l'Université pour sélection et financement à hauteur de quelques millions de francs CFA. Les montants des crédits accordés ne permettent cependant d'acquérir que du petit matériel, aucun financement public n'étant affecté aux équipements lourds.
- Néanmoins, des équipements ont été acquis pour certaines structures liées à des projets de développement mais une grande partie de ce matériel, faute d'une maintenance rationnelle, n'est désormais plus fonctionnel (cf. tableau). L'acquisition de certains équipements financés dans le cadre d'un programme d'investissement public est toujours à l'étude.
- L'absence d'agents de maintenance qualifiés ou spécialisés a conduit à faire appel à d'anciens étudiants du CPU, aux ingénieurs des PTT sur place, aux fournisseurs, etc.
- Toutes les initiatives à ce jour se heurtent à l'amenuisement des crédits d'équipement et de maintenance, voire à leur suppression, en raison peut-être de la conjoncture de notre économie mais aussi de certaines priorités discutables établies par nos décideurs politiques au détriment d'un développement des sciences et des techniques.

## **Perspectives d'avenir**

- Redéfinir clairement nos politiques scientifiques et techniques avec des objectifs clairs et chiffrés
- Mettre en commun nos modestes moyens en vue de créer des centres de recherche spécialisés disposant d'équipements conséquents et utilisables au niveau de la région ouest africaine par toutes les parties prenantes
- Doter chaque centre de recherche d'agents de maintenance qualifiés, formés dans des centres créés à cet effet et organiser des cours de recyclage périodiques à leur intention, en fonction des demandes exprimées par les différentes parties prenantes
- Exiger de nos dirigeants la prise en compte, dans l'élaboration des budgets, de lignes budgétaires pour l'entretien et la maintenance de l'équipement scientifique et technique.

## **Conclusion**

- Le pays ne dispose pas d'un bon niveau d'équipement scientifique et technique
- Aucune priorité n'est accordée aux sciences et techniques
- La politique de gestion du personnel et des acquis est modeste
- Le manque de coordination des actions au niveau national explique la dispersion et l'utilisation peu optimisée des équipements.

## BURKINA FASO

### Rapport de l'Université de Ouagadougou

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#### Résumé

La recherche scientifique au Burkina Faso et, en particulier, à l'Université de Ouagadougou, reste confrontée à de nombreuses difficultés. Les causes évoquées par les différentes parties prenantes sont principalement le manque de moyens financiers pour acquérir du matériel scientifique coûteux et l'absence de locaux appropriés et de structures adéquates permettant une bonne formation des utilisateurs afin d'assurer une maintenance préventive et curative du matériel scientifique.

#### Summary

Scientific research in Burkina Faso, especially at the University of Ouagadougou is facing great difficulties. The various stakeholders mainly point to shortage of funding to buy costly scientific equipment, lack of appropriate premises, and inadequate facilities to provide the training needed by the users to maintain and repair the equipment.

#### Introduction et état des lieux

A l'Université de Ouagadougou (UO), le suivi et la maintenance du matériel scientifique, souvent très difficilement acquis, restent peu satisfaisants, voire même inexistant. Face à une telle situation, il convient d'impliquer les différentes parties concernées, à savoir les techniciens, les chercheurs et les décideurs politiques, afin qu'ils identifient les problèmes et recherchent les solutions propices à un meilleur devenir de la recherche scientifique. Dans le présent rapport, nous passerons en revue l'état des lieux à l'U.O., les difficultés et les suggestions relevées par les différentes parties.

#### *Équipement*

Dans certains cas, le laboratoire d'enseignement est utilisé également comme laboratoire de recherche. Pour ce qui est du matériel scientifique, le gros équipement sert à la recherche tandis que les laboratoires de recherche et les salles de travaux pratiques (TP) se partagent l'utilisation du petit équipement plus mobile comme, par exemple, balances, lampes UV pour la chimie, chauffe-ballons, etc.

#### *Personnel*

Selon le cas, les appareils sont utilisés par l'enseignant, le technicien ou l'étudiant. Il n'existe pas d'école de formation de techniciens de maintenance pour l'équipement scientifique. Les techniciens de laboratoire recrutés au niveau de la classe de terminale, sont formés sur le tas dans les salles de TP. Ils ont la responsabilité du suivi et de la maintenance du matériel de TP dans les salles où ils sont affectés. Il n'y a pas de technicien affecté officiellement à un laboratoire de recherche sauf dans le cas d'un projet de recherche à financement extérieur. Les enseignants sont entièrement responsables de leur matériel de recherche. La maintenance du gros équipement est occasionnellement confiée à des personnes ressources, extérieures à la structure universitaire.

#### *Ressources financières*

L'acquisition du matériel actuellement opérationnel s'est faite dans le cadre global de la politique de coopération du Burkina Faso en matière de promotion de la recherche scientifique avec les partenaires du développement que sont la France, la Belgique, les Pays-Bas, le Danemark, la Suède, etc. Ainsi, plusieurs sources de financement ont permis à l'Université de Ouagadougou de se doter de matériel scientifique. Les

laboratoires les mieux pourvus en équipement scientifique le sont grâce au financement qu'apportent ces partenaires à des projets de recherche car, d'une manière générale, il n'existe pas de ligne budgétaire pour la recherche à l'Université.

Aucune rubrique n'est prévue dans le processus d'élaboration ou d'adoption du budget des projets de recherche pour assurer le suivi et la maintenance des différents appareils à acquérir.

## Recensement des satisfactions et des difficultés

Les différentes parties interrogées n'ont relevé que les difficultés, difficultés qui sont recensées dans les tableaux ci-après.

Tableau 1 : Techniciens

Causes	Difficultés	Solutions
Formation de base insuffisante	Méconnaissance des appareils	Solide formation de base Auto formation
Manque de formation avant l'acquisition d'un appareil	Absence d'une maintenance préventive et curative	Formation spécifique sur un appareil nouvellement acquis Stages de recyclage Formation continue
Non disponibilité des pièces de rechange	Dysfonctionnement prolongé	Accès facile aux pièces de rechange

Le suivi et la maintenance du matériel scientifique sont étroitement liés au degré de connaissance que les techniciens ont de ce matériel. En tant qu'utilisateurs directs des appareils, il serait souhaitable qu'ils reçoivent une formation spécifique dans ce sens, en plus de leur formation de base qui leur permettra d'assurer une maintenance préventive (environnement électrique de l'appareil, conditions d'entreposage).

Les chercheurs évoquent le fait qu'il n'y a pas assez de machines pour justifier la formation de techniciens.

Tableau 2 : Chercheurs

Causes	Problèmes	Solutions
Cherté de l'équipement scientifique Peu d'importance accordée au matériel scientifique	Peu d'activité de recherche Pas de motivation des enseignants	Recherche de partenaires extérieurs pour les analyses
Locaux insuffisants et inadaptés	Mauvais fonctionnement du matériel scientifique Appareil défectueux	Construction de locaux appropriés: climatisation, étanchéité, stabilisateur de tension etc.
Manque de synergie entre chercheurs	Pas de conseils pratiques ni d'astuces fournies sur l'utilisation de l'appareil Sous utilisation des appareils	Mise en place d'équipes de recherche pluridisciplinaire Utilisation commune des appareils
Absence de budget alloué à la maintenance	Impossibilité d'entretenir et réparer les appareils	Fonds alloués à la maintenance
Pas de coopération entre industrie et université	Absence de financement pour l'acquisition du matériel	Partenariat entre industrie et structure de recherche dans l'élaboration des thèmes de recherche

Tableau 3 : Décideurs politiques

Causes	Difficultés	Solutions
Absence totale de budget disponible pour l'achat de matériel à l'université	Impossibilité de financer l'acquisition de matériel scientifique sur le budget de l'Etat	Appuyer les accords de coopération bilatérale ou inter universitaire
Peu de subvention par les partenaires pour la construction de locaux	Manque de locaux adéquats	Sensibiliser les partenaires à la nécessité d'investir dans l'équipement des locaux

Pour les décideurs politiques, le principal problème est le faible budget dont dispose l'université pour assurer l'acquisition et la maintenance du matériel scientifique. C'est pourquoi l'accent est mis sur la nécessité d'identifier de nouvelles initiatives et des sources de financement en vue de remédier à cette situation. Dans le cadre des accords conclus avec les pays partenaires et par le biais des projets de recherche, il a été possible d'acquérir certaines pièces d'équipement (appareils IR et RMN grâce à la convention avec l'université de Provence, Marseille).

## Suggestions

### *Au Université de Ouagadougou*

- Favoriser la formation d'équipes de recherche pluridisciplinaire permettant le financement de gros projets et l'acquisition de matériel scientifique.
- Inclure dans le budget des projets de recherche un volet réservé à la formation de l'utilisateur de l'équipement, à l'entretien, au suivi et à la maintenance du matériel scientifique. Ce volet formation peut faire l'objet d'une clause lors de l'acquisition d'un matériel.
- Les techniciens doivent avoir une formation de base solide leur permettant une auto formation ou une formation spécifique par (chez) le fabricant.
- Former et affecter un technicien sur un type de machine.

### *Au plan national*

- Inciter les chercheurs (dans les universités et centres de recherche) à la mise en place d'un service commun d'utilisation du matériel scientifique avec une compensation financière pour la responsabilisation sur un appareil.
- Etablir une meilleure collaboration entre les chercheurs pour mieux coordonner les besoins en matériel au niveau des différentes composantes de la recherche scientifique (universités, centres de recherche, etc.) en vue d'y apporter des réponses adaptées.
- Mettre l'accent sur la formation des différents utilisateurs (techniciens et/ou chercheurs) en vue d'un meilleur suivi et d'entretien du matériel scientifique.
- Envisager l'acquisition du matériel scientifique de seconde main, ce qui permettra de minimiser les coûts.
- Mener une réflexion pour renforcer la coopération avec les partenaires du développement qui devront s'impliquer davantage dans la construction de salles de recherche et de locaux équipés aux normes en vigueur en matière d'installations électriques, mobilier, éclairage, climatisation, etc.

### *Au plan sous-régional*

- Développer la collaboration entre universités régionales dans les activités relatives à la maintenance du matériel scientifique, afin de promouvoir la formation de personnel qualifié et la mise en commun des compétences pour résoudre les différents problèmes de maintenance.
- Ouvrir une boutique de revente d'accessoires pour le matériel scientifique.

## Conclusion

L'acquisition, le suivi et la maintenance du matériel scientifique sont liés au manque de moyens financiers pour l'acquisition de nouveaux appareils et à l'absence de stratégies permettant de gérer le matériel

existant. L'accent doit être mis sur la recherche de financements et sur la formation des différents utilisateurs (techniciens et/ou chercheurs) en vue d'un meilleur suivi et d'un meilleur entretien du matériel scientifique. La collaboration entre universités régionales en matière de maintenance de matériel peut permettre la formation d'un personnel qualifié et la mise en commun des compétences pour pallier les différents problèmes de suivi et de maintenance.

N.B. De nombreux exemples concernant le domaine évoqué seront fournis au cours de la communication.

## **Annexe : Principaux exemples**

### *Expériences positives*

- Projet écologie de l'UFR-SVT financé par les partenaires néerlandais.
- Projet Gestion, traitement et valorisation des déchets (GTVD) au sein du Laboratoire de physique et chimie de l'environnement de l'UFR-SEA financé par la France.
- Dans ces deux projets, la construction, l'aménagement de locaux adéquats, la formation de techniciens des enseignants, l'achat de matériel ont été pris en compte dans le budget.
- L'acquisition d'une RMN 80 MHz a permis la formation de deux techniciens de l'Université de Ouagadougou chez le fabricant Brüker.
- L'atelier central de maintenance de l'Université de Ouagadougou assure l'entretien et la réparation de certains équipements accompagnant le matériel scientifique.

### *Expériences négatives*

- Pendant l'hivernage, les salles d'équipement IR et RMN sont inondées.
- La mise en route d'une CPG peut être affectée pendant des années par des difficultés liées à l'achat, à l'installation et au raccordement des bouteilles de gaz.
- Le non fonctionnement de certains gros appareils comme, par exemple, un four d'occasion ou une RMN 60 MHz de seconde main, peut être dû à ce que les portes du local ont été élargies pour faire entrer cet équipement lourd.
- La non livraison d'une clé informatique rend impossible depuis deux ans l'utilisation d'un potentiomètre neuf.



## CAMEROON

### Problems of purchasing and using scientific equipment: The Cameroon perspective

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#### Summary

Some factors affecting the use of scientific equipment and the problems encountered by users in Cameroon are highlighted. Such problems are likely to persist until the economic situation of the region improves, which may take quite some time.

#### Résumé

La communication porte sur les facteurs ayant un effet sur l'utilisation des appareils scientifiques et les problèmes que rencontrent les utilisateurs de ce matériel au Cameroun. Les auteurs concluent que ces problèmes devraient persister pendant un certain temps encore jusqu'à ce que la situation économique de la région s'améliore.

#### Introduction

The key to the success of all experimental research is equipment. It is produced in the world by a variety of manufacturers and has, depending on its role, different levels of sophistication. Equipment is required to play a variety of roles. Such roles vary from simple ones such as grinding and stirring to sophisticated ones such as measurement or analysis. In the latter cases, the equipment is complex as it would necessarily have modules to convert a physical, chemical or biological measurement into an electrical signal which provides the output. In the case of physical quantities, transducers are used to convert mechanical measurements into electrical signals.

Because of the sophistication of such equipment and our environment (level of development and distance from the major centres of production), the identification, purchase and use of such equipment creates problems in Cameroon. Hopefully, these problems will be identified, and can then be alleviated or reduced through information sharing (including on practices) and cooperation

#### Factors affecting the purchase and use of scientific equipment

##### *Technical manpower*

Cameroon is a developing country with a hot and humid climate. It lacks trained manpower, especially in the maintenance of scientific equipment. This is principally because there are still considerably fewer technical schools than other types schools. Also, candidates who seek admission into secondary technical colleges are often considered to be inferior to their colleagues who seek admission into grammar schools.

##### *Funds for the purchase of equipment*

The levels of income in Cameroon are quite low. Consequently, funds available to scientific institutions for research are quite small, and the available funding is nowhere near the cost of scientific equipment.

##### *Mobility and availability of staff*

Highly trained teaching and technical staff are scarce. The few who are available and have technical experience tend to be mobile, mainly because public sector salaries are often much lower than salaries in the private sector.

### *Product information*

Information on a wide range of scientific equipment for a given purpose is not often readily available. Choice of such equipment is therefore based on incomplete information on the range of equipment on the market and its performance.

## **Problems**

- The absence of repair workshops and qualified personnel implies that, at best, maintenance is provided if it is related to breakdowns. Consequently no attention is given to extending the life of equipment.
- Because equipment is often used in a hostile environment (dusty, hot, absence of air conditioning) its life is often short.
- High initial and transportation costs often make it impossible to purchase equipment.
- The non-availability and mobility of technical staff often makes it difficult to have the right specifications for and to properly set up new equipment. Users of scientific equipment in the region, therefore, may not get value for money.
- The non-availability of complete product information results in the purchase of equipment of inferior quality or equipment for which price does not match quality.

## **Prospects for the future**

The factors and problems listed above are likely to remain with us for quite some time. They are intimately linked to the economic situation of the region. Hence, as our economies recover, the situation of scientific equipment users should improve.

## **Recommendations**

To improve the lot of scientific equipment users reasonably fast, the following actions could be taken:

- Professional training in the area of electronic/electromechanical maintenance should be made readily available. To make this training relevant, all the stakeholders should participate in the programmes and teaching activities.
- A database of available scientific equipment is necessary for users of this region. Such a base will have to include important parameters such as performance and reliability, life of equipment and cost.
- Because of the economic situation of this region, volumes of equipment used will continue to be small. Manufacturers should consider scheduling "Third World" prices for equipment.
- It is important that each institution adopt the same policy/strategy for the purchase, use and maintenance of scientific equipment. The policy could include the principle of reasoning "from project to equipment" and not vice versa, the harmonization of equipment brands within each discipline to facilitate maintenance and servicing, a minimal training program for equipment users in the diagnosis and management of simple faults. Should third world countries accept used equipment as gifts, and if so under what conditions?
- Gradual development of the skills needed to manufacture/ produce some of the simple scientific equipment required for teaching and research must be included among the priorities of the developing countries.

## **Conclusion**

The factors affecting the use of scientific equipment and the problems encountered by users can be related to the size and performance of our economies. Consequently such problems are likely to be with us for some time. However, greater collaboration between all stakeholders could help reduce the consequences of the problems.

## CAMEROON

### Problèmes de gestion de la maintenance des équipements de recherche dans les écoles de formation

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#### Résumé

L'objectif de ce travail est de capitaliser les expériences acquises dans le domaine de la gestion de la maintenance des équipements de recherche dans les écoles de formation en prenant l'exemple de l'ENSAI. Il y a lieu de constater que le problème des appareils en panne concerne tous les domaines de la recherche, depuis les services administratifs et de secrétariat jusqu'aux activités de laboratoire et de conservation des échantillons. Grâce à sa vocation même et à ses compétences en matière de maintenance, notre école, l'ENSAI, peut aider à promouvoir la maintenance des appareils de recherche. Des suggestions sont formulées afin de nous permettre de tirer le meilleur parti possible de notre environnement.

#### Summary

The objective of this work is to make maximum use of management experience as it relates to the maintenance of research equipment in training schools, using ENSAI as a case study. Broken-down equipment is a problem in all facets of research, from the secretariat to the laboratory, and on to problems like conservation of samples. Our institution, with its potentials for a maintenance culture, thus, can help in maintaining our research apparatuses. Suggestions focus on how to derive maximum benefits from our environment.

#### Introduction

Les équipements de recherche peuvent être classés selon les différents types de matériel suivants: matériel de bureau (ordinateurs et accessoires, photocopieuses, machines à écrire, ronéo); appareils de conservation (congélateurs, réfrigérateurs); appareils de manipulation: séchoirs, distillateurs, extracteurs, presses.

Parce que les équipements de recherche sont très diversifiés, les fournisseurs sont très spécialisés et les pièces de rechange sont différentes les unes des autres. Le chercheur est confronté à des problèmes financiers, les budgets alloués à la recherche étant souvent très faibles, voire inexistantes. C'est dans ce contexte délicat que le chercheur doit assurer la maintenance du matériel scientifique dont il dispose. Or il convient de noter à cet égard que la question concernant la gestion de la maintenance des équipements n'a pas été suffisamment étudiée (Kapseu *et coll.*, 1994, Legros, 1998).

L'objectif de ce travail est de tirer parti des expériences acquises dans le domaine de la gestion de la maintenance des équipements de recherche dans les écoles de formation. Il s'agit de tirer les leçons des actions menées dans ce domaine et de les faire connaître. Une enquête a été menée dans notre institution afin de collecter toutes les données relatives à la situation de la maintenance du matériel scientifique.

## Situation de la maintenance

Un questionnaire a été élaboré dans le cadre d'une enquête conduite auprès des usagers des équipements de recherche. Les réponses au questionnaire ont permis de dresser le tableau ci-après de la situation prévalant en matière de maintenance.

Les données recueillies auprès des services administratifs (secrétariats) de la recherche sur la répartition des problèmes de maintenance par importance et par type d'appareil, font apparaître le classement suivant, par ordre d'importance décroissant, des appareils posant des problèmes de maintenance: photocopieur, micro-ordinateur, laboratoire, rétroprojecteur et électricité. En ce qui concerne les photocopieurs, c'est le manque de pièces qui est le plus souvent cité comme la plus grande contrainte, suivi de la difficulté d'établir un diagnostic, de la cherté des coûts de réparation et du manque de techniciens compétents.

Dans le cas des systèmes informatiques, l'imprimante vient au premier rang des appareils posant le plus grand nombre de problèmes. Ensuite viennent, dans l'ordre décroissant, l'onduleur, l'unité centrale et, enfin, la souris. Les fiches d'enquête montrent que les utilisateurs de logiciels sont d'abord préoccupés au plus haut point par les virus, avant de l'être par l'utilisation des logiciels Word et Excel.

En ce qui concerne l'alimentation électrique, les réponses font d'abord état du problème des coupures fréquentes de courant électrique, suivi par celui du manque de stabilité de la tension. Les réponses apportées à la question de savoir quels sont les moyens utilisés pour la maintenance des appareils sont données ci-après par ordre décroissant, de la réponse la plus au moins souvent donnée: «on se débrouille», «on met l'appareil au rebut», «on demande de l'aide à un autre département» et «on fait appel au fournisseur». Ce classement semble dénoter que les problèmes de communication découragent l'usager qui ne s'adresse donc guère au fournisseur du matériel.

Les données recueillies auprès des laboratoires sur la répartition des problèmes de maintenance par type d'appareil font apparaître les préoccupations suivantes, par ordre d'importance décroissante: électronique, froid, évacuation des eaux et électricité. Parmi les facteurs limitant la maintenance, les réponses font d'abord état du coût élevé des pièces de rechange, suivi de la défection des fournisseurs et du manque de pièces de rechange et, enfin, de l'absence de diagnostic. Il ressort des données concernant le coût et la gestion de la maintenance que cette activité est très coûteuse et prend beaucoup de temps. Il n'y a pas de responsable de la maintenance spécifiquement désigné à cet effet. L'absence de maintenance abaisse le rendement.

## Etat des lieux des pannes

Force est de reconnaître que le nombre d'appareils qui ne fonctionnent pas dans les laboratoires des écoles de formation est souvent important. Les causes des pannes sont nombreuses et il y a lieu de noter à cet égard l'absence de notices d'utilisation et de schémas techniques, la défection du fournisseur de l'appareil (qui n'existe plus ou ne répond plus), le manque d'argent pour acheter les consommables, le manque de techniciens qualifiés pour réparer l'appareil. Ainsi, il est plus facile d'acheter un appareil neuf que de chercher à réparer un appareil en panne.

Il en ressort que la gestion des pièces de rechange et l'achat des consommables sont des soucis permanents des chercheurs du sud. Les résultats de l'enquête confirment cette constatation.

## Leçons

De ces expériences, on peut dégager les premiers enseignements généraux qui concernent non seulement les chercheurs de notre école, mais l'ensemble des chercheurs africains dans un contexte fragilisé.

Avant d'acheter un appareil il convient de bien distinguer entre pièces principales et accessoires. Il faut choisir de préférence un appareil dont la manipulation est connue par un membre de l'équipe de recherche. Il est judicieux de s'assurer qu'il existe un service après-vente et des modalités spécifiques. Lors de l'achat, il convient de vérifier que le type d'appareil livré correspond à la commande et de s'assurer que toutes les pièces sont bien livrées ainsi que la notice d'utilisation.

Il est recommandé de faire fonctionner l'appareil avant de signer le bon de livraison. Pour les appareils lourds, il est conseillé de faire former le technicien par le fournisseur.

Après l'achat :

- Il est nécessaire de former un technicien à la manipulation de l'appareil
- Il convient d'installer l'appareil à un endroit approprié et de conserver en lieu sûr les fiches d'entretien périodique et d'utilisation afin d'identifier les utilisateurs

## Conclusions et suggestions

Le fonctionnement des laboratoires et l'achat des appareils dans les écoles de formation obéissent à des règles particulières dont la plupart se fondent sur la maintenance.

C'est une bonne maîtrise de l'outil de manipulation et une bonne gestion de la maintenance qui permettent de garantir l'appareil contre toute panne ou défektivité. Lorsqu'il en sera ainsi, les tâches assignées à la maintenance seront remplies et les objectifs atteints, à savoir ceux qui consistent à assurer la disponibilité du système de recherche et à faciliter la manipulation et l'utilisation des appareils grâce, notamment, aux deux leviers d'action que constituent la capacité de maintenance et la fiabilité.

On peut retenir les suggestions ci-après dans le contexte des écoles de formation:

- Mettre en place une structure centrale de maintenance avec des techniciens compétents et spécialisés
- Au lieu de compter sur l'extérieur pour trouver une solution aux problèmes de maintenance, il serait judicieux d'étoffer les laboratoires en le dotant de personnel spécialisé apte à rendre des services appréciables. Les techniciens de laboratoire ainsi recrutés ne pourront certes pas s'occuper à plein temps de problèmes de maintenance tout en ayant un rendement suffisant mais pourront néanmoins apporter leur concours en fonction de leur charge de travail. La structure centrale de maintenance ne pourra donc fonctionner normalement que grâce au renforcement de ses effectifs qui devront être complétés par le recrutement de diplômés en maintenance et en informatique
- Vérifier l'état des équipements chaque semaine
- Remédier aux problèmes par ordre d'importance des appareils et surtout du coût de réparation
- Sensibiliser les utilisateurs pour ce qui est des pannes et instaurer un système d'inscription de chaque panne dans un carnet
- Signaler la moindre difficulté d'utilisation d'un appareil. Ceci permettra au technicien chargé de la maintenance de détecter précocement les pannes futures
- Instaurer la maintenance préventive, c'est-à-dire que l'utilisateur devrait comprendre qu'un appareil peut se fatiguer. Il convient d'éviter de faire fonctionner un appareil 24h/24
- Commander des matériels de même type et constituer des stocks de rechange pour le matériel
- Centraliser les problèmes de maintenance
- Pour l'informatique, il faut tout faire pour être connecté sur Internet afin de bénéficier du service gratuit en ligne compte tenu de l'isolement des pays du Sud.

## Remerciements

Nous remercions l'IFS (Stockholm, Suède) de nous avoir permis de présenter ce travail financé par AIRE-Développement (Paris, France).

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## CAMEROON

### **Purchasing, servicing and maintenance of scientific equipment in Western Africa: The situation in Cameroon**

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#### **Introduction**

Following the reorganisation and the creation of new universities in 1993, there are now six state universities in Cameroon. In each of these universities, there is the Department of Infrastructure, Planning and Development which has a Division of Infrastructure, Equipment and Maintenance. Each university faculty has an equipment servicing and general maintenance unit, which includes scientific equipment.

#### **Purchasing scientific equipment**

Previously, when there was adequate government funding for research, the Department of Infrastructure, Planning and Development in each of the State Universities did the purchasing. At present, as a result of the economic crisis and the drastic decrease in the budget allocated to these institutions for research, these Universities cannot afford to purchase scientific equipment anymore. For quite some time now, organisations such as IFS (International Foundation for Science), IPICS (International Program In Chemical Science) and TWAS (Third World Academy of Sciences) which sponsor research projects, have been purchasing scientific equipment and sending it directly to the grantees in these Institutions. Less often, these universities receive donations of scientific equipment from friendly countries and organisations.

When these institutions purchase scientific equipment it is usually ordered from manufacturers abroad (generally Europe & USA). Upon arrival at the sea ports or airports, high custom duties are charged thus increasing cost prices. Usually even the equipment provided through grants or donations is hit with high custom duties, although sometimes customs exemptions are obtained.

#### **Servicing and maintenance of scientific equipment**

This is a matter of serious concern in most of the state universities. As a rule, equipment servicing and maintenance should be carried out by technicians in the various laboratories and faculties, but most, if not all, of them lack the necessary training. Quite often, technicians are brought in from Europe to service the heavy scientific equipment, e.g. IR, UV and NMR machines. There is a small number of qualified technicians in Cameroon but they prefer to work in the private sector because of the low salaries paid to public sector workers. The cost of hiring them on a private basis to service or repair broken-down equipment is usually prohibitively high.

Another serious problem related to servicing and maintenance of scientific equipment in Cameroon is that of spare parts. Not only are they not found in the country but order-to-delivery time is long, which makes it difficult to service and repair broken equipment rapidly. The question of high customs duties on imported spare parts for equipment is an added factor to this problem of servicing and maintenance of scientific equipment.

## **Proposed strategy to tackle the problem of the purchasing, servicing and maintenance of scientific equipment in Cameroon**

### *Purchasing equipment*

Now that the economy of our country has improved somewhat, the Government should provide more funding for research so that the state universities can purchase the scientific equipment they need.

Concerning the problem of high custom duties on imported equipment and spare parts, it is urgent to appeal to the Cameroonian administration (Minister of Finance/Budget and Minister of Higher Education) to reduce if not eliminate them, so as to reduce the costs of scientific equipment for research.

### *Servicing and maintenance*

There is an urgent need to train and / or recruit competent or qualified technicians in these universities and make them responsible for equipment servicing and maintenance. Public sector salaries should be increased so as to attract these technicians to jobs in state universities.

Further, a network devoted to the servicing and maintenance of scientific equipment not only in Cameroon but throughout the sub-region should be created to help train and bring together competent and qualified technicians.

Finally, countries within the sub-region should be encouraged to buy similar equipment from the same manufacturer (e.g. Bruker, Perkin, etc.) so as to persuade manufacturing companies to send technicians around the sub-region to service and maintain equipment from their company.

## CAMEROON

### **The experience of maintaining and servicing scientific equipment in Cameroon (Problems, current trends and recommendations)**

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#### **Summary**

Dozens of piece of broken down scientific equipment are in need of repair today in Cameroon. The problem lies with the lack of appropriately trained repairpersons, improper diagnoses, lack of spare parts, and bureaucracy that prevents a fluent repair system from working. Technicians charged with the repair of equipment are faced with the problem of obtaining not only spare parts but also specialised service equipment and information.

Scientists find that their work schedules cannot be kept or are continually re-scheduled. They are sometimes tempted to use faulty and improperly calibrated equipment. The situation needs a remedy and a quick one at that. Ideally, there should be networking among scientists, repairpersons and manufacturers in this domain so that they can share information on trends in technology. Specialised national or regional service centres would be useful if they had the right personnel and specialised equipment for proper and prompt repairs. Repair personnel need to take refresher courses so as to keep in touch with the latest developments in the industry. Bureaucracy should be reduced to a minimum if it cannot be eliminated.

#### **Résumé**

De nombreuses pièces d'équipement scientifique sont hors service aujourd'hui au Cameroun et ont besoin d'être réparées. La pénurie (due à l'absence d'une formation adéquate) de techniciens qualifiés, l'inexactitude des diagnostics de panne, le manque de pièces de rechange et la bureaucratie font obstacle à la mise en place d'un système de réparation efficace. Les techniciens chargés des réparations ne sont pas seulement confrontés à la difficulté d'obtenir des pièces de rechange mais n'ont pas facilement accès à des informations et services spécialisés.

Dans ces conditions, les scientifiques ne peuvent respecter les délais impartis ou doivent constamment remanier leurs programmes de travail. Ils sont parfois tentés d'utiliser du matériel défectueux qui n'a pas été rigoureusement calibré. Pour remédier rapidement à cette situation, la solution idéale consisterait à créer un réseau de communication entre scientifiques, techniciens chargés des réparations et fabricants de matériel scientifique afin de leur permettre d'échanger des informations sur l'évolution des technologies. Il serait utile de mettre en place des services nationaux ou régionaux spécialisés en les dotant du personnel qualifié et du matériel nécessaire pour procéder aux réparations avec promptitude et efficacité. Le personnel chargé des réparations devrait bénéficier de cours de recyclage pour être informé des progrès techniques les plus récents dans ce domaine. Il faudrait aussi réduire la bureaucratie au minimum s'il n'est pas possible de l'éliminer entièrement.

#### **Introduction and background**

Like in most developing countries, scientists in Cameroon encounter many problems when scientific equipment that breaks down. The problem is not only the shortage of service personnel but also, and more urgently, keeping equipment in good working order and repairing it when it breaks down. Across the country today, there are dozens of pieces of scientific equipment in need of repair. Many of them have been



in that condition for a long time due to lack of appropriately trained repairpersons, improper diagnoses, lack of spare parts or also bureaucracy that prevents a fluent repair system from working.

This paper seeks to identify what is wrong with maintenance and repair of scientific equipment in Cameroon today, current trends in the midst of the prevailing difficulties, and what efforts can be made to remedy the situation.

## **Equipment maintenance in Cameroon**

A catalogue of problems stands in the way of an effective maintenance system in Cameroon. Prominent among them are:

### *Training*

Most repairpersons in Cameroon studied the general principles of engineering and later on found themselves faced with the job of repairing scientific equipment. Their initial training often gave them general technical skills, but not details on how these general principles are applied to research equipment. They are expected to adapt principles to practice. The present educational structures provide for very little or no specialised training.

The repairperson's major task here is to apply his knowledge. A proper diagnosis of the cause of the breakdown is needed of course, otherwise no good results can be expected from any repair.

### *Repair information*

Most equipment is acquired without service manuals and when it breaks down, repairs tend to be based on trial and error. When it is not possible to obtain either the service manual or the necessary service information and spares, the end result sometimes is a permanently broken appliance.

It should be noted here that the more a service person understands the why and wherefore of the scientist's operations, the better placed he is to make the necessary adjustments on equipment. Another point is that documentation concerning basic laboratory safety procedures is usually not available to service personnel.

### *Routine Maintenance*

Unfortunately, in many establishments in Cameroon, there is hardly any maintenance schedule to keep the equipment in good working condition, and prolong its service life.

The job of maintenance has to be viewed as something that concerns both the users and the repairpersons. The user takes care of maintenance operations specified for users while other technical operations, that may include dismantling part or all of the equipment, is to be carried out by the trained service personnel.

### *Communication*

It regularly happens that to buy equipment, the scientist consults a catalogue, then accepts what the dealer says about the machine's specifications and what it machine can accomplish, and goes ahead and buys it. In some cases not only the voltage specification for the appliance differs from that available from the local power supply company, but the necessary attachments are only available in the country where the equipment is manufactured or else local standards differ and above all, spare parts can only be got from another manufacturer in a foreign country, etc. These problems could be brought to a minimum through consultation with the eventual maintenance and repair services.

Bureaucracy sometimes forms a wedge that prevents the scientist and the repairperson to work together. Bureaucracy is also to blame for the fact that a repairperson's increased Professional ability and seniority is not usually accompanied by proportional changes in his wages and fringe benefits. This leads such persons either to quite or to introduce their own style of bureaucracy.

Another dimension is that repairpersons or departments usually work in isolation and do not share information with other people in the field. Information sharing, which is usually available when a network

exists, reduces some difficulties that are frequently encountered. Appropriately, one would advocate networking among servicepersons when repairing equipment.

## Current approaches

Normally when equipment breaks down, a repairperson is called in to make a diagnosis of the problem and possibly effect a repair. Should he belong to the establishment, he will probably only need to identify spare parts to be bought and replaced. He is paid through his salary. On the contrary, if someone external to the establishment is called, the cost is higher. The latter case is more often encountered in Cameroon as some establishments do not quite realise the importance of a maintenance and repair service despite their appreciable stock of equipment. The result is that they end up spending more than necessary on repairs and sometimes also on maintenance.

Some machine spare parts are locally available while others have to be ordered from abroad. In most cases, the ordering procedures are quite slow resulting in prolonged periods of equipment lying fallow.

When the need for repair arises, some other establishments known to possess similar equipment can be contacted for information on the availability of scarce spares. It is very handy when there is stock to spare, otherwise the inevitable order abroad is required.

## Recommendations

Scientific research and operations is clearly not slowing down, on the contrary, they are increasing at an ever-higher rate, with increased demands on equipment. To cope with this rate of increase and be sure to work with equipment on which scientists can depend for good results, it is becoming absolutely essential that measures be taken to bring about stability in the domain of maintenance and repair. Such measures should include:

- Training of repair personnel in the specific techniques of repairing scientific equipment. This will involve tailored courses that provide hands-on training for persons who will take charge of the maintenance of equipment. Refresher courses should be organised at regular intervals in order to keep up with changing trends in the manufacturing sector.
- A system of networking among stakeholders should be put in place and involve information sharing between manufacturing companies, researchers, scientists and repairpersons. This would make it possible to develop databases to which stakeholders, especially those involved in maintenance and repair, can turn for information on any equipment or new developments in the industry.
- National and regional service centres should be put in place. Such centres would be able to pull together all the necessary information about equipment in use in the country or region. It would serve as a reference centre to which repair persons could turn for information concerning changing trends in the manufacturing sector, the availability of spare parts and specific repair equipment. Such specialised repair equipment should thus be made available at these centres so that repairpersons are not obliged to turn to distant locations to make repairs that require specialised equipment. Manufacturers, salesmen, scientists and repairpersons should contribute to such centres with the view to sharing information on the state of scientific equipment.

### *"Estate Department/Service"*

It is advisable for every university, institution and research establishment to make room for an Estate Department/Service. This department or service will be composed of work units that can handle some or all of the following work:

- Electrical: electrical installations, electronics and computer repairs;
- Mechanical: repairs of rolling stock;
- Refrigeration: cold rooms, refrigerators and air conditioning;
- Construction: masonry, woodwork, plumbing, decoration;
- General Pool: any other service work.

*Routine Maintenance Schedule*

The institutions should also put in place an effective and routine maintenance schedule, and qualified personnel should be engaged to handle the various maintenance and repair jobs. Close follow-up should be assured so that assignments are carried out on time. Proper records of usage, maintenance and repair operations should be kept in order to cut down on repair costs and ensure the longevity of scientific equipment.

*Stock of Spare Parts and Accessories*

The various maintenance workshops should, among other things, identify and stock spare parts and accessories for the routine and long-term equipment maintenance and repair. Long-term replacement parts are to be stocked because they may be needed at some future time when the equipment manufacturers may have changed the machine model or even closed their factory and the said spares are hard to come by.

## GHANA

### Purchasing, servicing and maintenance of scientific equipment in Ghana

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#### Summary

In Ghana, scientific equipment is found in universities, research institutions inside and outside the CSIR, (Council for Scientific and Industrial Research), hospitals and medical laboratories, organizations that deal with standards such as the Food and Drugs Board, and quality control laboratories in the manufacturing industries. The scientific equipment used include HPLC systems, spectrophotometers, fluorimeters, clinical chemical analyzers, radioisotope counters and medical diagnostic scanners. Many of the pieces of equipment are procured by the Ghana Government for educational, health and research purposes from its own resources and also by soliciting for financial help from development partners. The major problems identified are:

- Lack of funds
- Scarcity of spare parts and service manuals
- Lack of special training for service technicians
- Labour turn-over of service engineers and technicians

Useful suggestions for the future and for new approaches include ensuring that service engineers and technicians acquire more practical training to handle faulty equipment. Some old basic pieces of equipment such as Bausch/Lomb Spetronic 20 Spectrophotometers are still functioning in Ghana, and the success story is attributed to qualified service engineers and technicians as well as availability of spare parts.

#### Résumé

Au Ghana, on trouve des équipements scientifiques dans les universités, les instituts de recherche à l'intérieur et à l'extérieur des CSIR, (Council for Scientific and Industrial Research) les hôpitaux et les laboratoires médicaux, les organisations qui s'occupent de normalisation comme la Food and Drugs Board et les laboratoires de contrôle de la qualité dans les industries manufacturières. L'équipement scientifique utilisé inclut les systèmes HPLC, les spectromètres, les fluorimètres, les analyseurs chimiques cliniques, les compteurs radioisotopes et les scanners de diagnostic médical. Le gouvernement ghanéen en achète une grande partie sur ses propres ressources à des fins éducatives, de santé et de recherche mais aussi avec une aide financière de ses partenaires pour le développement. Les principaux problèmes identifiés sont les suivants :

- Insuffisance de fonds
- Pénurie de pièces de rechange et de manuels de service
- Absence de formation particulière pour les techniciens chargés du service
- Rotation de la main d'œuvre chez les ingénieurs et les techniciens

Au nombre des suggestions utiles et des nouvelles approches pour l'avenir, il conviendrait de veiller à assurer une formation plus pratique aux techniciens et ingénieurs du service pour permettre une meilleure réparation des équipements défectueux. Des équipements de base anciens tels que les spectrophotomètres Bausch/Lomb Spetronic 20 sont toujours en bon état de fonctionnement au Ghana et ce succès est attribuable aussi bien à des ingénieurs et techniciens qualifiés qu'à un bon stock de pièces de rechange.

## Introduction and background

The major problem besetting laboratories in Ghana is the servicing and repair of broken-down equipment. The government of Ghana set up the Scientific Instrumentation Centre, and the universities have electronics workshops to cater for maintenance and servicing of scientific equipment. The Ghana Government instituted the Ghana Supply Commission and Project Management Unit of the Ministry of Education for purchasing scientific equipment, while the universities established purchasing units within their finance offices to procure scientific equipment.

The following are some of the organizations with principal laboratories and the kind of facilities in existence:

- Faculties of agriculture, medicine, pharmacy and science and specialized laboratories and research institutes within universities and polytechnics;
- Research Institutes within the Council for Scientific and Industrial Research (CSIR);
- Other research institutes such as the Centre for Scientific Research into Plant Medicine, Ghana Atomic Energy Commission, Cocoa Research Institute;
- Ghana Standards Board, Food and Drugs Board;
- Medical laboratories;
- Quality control laboratories within industries;
- Customs, Excise and Preventive Service (CEPS), SGS.

The facilities include spectrophotometers, microscopes, chromatography systems (thin layer, column, including HPLC, and gas), centrifuges freeze dryers, clinical chemical analyzers, densitometers, amino acid analyzers, fluorimeters, radioactivity counters, electrophoretic equipment, drum and spray driers, plate readers and washers, microscopes, ultra-cold freezers, pH meters, balances, shakers, water baths, incubators, laminar flow cabinets.

## Review of problems and success experienced

### *Purchasing*

In Ghana, the purchasing of equipment poses no problem except that of sourcing for funds. The universities have been successful in acquiring scientific equipment by:

- Appealing to local organizations for assistance;
- Having links with other (foreign) universities and institutions for collaborative research projects, e.g. Africa Regional Programme on Insect Science (ARPIS), Microbial Biodiversity Project (DIVERSA), Leventis Agricultural Project;
- Government soliciting for grants for equipment from development partners such as the Japanese International Co-operation Agency (JICA) and the International Development Association (IDA).

### *Maintenance and servicing*

In Ghana, maintenance of equipment does not pose a problem because most researchers and technicians are able to follow the instructions for calibration and maintenance provided by the manufacturers. However, servicing is a major problem due to:

- Lack of special training for service engineers/technicians;
- Lack of spare parts and service manuals;
- Uncompromising attitude of some manufacturers and their local agents;
- Ignorance of some authorities on the right training for servicing technicians;
- Poor motivation of service technicians and engineers.

The following are some successes:

- Policy-makers recommend that part of project funds be used to train researchers and technicians or to send down specialists to service equipment.
- Some researchers use part of their project fund to acquire spare parts.
- Technicians cannibalize obsolete equipment to repair others of the same make.
- Researchers and technicians have been corresponding through overseas universities with manufacturers who felt reluctant to release service manuals for particular scientific equipment.

## Review of previous approaches

The major problems identified and the approaches to address them are as follows:

### *Lack of funds*

The Government of Ghana has instituted the Ghana Education Trust Fund (GET Fund), part of which could be used to procure scientific equipment. An appeal has been made to the Institute of Science Technology (IST), U.K. by the universities for donation of used functional equipment.

### *Scarcity of spare parts and service manuals*

Technicians have been contacting their counterparts in other organizations to request spare parts, either new or retrieved from obsolete equipment, to repair faulty equipment. Photocopies of particular service manuals are made available to fellow technicians on request.

### *Lack of special training in the servicing of equipment*

Service technicians without special training for a piece of equipment have been sharing ideas with their counterparts who have been specially trained.

## Useful suggestions for the future

- Attempts should be made to reduce the number of makes and models in any particular laboratory.
- All scientific equipment should be purchased from manufacturers or suppliers who provide service manuals and enough spare parts.
- Purchases should be made from manufacturers of scientific equipment whose local agents have qualified service technicians to handle faulty equipment.
- Special funds should be set aside for payment of work done at the electronic section of science workshops in various universities, so that the technicians there can concentrate on servicing scientific equipment instead of radio and television.
- Service engineers and technicians should be given enough practical training by attaching them to the service centers of the equipment manufacturers.
- Basic scientific equipment for teaching should be of one particular model to facilitate cannibalization when there is scarcity of spare parts.

## Suggestions for new approaches

- The Scientific Instrumentation Centre of Industrial Research Institute in Ghana, which services equipment, should be well equipped and upgraded to serve the West Africa Sub-Region, as planned by the United Nations Development Programme (UNDP).
- A library should be set up in Scientific Instrumentation Centres to offer collections of useful books, service manuals and data on both new and obsolete, functional and broken-down equipment in Ghana.
- Policy-makers should ensure that part of grants for donations of scientific equipment is used for the practical training of technicians and service engineers to handle such equipment.
- Faculties in various universities should set up an instrumentation laboratory where special expensive equipment would be housed to serve the various departmental research and teaching programmes.
- The Government of Ghana should ensure that the proposed Bachelor of Technology Programme for Scientific Instrumentation at Accra Polytechnic is implemented with the help of Scientific Instrument Manufacturing Association (SIMA) of United Kingdom.

## Conclusion

Successful scientific research work requires qualified personnel to maintain and service scientific equipment. Although some commendable progress has been made, efforts have mainly identified problems which have yet to be solved. Achieving solutions to the problems therefore requires fundamental changes in the attitude of policy-makers, equipment users, and service engineers and technicians trained to maintain and service the equipment.

## MALI

### Politique d'acquisition, d'entretien et de maintenance des équipements scientifiques au Mali

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#### Résumé

Une bonne politique d'acquisition, d'entretien et de maintenance des équipements conditionnent l'efficacité d'une recherche scientifique et technologique durable. Au Mali, les différentes institutions en charge de cette activité appartiennent à des départements ministériels différents, d'où l'absence d'une politique concertée en la matière. Chaque institution, dans le respect des règles du marché public, conduit sa propre politique en la matière. A notre avis, une politique nationale unique en matière d'acquisition de matériels avec de fréquentes sessions de recyclage et de formation initiale et continue des techniciens chargés de l'utilisation et de la maintenance dans un environnement sous-régional organisé en réseau s'impose si l'on tient compte de la faiblesse de nos États pris individuellement dans ce secteur.

#### Summary

A good policy on equipment acquisition, warranty and maintenance conditions the efficiency of a good, sustainable scientific and technological research. In Mali, the various institutions in charge of research activity belong to different government ministries which do not have a concerted policy in this field. Each institution leads its own research policy in compliance with the rules of the public market. We feel that there is a great need for a single national policy on equipment acquisition, supported by frequent sessions to provide initial and ongoing training and refresher courses for technicians responsible for equipment utilisation and maintenance. Because of the weakness of our states taken individually in this sector, this should be organised at the sub-regional level, by networking.

#### Introduction

L'acquisition et la maintenance d'équipements scientifiques performants conditionnent, pour une large part, la réussite d'un programme de recherche scientifique et technologique durable. Or, à l'instar de leurs homologues de nombreux pays africains, les institutions maliennes de recherche se trouvent bien souvent confrontées, d'une part au problème de sous-équipement et, d'autre part, à celui plus crucial de la maintenance d'équipements spécialisés coûteux qui ont été le plus souvent acquis après bien des péripéties, avec des financements extérieurs et des fournisseurs variés.

Les activités de recherche scientifique et technologique se font au Mali dans deux principaux types d'établissements. Les institutions nationales dépendent de différents ministères et les principales sont les suivantes:

- l'Institut national de recherche en santé publique (INRSP)
- l'Institut d'Économie rurale (IER)
- le Laboratoire central vétérinaire (LCV)
- le Centre national de recherche et d'expérimentation sur les matériaux locaux (CNREX-BTP)
- le Centre national de l'Énergie solaire et des énergies renouvelables (CNESOLER)
- la Direction nationale de la Géologie et des Mines (DNGM)

Les structures relevant de l'Université de Bamako et des Grandes Écoles de formation :

- les laboratoires des Facultés et Écoles
- l'Institut supérieur de formation et de recherche appliquées (ISFRA)

Outre ces institutions, il existe un organe de coordination, le Centre national de la Recherche scientifique et technologique (CNRST), rattaché au Ministère de l'Éducation chargé de la recherche scientifique. L'éparpillement entre différents ministères des structures concernées par la recherche rend difficile la coordination et pose beaucoup de problèmes institutionnels, chaque institution travaillant ainsi sous la tutelle de son ministère et mobilisant son financement, à plus de 80 pour cent, à travers ses propres réseaux de coopération. Ainsi l'acquisition du matériel scientifique n'est soumise à aucune politique nationale, si ce n'est l'obligation de respect du « code des marchés publics », en particulier dans le cas de subventions de l'État (marchés de gré à gré jusqu'à 10 000 000 FCFA, consultation restreinte ou appel d'offres ouverts au delà). Quelques exigences de la Banque Mondiale doivent également être respectées (interdiction de fractionnement des marchés, etc). Dans tous les cas, le respect de la concurrence est de rigueur. Concernant la garantie des équipements, une période de un à deux ans est en général exigée, suivant la taille et la qualité technologique de l'équipement.

En matière de politique d'entretien et de maintenance on rencontre plusieurs formules, selon les institutions :

- Formation, sur place ou à l'extérieur, d'agents propres à la structure lors de l'acquisition de l'équipement (LCV, CNESOLER)
- Contrats de maintenance d'un an ou de deux ans avec une société ou un particulier dans un domaine bien défini (IER, structures universitaires)
- Cellule de maintenance interne pour le matériel qui n'est pas du matériel trop sophistiqué, et contrats ponctuels pour le reste (DNGM)

## Difficultés rencontrées

Parmi les nombreuses difficultés rencontrées, on peut citer :

- Une absence de spécialistes locaux pour apprécier, dès le départ, la pertinence de la commande laissée au seul bailleur de fonds, ou même souvent au fournisseur
- L'achat d'appareils sophistiqués sans s'assurer au préalable des conditions d'entretien et de maintenance
- Les problèmes d'étanchéité des locaux abritant les équipements pouvant affecter les composants (poussière, humidité, chaleur...)
- Le problème de conformité des commandes avec les clauses du marché, les seuls habilités à soumissionner étant souvent des commerçants locaux ne disposant pas de spécialistes
- Les problèmes liés à la multiplicité des provenances des équipements : le technicien d'entretien et/ou de maintenance ne connaît pas souvent toutes les marques
- Le problème d'adaptation des formations (pas suffisamment de recyclage et de formation continue)
- Le problème de gestion des interventions internes pouvant provoquer des pannes fréquentes

## Suggestions et recommandations

Au vu des nombreuses difficultés rencontrées, nous suggérons que les politiques d'acquisition et de maintenance des équipements soient harmonisées à plusieurs niveaux:

*Au niveau national*

- par le recensement annuel des besoins et le groupement des commandes. Un exemple réussi de ce type au Mali est le groupage annuel des commandes des différents Centres régionaux de recherche de l'IER
- par l'organisation de sessions de formation initiale et continue à chaque acquisition de nouveaux groupes de matériels, en faveur des agents chargés de l'utilisation, de la maintenance et de l'entretien, internes à l'institution ou sous contrat



*Au niveau régional et sous régional*

- par la constitution de réseaux de maintenance
- par l'encouragement d'échanges d'information concernant les équipements disponibles, y compris les problèmes relatifs à leur maintenance
- Pour une structure universitaire ou un institut donné, nous pensons que les contrats avec des opérateurs privés sont préférables aux cellules internes de maintenance.

## **Conclusions**

Les problèmes d'entretien et de maintenance des équipements scientifiques devrait beaucoup plus préoccuper nos décideurs. En effet, de nombreux appareils sont au rebut aujourd'hui dans nos laboratoires faute d'un entretien régulier ou d'une bonne politique de garantie et de maintenance à l'achat. Étant donné l'étroitesse du marché de la demande pour de tels équipements scientifiques plus ou moins lourds, nous pensons que la solution serait de créer un réseau sous-régional de garanties et de maintenance, réseau qui aurait son sous-réseau interne et spécifique à chaque Etat. A l'intérieur des Etats, il conviendrait de mettre en œuvre une politique d'harmonisation et de formation initiale et continue des techniciens chargés de la maintenance.

## NIGERIA

# Purchasing, servicing and maintenance of scientific equipment for research and development in Nigeria: Problems and prospects

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### Summary

Research is the springboard for science and technology. Research data provide the tools for national growth and development. Local research and development are the most noble means of advancing technology, as they create new processes, products and technologies locally, thereby satisfying the needs and aspirations of the local communities while ensuring that essential expertise are developed and maintained. The role of R&D in fostering national development has been recognized in Nigeria, and adequate policy structures have been put in place that should ensure rapid economic advancement.

However, a number of factors militate against the country's desire to achieve technological strides. Key among them is the defective policy on purchasing, servicing and maintenance of scientific equipment for R&D. The difficulties faced by policy-makers, researchers and technicians are discussed and efforts made to overcome them. Issues of poor maintenance culture, poor coordination, inadequate training, lack of good communication and cooperation are mentioned. The establishment of specialized equipment maintenance centers and management committees for research institutes, similar to the existing equipment maintenance and development centers in Nigerian universities is advocated.

### Résumé

La recherche est un tremplin pour la science et la technologie. Les données de la recherche fournissent les outils de la croissance et du développement national. La recherche et le développement au niveau local sont le moyen le plus noble de faire avancer la technologie car ils créent localement de nouveaux processus, produits et technologies qui répondent aux besoins et aux aspirations des communautés locales tout en assurant le développement et le maintien des compétences essentielles. Le Nigéria reconnaît le rôle de la recherche et du développement dans le développement national et a encouragé la mise en place de structures politiques adéquates pour accélérer la progression du développement économique.

Cependant, un certain nombre de facteurs empêchent le pays de faire d'importants progrès sur le plan technologique. Parmi ceux-ci, il faut citer en premier les politiques d'achat, de service et de maintenance défectueuses pour les équipements scientifiques liés à la recherche et au développement. Les auteurs de la communication abordent les difficultés auxquelles sont confrontés les décideurs, les chercheurs et les techniciens et essaient d'y remédier. Sont également mentionnées une culture de la maintenance peu développée, une mauvaise coordination, une formation inadéquate ainsi que l'absence de communication et de coordination. Ils préconisent la création de centres spécialisés de maintenance des équipements et la constitution de comités de gestion pour les instituts de recherche, semblables aux centres de développement et de maintenance de l'équipement qui ont été mis en place dans les universités nigérianes.

### Introduction and background

Science and technology have been accepted as a tool for rapid economic advancement in the 21st century. Research, defined as the organized quest for new knowledge based on scientific methods, has been identified as the springboard for science and technology. Research enables us to obtain data on current

events and be able to predict future happenings. Research data provide the tools for development, which enables nations to obtain tools to handle issues of today and tomorrow. One of the critical components of scientific research is the availability of functional equipment for analyses. Such equipment needs to be carefully procured, maintained and serviced in order to make for smooth and error-free operations.

Technology that is essential for national growth and development may be acquired in two ways. First, it may be acquired via international transfer, usually through the activities of multinational corporations. Second, technology may be acquired through investment in scientific research and development (R&D). The latter approach is generally favored as it can generate really new products, processes and technology locally. The need for local R&D initiatives is also justified by the local benefits, that may be derived, e.g:

- Relevance to the needs of the society;
- Attention to the local problems of the people;
- Essential expertise that is developed and maintained through continuous R&D;
- Stimulation of growth and development in goods and services, and new products that can lead to improvements in the economy and socio-political life of the people.

The government of Nigeria has recognized the role of R&D in its growth and development efforts and has developed policies and programs that support scientific research, e.g. research institutes and centers (61), universities (38) and polytechnics spread all over the country that engage in various teaching and research activities. R&D is recognized and gives due attention to virtually all the sectoral economic policies of Nigeria. Thus, Nigeria's economic master plan tagged "Vision 2010" has stressed that indigenous capabilities must be built up in S&T in order to make meaningful progress.

In this regard, the Federal Ministry of Science and Technology coordinates the activities of most of the R&D institutions and centers while the National Universities Commission (NUC) coordinates research and teaching in the universities. Government, through the NUC and The British Council Overseas Development Administration (ODA) set up Equipment Maintenance and Development Centers (EMDCs) in five universities in Nigeria, as far back as 1990 to revive teaching and research equipment in the Nigerian university system. This project is currently supported and funded by the NUC. The five EMDCs were established in different geographical locations in order to help in establishing Equipment Maintenance Centers (EMCs) in universities located nearest to them. The project was aimed at inculcating the culture of maintenance, and supporting equipment purchasing, servicing, maintenance and use in the universities. The effort was to reduce costs thanks to in-house repairs, and to build up capacity in maintenance.

At the moment, all the Universities have established EMCs. This initiative is however missing in the stand-alone research institutes. But there are research and development centers in Nigeria that specialize in the manufacture, servicing and maintenance of laboratory and industrial equipment, e.g. the National Agency for Science and Engineering Infrastructure (NASENI), the Project Development Institute (PRODA) at Enugu, the Science Equipment Development Institutes (SEDI) at Enugu and Minna, the African Regional Center for Equipment Development and Manufacture (ARCEDEM) at Ibadan, etc.

The country has invested in the S&T system to move forward economically. It is however sad to mention that despite a relatively huge investment in S&T policy structures and programs, the system still falls short of the desired impact on the economy. The S&T system in Nigeria has experienced many set backs due to political instability and military rule. Generally speaking, research suffers from policy incoherence, poor coordination among scientists and inadequate infrastructural support and manpower development. It is generally believed that the problem may be linked to the fact that government's efforts in encouraging R&D activities are thinly spread across a large number of institutions, resulting in under-funding, and a poor state of facilities and staff motivation. Over the years, the condition has been compounded by:

- Deteriorating educational system with low output of science and engineering graduates;
- Low development of science and technology infrastructure;
- Slow development of telecommunications;
- Decline of foreign investment and low level of technology-related investment;
- Low level of international networking in technology.

Although the R&D institutes and universities have different mandates and are at various stages of development, issues of equipment purchase, servicing and maintenance are crosscutting to all of them. The impact of good scientific equipment in the effectiveness of teaching and learning, research, quality of R&D results and products cannot be overlooked in Nigeria's quest for self-reliance in S&T. This paper therefore gives an overview of the problems and prospects of equipment purchasing, servicing and maintenance in Nigeria and suggests the way forward in the light of the emerging democratic recovery.

## **Review of problems and successes regarding purchasing warranty conditions, servicing and maintenance of research equipment**

Presently equipment required for scientific research in Nigerian universities and R&D institutes is grossly inadequate. It is either not available or, mostly, in a non-functional condition. The care, maintenance and repair of research equipment have been very poor. In some cases, manufacturers supply obsolete or incomplete systems. The necessary administrative support is missing, leading to bad usage compounded by frequent changes in technology. The operators lack adequate information and knowledge of the relevant technologies and equipment. Most establishments have depended on donors, but even then, government sometimes constitutes its own barriers through bureaucracy, lack of continuity in programs, etc. Nevertheless, the establishment of the EMDCs by the NUC has offered some relief even though the centers have cried of inadequate funding recently.

### *Evaluation, selection and procurement*

The process for equipment evaluation and selection before purchase and use in the scientific laboratories is faulty and should be re-examined. This process helps with the economic analysis and understanding of performance and ease of operation before the purchase. The costing process in the procurement of R&D equipment is unique and has to be addressed carefully. The cost of acquiring equipment, for instance, must also be considered in terms of possible options, namely, purchase, lease or rental. In the case of purchase, amortization, depreciation and interest rates on borrowed money, or rate and volume of cash flow are matters for serious consideration. In other cases, factors such as terms of contractual commitment require evaluation in connection with cost and expected revenue (income).

The cost of operating and maintaining equipment is also critical in its selection, evaluation and procurement. The overall view of acquisition and operating costs will depend largely on the administrative priorities of the organization (for institutions with respect to pay back period, present value and return on investment). Therefore, the institutions' management and their laboratory directors need to work together to analyze the cost of equipment before purchases are made.

### *Poor funding*

Generally, government funding of scientific research is grossly inadequate and the funding processes are inconsistent. Agreement with donors and suppliers are difficult to secure especially with regards to counterpart funding; contracts are sometimes inflated and discounts are lost to middlemen. There is general lack of interest in funding research among private organizations and individuals. Whereas, on the average, up to 2.5% of GDP is devoted to R&D in developed countries, the figure is <1% in developing countries like Nigeria. As a result of this, it is difficult to negotiate and select research equipment properly, and sometimes quality may be compromised by affordability.

### *Poor servicing and maintenance culture*

The servicing and maintenance of equipment is a requirement of Good Laboratory Practices (GLPs), which we are beginning to adopt with some difficulty. It is usually carried out either routinely or at regular intervals, irrespective of performance and reparative work done on equipment. Regular calibration or checking ensures that a piece of equipment is in a good functional state according to the specifications. There is generally a poor or total absence of maintenance culture among Nigerian equipment users/operators and managers. Contractors in Nigeria have used this weakness to shortchange institutions. Preventive maintenance of equipment may take time, but it extends the live span of equipment and increases the accuracy and precision of test results. At the same time, damaged equipment can be made functional again either by repairing damaged parts or outright replacement. In Nigeria, the problem seems to be that the culture of maintenance is missing.

### *Import duties*

Duties on imported equipment constitute a major barrier to the acquisition of scientific equipment even when they come as grants. Sometimes, due to customs bureaucracy or delays in counterpart obligations, offers and warranties expire. There is a need for awareness and understanding between users and the customs officials on the need to view equipment purchases as an essential commodity for industrial growth and national development.

### *Absence of specific policy on equipment*

The NUC has developed a system of coordination for the purchasing, servicing and maintenance of research and teaching equipment in the universities through the establishment of Equipment Maintenance Development Centers (EMDCs) and Equipment Maintenance Centers (EMCs). Equipment procurement is done centrally under the Committee of Vice Chancellors (CVC) and the NUC collaborative program. In the selection of equipment, priorities are given an order of importance, which can be determined by the following considerations:

- Systematic analysis of the role of the equipment (i.e. its suitability) in the workflow in the laboratory;
- Identification of candidate systems;
- Analysis of cost-effectiveness of rival candidate systems;
- Assessment of the systems acceptability to operations (i.e. user friendliness, serviceability, etc.);
- Characterization of analytical performance.

Therefore, there is need and an equipment database for policy to guide the screening methods, which utilize information from various sources including manufacturer's literature and equipment users. Other sources of information are on-site demonstrations, visits to laboratories that use the equipment, conversations with colleagues and displays at Professional meetings.

Research institutes should adopt the maintenance structure of the EMDCs of the NUC in Nigeria. The centers will provide for repair and maintenance and will maximize manpower and resources. A policy of standardizing equipment in universities and research institutes should be pursued as well.

### *Inadequate personnel and training*

Institutions in Nigeria responsibility for scientific research are under-staffed, especially in areas of equipment operation and maintenance. It is either that there is no qualified staff or that too few are available. Training and retraining on equipment use and maintenance in R&D institutes is grossly inadequate or totally missing. The NUC through the EMDCs have organized training workshops under the project although finding funding seems to be another handicap. The training and maintenance of the entire program of EMDCs should be self-sustaining.

## **Review of previous approaches that have been made to address identified problems**

### *Funding*

Universities and research institutes in Nigeria have always asked for larger subventions from government since the yearly allocations never meet their budgetary requirements. Further, individual institutions continue to seek grants from potential donors to enhance their research capabilities.

### *Equipment repair and maintenance*

Repairs or replacements of broken-down equipment are being affected in some instances but the effort is not enough to provide for even 50% of the equipment needs of research institutes and universities. The tendency these days is to improvise or use second hand spare parts, and this strategy has worked to some extent. Also, Standard Operating Procedures (SOPs) are being adopted for the use and maintenance of research equipment by some institutions (e.g. the National Institute for Pharmaceutical Research and Development, NIPRD).

### *Personnel*

Steps are being taken by some organizations (e.g. NIPRD) to produce blueprints for the training of equipment operators and maintainers. The Nigerian Institute of Science and Technology (NIST), and the Nigerian Institute of Medical Laboratory Technology (NIMLT) have been addressing the issues of Professionalism for technologists and technicians. Training needs should be based on the prevailing situation, and processes should be aligned with new trends in information technology and new equipment.

### **Suggestions on what will be useful in the future**

- Need for cooperation between research fellows, lecturers, and technicians, chief executives at institutional level is paramount if the program of purchasing, servicing and maintenance is to succeed. All the stakeholders, organizations with experience and donors need to sit together to plan for future activities in this sector.
- There is need for global cooperation and networking among stakeholders and a strong linkage between R&D establishments and industries.
- We need to ensure the quality of research through GLP and to imbibe an “efficient funds use” culture.
- Manpower development and staff motivation through training and retraining is necessary.
- In terms of funding, the process of purchasing, servicing and maintenance should be self-sustaining after take off, and there should be a budget allocation for equipment maintenance.
- The low investment Profile of the private sector in R&D should be discussed with the relevant industry itself. Government should increase its funding to enable a successful take off of the system.
- Equipment purchasing, servicing and maintenance centers are essential at the institutional level to help with equipment management. A few centers should be designated as specialized centers for this purpose. This process should be pursued because of its enormous potentials.
- There is need for policy to guide the screening method and standardization before the purchase of equipment.
- There is need for prioritizing equipment purchasing and use and for new initiatives in this regard through selective targeting of projects, technologies and processes. The problem is that expensive equipment purchased but not put to efficient use is a waste in itself.

### **Suggestion of new approaches for universities and research institutes - national and regional strategies**

Any attempts at solving the problems of equipment procurement, servicing and maintenance in scientific research must involve a deliberate effort on the part of governments and/or organizations towards the development of clear-cut policies. Good policies at institutional, national and regional levels will address critical areas. Generally there is need for national and regional databases for information sharing.

### *Institutional level*

- The monitoring and evaluation of equipment use, service and maintenance create avenues for sharing knowledge on equipment, repairs and maintenance.
- Equipment for use in any research laboratory must be selected according to standard methods which consider the suitability of the system through an analysis of its cost-effectiveness, user-friendliness, serviceability and performance vis-à-vis other candidate systems (NCCLC standard EP11 guidelines of 1992). Therefore, coordination and control of purchasing, servicing and maintenance through instrument management committees is suggested so as to reduce cost. Such a group should also manage spare part supplies, communicate with other establishments, etc.
- Equipment should be procured as much as possible from reputable nationally and internationally accredited manufacturers.
- Purchased equipment should, on arrival, be evaluated to ensure that the sensitivity, specificity, accuracy and precision claimed by the manufacturers are achievable (NCCLS standard EP 5-T guidelines of 1982). Equipment should be used and maintained in accordance with the manufacturer’s instructions and by qualified personnel only.

- Research equipment should be automated to improve speed, precision and accuracy of collection and data analysis. Vital and delicate equipment should be provided with back-ups as safeguards and to prevent loss of data in the event of power outage.
- Proper records of all repairs, routine maintenance and any non-routine work carried out on any equipment should be documented and kept so that users can be made aware of the state of the equipment at all times. Individual laboratories should develop SOPs for the use and maintenance of scientific equipment in accordance with GLP requirements.
- Training provisions should be made for research fellows, lecturers and technologists; organize workshops and training courses. Equipment operators should be provided with adequate training and user manuals on research equipment to enable them to use the equipment properly as well as to detect ordinary malfunctions and effect simple repairs on-site.
- Equipment manufacturers should provide service engineers for periodic servicing and maintenance of the equipment they supply. Their representatives should install the equipment and also train the intended users.

#### *National level*

- The school curricula should lay emphasis on the need for maintenance and servicing skills especially in the polytechnics and colleges that train technicians.
- To avoid duplication of efforts specialized centres should be designated for equipment purchasing, servicing and maintenance, similar to the NUC EMDCs, with funding provisions that should be self-sustaining.
- Scientific research should be adequately funded in universities and research institutes by the government and the private sector.
- Government should continue to give concessions/exemptions on customs duties for equipment donated by foreign organizations or governments.
- Administrative priorities of research organizations should be arranged such that equipment needs are adequately met.

#### *Regional level*

- Encourage networking with national and regional institutions that have common goals and aspirations. Set regional priorities in line with economic realities.

## **Conclusion**

Only a well-defined policy on funding of equipment needs and training of equipment handlers can ensure that the problems of purchasing, servicing and maintenance of scientific equipment are surmounted. There is need for a policy on the standardization of research equipment. EMDCs will institutionalize the maintenance culture into the R&D system and should be adopted by all R&D Institutions. There is also a need for an information database on equipment that should be available on a network to which all the stakeholders may be hooked.

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## NIGERIA

### A review of problems in purchasing, servicing and maintenance of scientific research equipment in the Nigerian Universities

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#### Summary

This position paper reviews the equipment maintenance experience in Nigerian universities while making a critical review of the maintenance culture itself. A case study revealed that out of the equipment surveyed in a typical Nigerian university, close to 48 percent was functional, 24 percent was obsolete while 29 percent was non-functional. Obsolescence is therefore a major factor requiring serious consideration during purchase. Synchronization of the country of origin / brand of equipment, etc, is highly recommended. Since a little under a third of the equipment at the time of survey required servicing, the importance of functional service centres and of the provision of an adequate stock of spare parts cannot be over-emphasized.

#### Résumé

Les auteurs de cette communication font le point de l'expérience vécue par les universités nigérianes et élargissent le débat en analysant la situation de la maintenance de l'équipement scientifique dans son ensemble. Une étude de cas a montré que le parc de matériel scientifique d'une université nigériane type était constitué à 48 pour cent d'appareils en état de marche, à 24 pour cent d'appareils obsolètes et à 29 pour cent d'appareils hors d'usage. La désuétude est donc un point important qui mérite d'être pris en compte lors de tout achat d'équipement. Il est recommandé de veiller tout particulièrement à une bonne synchronisation entre pays d'origine, marque de fabrique, etc. Au vu de la constatation faite à l'époque où l'étude avait été réalisée et selon laquelle un peu moins d'un tiers des appareils avait besoin d'un service d'entretien, on ne saurait assez relever l'importance de disposer de centres de maintenance en bon état de fonctionnement et de stocks de pièces de rechange bien approvisionnés.

#### Introduction

The maintenance culture in Nigeria is weak, if not totally absent (Lawal 2000). Generally, in the past, foreign technology was mostly in use and the maintenance strategy applied in the country of origin was not endorsed. It was therefore easier for Nigeria to follow the way of others in the "throw away culture". Faulty equipment was thrown away and replaced by new equipment. This method was easy to operate during the period of the "oil boom" when Nigeria could afford whatever it wanted. During the economic down-turn, when it became impossible to finance new projects, it became necessary to maintain existing equipment. This period brought in the era of ingenuity and creativity in Nigeria's maintenance culture. The consciousness of and need to cultivate a maintenance culture became apparent.

In the university system, up to a certain epoch, the maintenance culture was different. The university system had its own in-house maintenance division as an integral part of its existence. At inception in Nigeria, the university created well-equipped workshops for the maintenance of its equipment. The system also had a well-arranged and sustainable maintenance culture of continuous training for technologists. Besides, the university, through its agents, contributed to the design and quality control tests for new equipment.



However, the university system was affected by the economic down-turn. This was manifested in the university's inability to finance training programmes for technologists, procure new equipment and spare parts, etc. This regional meeting at the Buea University, Cameroon aimed at bringing together stakeholders in the Western African sub-region involved in the supplying, purchasing, using and maintenance of scientific equipment is, therefore, a welcome development.

### Purchasing, acquisition and procurement in retrospect

Shortly before independence, Nigeria had a College of the University of London as the only degree-awarding institution. The academic, technical and administrative staff then were all trained in Europe (particularly in Britain). Equipment purchasing, acquisition and general procurement were centrally made and standardised through the Crown Agent based in London, U.K. However, after independence, more universities were established and Nigerians were trained in different parts of the world to replace expatriate staff. The exclusive monopoly of the Crown Agent began to diminish. Other agents in the USA, continental and eastern Europe and Asia began to have an in-road into the Nigerian market. The emergence of more state and federal universities in the 1970s radically influenced a dramatic increase in volumes of acquisitions as well as in the variety of scientific equipment. This affected uniformity, standardisation, quality and reliability. Most of the equipment was supplied by vendors who knew nothing about the functions of the equipment. They therefore were not able to test its reliability. In most cases vital accessories were not included in the purchase. Hence, even if the equipment was successfully installed, maintenance became a problem. Vendors purchased equipment from all parts of the world as long as their profit margin was not tampered with. Those who suffered the consequences of this uncoordinated purchase were the researchers and the other end users.

### Classification of the situation on the ground

In most laboratories and workshops in our universities, the conditions of the equipment could be classified into four main groups as follows:

- Functional
- Non-functional
- Non-functional but serviceable
- Obsolete

A greater percentage of equipment in the laboratories and workshops could be classified as **non-functional**. From the inventory of equipment in one of the universities under our Centre, the pie chart below (Figure 1) shows the relationship between functional, non-functional and obsolete equipment.



Figure 1. Typical ratio of Functional, Non-functional and Obsolete equipment in a university

The erratic electric power supply in the country contributes to a lot of the damage observed in power supply units of much of the equipment. Cases of blown fuses, burnt transformers and switching devices are common. Minor as it may seem, blown fuses can cause delays if the spare parts are not readily available. Environmental factors significantly affect the performance of our equipment. The Nigerian weather is hot (24 – 38oC) and humid (up to 98% Relative Humidity) and at most times in the year, it is very dusty with particulate sizes up to 70µm (Akeredolu 1989, Ogunsola *et al.* 1993). In addition to the dust-laden harmattan, many road construction projects taking place all over the country constitute continuous sources

of dust. These all contribute to equipment deterioration in most laboratories. Many laboratories require dehumidifiers during the rainy season (Osasona 1988).

Another set of non-functional equipment are those with missing vital parts. Some vital parts were lost in transit or damaged as a result of rough handling at the port of entry. In some cases vital components were omitted at the time of ordering of the equipment. This may be an error out of ignorance on the part of the equipment vendor, who genuinely did not know anything about the equipment. It could equally be a way of increasing the Profit margin. Such equipment can therefore be classified as non-functional since it cannot be fully installed or commissioned. The contractors or vendors usually have nothing to lose in this case since the bulk of their money is paid up front. The equipment may then be abandoned and remain non-functional.

Equipment that comes without any operating or service manual is also included in this category since it may be abandoned if no effort is made to procure the manual from either the manufacturer or the supplier. The omission of the service manual may be a deliberate ploy of the supplier to ensure that the user always has to refer to him. This guarantees that the Maintenance Agreement signed with the company is not tampered with. The last category is composed of equipment considered to be obsolete. This category is no longer on the production line of the manufacturers. When the stock of spare parts is depleted, it becomes difficult to keep the equipment running. The equipment then becomes non-functional. Obsolescence may not result from years of service. It may be the result of newer and more efficient models, with improved capabilities, being made available in the market.

## **Other problems associated with use of scientific equipment**

### *Non-standardisation*

It is obvious that acquisition of equipment from different manufacturers and foreign countries creates maintenance problems. A technologist trained on one brand of products may need re-training when the brand is changed. It becomes difficult if the collection in a laboratory is a mixed bag since the technologist must be skilled in the maintenance of all the brands in his/her laboratory. This may be difficult. Besides, the spare parts may not be interchangeable, which means increased costs.

### *Phased out Equipment*

Technology has fast-changing phases, so new models are on the market virtually on a daily basis. Universities and research institutes often possess a large number of phased out equipment in their collection. Since spare parts are no longer on the market, maintenance of such equipment is a problem. Whenever the spare parts are needed, special orders have to be placed. The equipment, therefore, is more expensive to maintain. It is important to note that most equipment now in laboratories are microprocessor based. There is the need to re-train our old hands if effective maintenance is to be carried out on the new equipment, as well as to procure diagnostic tools.

### *Environmental Factors*

Scientific equipment has inherent sensitivity to environmental conditions. If not used in the right atmosphere, erratic results may be obtained. Most of the equipment used in Nigeria is manufactured for temperate countries where the electricity supply is stable. Unless such systems are designed with the tropics in mind, their life span will be shortened significantly by environmental factors. Power supply units should be designed specifically to cope with the erratic nature of our electric power supply. A simple example is the usual 5 seconds delay before a power amplifier stage comes on after the power supply is switched on. The fact that the power amplifier stage does not come on immediately limits the effect of surge on the equipment. Bad sectors in the computer hard disk are caused by sudden power outages while the computer is operating. Designs must take into account the effect of high relative humidity in the country, high level of dust and very high ambient temperatures.

### *Shortage of Spare parts*

A large percentage of idle and faulty equipment in laboratories and workshops is caused by non-availability of spare parts. This shortage could come from the inability to finance the purchase of the needed spares. Equipment like High Pressure Liquid Chromatograph may be out of use because the pump or the synchroniser has broken down. Equally, Ultraviolet Visible Spectrophotometer equipment may be down because of a faulty lamp, or an Atomic Absorption Spectrometer may be idle because the hollow cathodes of the elements are dead, etc. There are no spare parts industries for scientific equipment in Nigeria.

### *Lack of skilled Technical Staff*

The majority of technologists/technicians have been given general training. With this general training they have kept the system going. Almost all modern equipment is microprocessor-based. Therefore, for our technologists to continue to perform efficiently they must be re-trained, preferably by the equipment manufacturers. They must also be made computer-literate. In addition, a proper policy of enhancing a sustainable maintenance culture must be put in place in our universities.

## **Equipment maintenance initiatives in the Universities**

The National Universities Commission (NUC) and the Overseas Development Agency (ODA) of the British Council created a pilot project in 1989. The programme was started in four centres: Ahmadu Bello University in Zaria, Abubakar Tafawa Balewa University in Bauchi, Obafemi Awolowo University in Ile-Ife, and University of Calabar. These centres were financed through the World Bank sector credit, while the University of Nigeria Nsukka was financed by the European Union. The main task of these centres was to develop a maintenance culture within the five universities directly and other universities within their zone indirectly through outreach training activities. The outreach training workshops are organised to assist the remaining universities in their respective zones establish their Equipment Maintenance Centres (EMCs).

The first national awareness seminar on equipment maintenance policies for Nigerian universities was held in 1989. Some technologists and scientists were sent to Britain. The second seminar in September 1990 brought together those trained in Bristol, UK and other technologists from Nigerian universities to sensitise them to the functions and types of Equipment Maintenance Centres being inaugurated. Between October 1990 and March 1993, over eight workshops/seminars were organised in different centres to review and implement the maintenance culture in the various universities. The pilot centres which were later redesignated Equipment Maintenance and Development Centres (EMDCs) were encouraged to assist the other universities start their own Equipment Maintenance Centres (EMCs) through the support of the National Universities Commission (NUC).

Each EMDC is to have an academic director, a technical coordinator and some affiliated technologists. They all work on a part-time basis. There are two full-time technical assistants, an administrative secretary and a despatch clerk. Workshops are held for three to five days in a month. During this period a lot of equipment is actually repaired.

Financial allocations are made directly to the EMCs from the NUC; in addition, the EMCs receive 8% of their respective university's teaching and research equipment allocation.

Fifteen percent of the basic salary of each affiliated technologist is paid as remuneration. This is paid on a pro-rata basis. Only the Director and the Technical Coordinator are paid on a monthly basis, the same 15% of their basic salaries. With the dwindling government allocations to the universities, there is a tendency to spend all the money in paying staff salaries, to the detriment of the centres.

## **The Central Science Laboratory initiative**

With the continued dwindling financial support to universities from the Federal Government, the idea of the Central Science Laboratory was conceived recently. It has research equipment that is too expensive for individual departments to procure, but nevertheless required for continued good quality research by scientists. Resources are thus pooled together to achieve this objective. A building is dedicated to the use of the Central Science Laboratory. It is fully equipped to include steady power supply, relevant chemicals, consumables and all that may be required for a conducive research environment. Equipment like 200MHz

Nuclear Magnetic Resonance (NMR), Scanning Electron Microscope (SEM), UV-VIS, HPLC, AAS, Centrifuges, etc are installed and operational. User groups participate fully in the daily operations of the laboratory and are also represented on its Management Board. The users are charged a token sum for the services rendered by the laboratory, if they are from the home university. External users are charged more.

## Conclusion

The equipment maintenance initiative, if continued, will eventually help to restore the old university maintenance culture. Presently, it has helped to provide a database on all the equipment in service at the Nigerian universities. About 48% of the equipment in these universities is functional, about 29% non-functional or awaiting spare parts for repairs and roughly 24% is obsolete. The concept of the Central Science Laboratory is expected to improve the quality of research output in the university. It is therefore recommended to universities as a way of acquiring expensive research equipment. The method of purchasing equipment in universities should be looked into critically with the aim of avoiding purchasing through vendors who are not familiar with the equipment. All new equipment should be purchased with enough spare parts to last a reasonable period of their operating life. Service and maintenance manuals should be made available to the users. Purchasing the same type of equipment from various manufacturers should be discouraged. Local and overseas training of technologists should be encouraged through regular workshops partly sponsored by the manufacturers and by other interested parties.

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## SENEGAL

### Problématique d'une infrastructure scientifique au Sénégal

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#### Résumé

Le manque d'équipement scientifique adéquat est l'un des principaux problèmes auxquels se trouve confrontée la recherche scientifique au Sénégal. Un certain nombre de difficultés et de lacunes ont grevé les modalités d'acquisition du matériel scientifique encore en usage aujourd'hui. En général, aucun budget national n'habilite les chercheurs à acquérir du matériel scientifique. Certains appareils lourds dont l'acquisition a été financée sur les fonds de la coopération pour le développement sont toujours utilisés à ce jour. Il reste que l'absence de cours de formation et de recyclage pour les techniciens et le manque de communication avec les fournisseurs sont les enjeux les plus importants. Des suggestions sont formulées pour promouvoir la recherche scientifique en Afrique de l'ouest.

#### Summary

Lack of adequate scientific equipment is one of the main problems of scientific research in Senegal. Ways to purchase scientific equipment used up to now had some drawbacks and problems. In general, a national budget does not enable researchers to purchase scientific equipment. Some heavy equipment purchased from development cooperation fund are still now no in service. Lack of training and retraining for technicians and lack of maintenance contacts with suppliers are the main problems. Suggestions are made to promote scientific research in West Africa.

#### Introduction

Selon des estimations non officielles, l'Afrique au sud du Sahara (à l'exception de l'Afrique du Sud) participe à moins de 1 pour cent de la production scientifique mondiale. Cette faiblesse est liée, entre autres facteurs, aux conditions d'exercice de la recherche. Aujourd'hui, incontestablement, la plupart des pays africains disposent d'hommes et de femmes capables de participer à l'effort mondial pour la maîtrise et le partage du savoir scientifique. Le Sénégal qui oriente sa politique scientifique vers la résolution des problèmes de santé et d'alimentation, d'une part, et la valorisation des ressources naturelles, d'autre part, dispose d'une Délégation aux Affaires scientifiques et techniques dont le rôle est de coordonner et de donner une impulsion à la recherche scientifique. Cette recherche s'effectue principalement dans les universités et à l'Institut sénégalais de recherche agricole (ISRA), l'Institut de technologie alimentaire (ITA), l'IRD et l'Institut Pasteur.

Notre intention n'est pas de décrire les problèmes d'équipement dans les différentes structures existant dans le pays mais de nous limiter à quelques exemples connus à la Faculté des Sciences et techniques et à la Faculté de médecine et pharmacie de l'Université Cheikh Anta DIOP de Dakar ainsi qu'à l'Institut Sénégalais de Recherche Agricole (ISRA). Nous essaierons de faire des propositions pour ouvrir des pistes de réflexion qui pourraient permettre d'améliorer la gestion des appareils et aider à prolonger leur durée de vie.

## Situation actuelle

Les trois structures citées plus haut ont pour mission de :

1. former des ressources humaines compétentes;
2. participer de manière déterminante à la politique de recherche scientifique du Sénégal;
3. générer des technologies et des connaissances.

Les structures universitaires et les instituts de notre pays ont presque les mêmes procédures d'acquisition d'équipement. En raison des coûts élevés qui ne peuvent être pris en charge par le budget alloué par l'Etat, les projets représentent alors la meilleure voie d'accès à l'équipement scientifique. Ces projets sont financés soit par les accords de coopération avec les entités de recherches européennes en général, soit par des organismes internationaux (TWAS, UNESCO, COSTED, IFS, IOCD), l'UCAD comme l'ISRA bénéficiant en outre de projets de réhabilitation financés par la Banque Mondiale avec possibilité d'acquérir des équipements scientifiques. C'est dans ce cadre que s'inscrivent les prévisions de financement de l'ISRA pour acquérir les appareils suivants en complément du matériel existant:

- une chaîne colorimétrique technicon de 2ème génération ;
- un bloc de minéralisation azoté de 20 postes
- un agitateur tournant à 10 postes ;
- un AS-90 pour spectroscopie atomique,
- des broyeurs et une station de déminéralisation.

L'ISRA effectue dans ses laboratoires (Dakar, Bambey et Saint-Louis) des analyses physiques, chimiques et physico-chimiques des sols, des plantes et de l'eau, selon une moyenne estimée à 1 000 échantillons analysés au cours des trois dernières années. La capacité potentielle d'analyse peut atteindre 12 000 échantillons par an.

Le projet de réhabilitation de l'UCAD financé par la Banque Mondiale prévoit un équipement scientifique pour la recherche qui n'est pas encore disponible. Par contre, on peut citer des exemples de partenariat inter-universitaire avec les laboratoires de la Faculté des sciences et de la Faculté de médecine et pharmacie :

- *Le Laboratoire des Produits Naturels* a pu acquérir, grâce à l'accord inter- universitaire avec Perpignan (France), des pompes à vide, de la verrerie de laboratoire, du matériel de chromatographie (plaque, colonne, gel, ...) des produits et solvants, sur une durée de trois ans. Il a également bénéficié d'un projet financé par la TWAS à hauteur de cinq (5) mille dollars, ce qui permis d'acquérir un congélateur, du matériel de chromatographie et des consommables. En ce qui concerne l'équipement lourd, les laboratoires restent dépendants de l'extérieur pour une bonne partie des travaux scientifiques. C'est ainsi, par exemple, que toutes les micro-analyses, tous les spectres RMN mono ou bidimensionnelle, les spectres Moss Bauer, les couples HPLC – IR, HPLC – Masse ou HPLC – RMN sont réalisés à l'extérieur. Cela compromet la recherche scientifique.

- Pour contrôler la pollution de nos côtes, *le Laboratoire de Chimie Analytique et de ToxicologiePharmacie* avait fait l'acquisition des deux appareils suivants par le biais de la FAO:

- 1 CPG
- 1 SAA

Aucun problème ne survint ni lors de l'installation du matériel, ni pendant la formation du technicien appelé à prendre en charge le fonctionnement des appareils, ni pour des questions de maintenance, la raison en étant que le technicien avait été formé au maniement de l'appareil ainsi qu'aux techniques analytiques relatives à l'échantillonnage, à la préparation des analyses et à l'interprétation des résultats. De plus, à intervalles réguliers, un ingénieur chargé de la maintenance se rendait périodiquement sur le terrain.

Aujourd'hui, le problème de maintenance se pose pour les dernières acquisitions que nous avons faites. Nous avons essayé de le résoudre avec la participation du technicien- ingénieur spécialisé en chromatographie afin de maintenir un service d'entretien à moindre coût. Cet ingénieur spécialisé nous offre gracieusement tous les frais liés à sa rémunération. C'est lui auquel nous avons fait appel au moment

de l'installation parce que la Société localement responsable de ce volet du programme n'avait pas les compétences requises.

- En 1992, le *Département de Chimie de la Faculté des Sciences et Techniques* a pu acquérir, grâce à la coopération établie entre Dakar et Trento, un matériel d'analyse comprenant :
  - 2 HPLC Jeol (Sciences et Pharmacie)
  - un FT IR Jeol
  - une H1 RMN Varian 60 MHz ;
  - 2 CPG Carlo Erba (Pharmacie)

La HPLC et le FTIR d'installation et de mise en service facile sont en fonctionnement. Toutefois le renouvellement des colonnes pose souvent des problèmes. La RMN 1H 60MHz, livrée sans accessoires, n'a toujours pas été déballée, aucun technicien sénégalais ne sachant installer ni faire fonctionner cet appareil qui est encore dans son emballage d'origine. Le négociant-fournisseur, à ne pas confondre avec le fabricant, n'a jamais pu se déplacer à Dakar pour procéder à l'installation.

Comme on le constate, il est nécessaire d'améliorer cette stratégie d'acquisition de matériel scientifique de haute portée technologique dans un grand projet comme celui de Dakar et Trento, reconnu et apprécié par les différents partenaires. On peut citer de nombreux cas, dûs au manque de compétence, de matériel neuf resté dans l'emballage d'origine jusqu'à détérioration. A cela s'ajoute une carence notoire d'entretien dans nos structures. Les dépenses d'entretien sont souvent considérées comme un luxe alors qu'elles sont garantes de la longévité du matériel.

## Suggestions

La résolution des problèmes soulevés ici, nécessite à notre avis l'examen des quatre recommandations suivantes (non exhaustives):

1. L'ouverture au niveau régional (Afrique) ou sous-régional (Afrique de l'Ouest) d'une formation permanente et d'une formation continue de techniciens capables de prendre en charge le fonctionnement et la maintenance des équipements scientifiques.
2. La création, dans chaque sous-région africaine, d'un centre d'excellence en mesures physiques équipé d'instruments performants et ceci d'autant plus que nous disposons, entre scientifiques, des outils d'intégration de nos efforts de recherche (exemple : la Société Ouest Africaine de Chimie (SOACHIM), le WANNPRESS, l'AAPAC).
3. Les cahiers des charges pour l'acquisition d'instruments scientifiques devront comporter des exigences en matière de contrats d'installation, de mise en service, de maintenance et de stages de perfectionnement pour les techniciens.
4. La création d'une base de données sur les appareils de laboratoire avec indication des performances et des lacunes, des facilités de réparation sur place, etc.

Pour promouvoir l'instauration de conditions propices à la recherche scientifique et, par voie de conséquence, au développement, l'Afrique doit continuer à déployer des efforts d'intégration de façon encore plus hardie, notamment dans le domaine des sciences et des techniques, en créant dans chaque sous-région un «centre régional africain de mesures physiques» (CRAMP).

## Conclusion

Il apparaît que des moyens importants ont toujours été dégagés pour faciliter l'acquisition d'équipement scientifique. Bien que l'accent ait souvent été mis sur le matériel de laboratoire de base, les différents projets de recherche conjointe entre Sénégalais et étrangers ont permis aux chercheurs de disposer d'un minimum d'outils performants indispensables à une production scientifique de qualité. Il n'en reste pas moins que des problèmes persistent tant au niveau de la mise en service que de la maintenance. Les ressources humaines sont malheureusement négligées, notamment la mise à disposition de services qui soient assurés par des techniciens capables de gérer le fonctionnement de cet équipement de pointe. Les suggestions formulées dans cette communication pourraient apporter un début de solution à nos préoccupations.

## TOGO

### Achat et maintenance des équipements scientifiques au Togo

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#### Résumé

La recherche scientifique est un outil essentiel du développement économique. Au Togo, le cadre institutionnel créé il y a quelques années pour coordonner la recherche n'est pas suffisamment étoffé pour tirer parti de toutes les prérogatives qui lui ont été accordées. Les institutions de recherche ne sont pas suffisamment efficaces. Le parc scientifique est peu important et parfois mal entretenu. Le service d'achat et de maintenance est presque inexistant. La création d'une école sous-régionale pour la formation de techniciens de maintenance de matériel scientifique et d'équipement de mesure doit être sérieusement envisagée. Les centres de recherche mettant en valeur les compétences et les capacités de plusieurs pays constituent le cadre privilégié pour la promotion de la recherche scientifique en Afrique.

#### Summary

Scientific research is an essential tool for economic development. In Togo, the institutional structure created a few years ago to coordinate research is not well enough endowed to take full advantage of its prerogatives. The research institutions are not effective. The scientific installations are sparse and poorly maintained. The purchasing and maintenance service is practically non-existent. Serious thought needs to be given to creating a sub-regional school for training maintenance technicians for scientific and measurement equipment. Research centres that optimise expertise and capacities from several countries at a time could serve as an excellent framework for promoting scientific research in Africa.

#### Introduction

Au Togo comme dans la sous-région de l'Afrique de l'ouest, la santé, l'agriculture et l'environnement sont des domaines prioritaires qui tirent davantage parti des résultats de la recherche scientifique nationale ou multinationale. Dans le cadre spécifique de l'agriculture, les Africains sont confrontés à de nouvelles réalités liées aux changements récents de l'ordre économique mondial. La diversification et la valorisation des produits africains sur les marchés internationaux doivent être appuyées par une recherche scientifique de qualité, efficace sur le plan de la conception, de la réalisation et de la mise aux normes des produits à valeur commerciale. C'est un défi qu'il faut relever sans perdre de temps car les pays de l'UE et les Etats-Unis d'Amérique imposent inexorablement des normes qui excluent chaque jour davantage les pays africains de la concurrence commerciale. Dans le cadre du présent séminaire notre intervention portera essentiellement sur l'équipement scientifique et sur l'acquisition, l'utilisation et la maintenance de cet équipement.

#### Le parc scientifique au Togo

Au Togo comme dans plusieurs pays de la sous-région, les institutions de recherche sont des institutions d'Etat. Un projet de privatisation partielle de certains instituts de recherche dans le domaine de l'agriculture a été envisagé. Il s'agit d'une initiative conjointe de la Banque Mondiale et du gouvernement togolais. Certains pays ont le privilège d'abriter des institutions multinationales de recherche dans des secteurs spécifiques avec des prérogatives bien définies. Au Togo, c'est la Direction de la recherche scientifique qui



coordonne la recherche scientifique. Il n'existe pas encore de pool d'excellence bien structuré et bien outillé. Une partie importante de la recherche scientifique se déroule à l'Université de Lomé avec un spectre d'activités aussi large qu'il existe de spécialistes. Il y a d'autres instituts de recherche dotés de moyens très modestes et qui sont encore irrégulièrement équipés. Les équipements scientifiques les plus fréquents sont destinés à des analyses de routine. Ce sont des spectrophotomètres UV, parfois avec balayage de plusieurs longueurs d'ondes, des microscopes à inversion, des centrifugeuses, des appareils à infrarouge (IR), des équipements pour des analyses bactériologiques, les appareils pour chromatographie liquide (HPLC) et à phase gazeuse (CPG), des équipements de recherche fondamentale en pharmacodynamique etc.

Il n'existe pas au Togo, de sociétés ou d'entreprises fabriquant des équipements scientifiques même les plus élémentaires. Les chauffe-ballons, la verrerie, les appareils de mesure, les consommables sont achetés en Europe et en Amérique. Dans bien nombre de cas ces équipements sont achetés dans le cadre des projets de recherche financés par des bailleurs étrangers ou à l'aide d'un financement conjoint du Togo et d'autres pays donateurs. La prise en charge de la maintenance n'est souvent pas prévue dans le budget du projet. Dans les cas les plus favorables, cette prise en charge dure autant que la période de validité du projet.

Il existe sur place quelques services commerciaux qui font aussi de la représentation. Ils n'ont généralement pas d'articles disponibles sur place. Ils servent tout simplement à acheminer une commande. De toutes façons, ils ne sont pas en mesure d'évaluer les besoins du client. Ce sont des intermédiaires qui ont signé un contrat de représentation avec une société étrangère. Cette incompétence technique ne facilite pas la communication et rallonge encore les délais d'acquisition du matériel.

## **Politique nationale en matière d'acquisition d'équipements scientifiques**

L'université et les institutions de recherche n'ont pas de statut particulier. Tout matériel de laboratoire commandé est soumis à des taxes douanières. Deux cas de figure peuvent se présenter:

*1. Le bailleur met à la disposition de l'institution bénéficiaire, des ressources financières en devises locales pour l'acquisition d'équipements scientifiques.*

L'institution passe directement la commande du matériel ou le fait par l'intermédiaire de représentations opérant sur place. Le prix initial se trouve majoré des taxes et de la marge bénéficiaire des opérateurs locaux. En général, on constate que le prix de revient d'un consommable est le double du prix à l'origine. Le processus d'acquisition des équipements scientifiques est souvent long et comporte plusieurs types de papiers administratifs. Il n'existe pas de dispositions particulières facilitant l'acquisition des équipements scientifiques au Togo. Les formalités sont pratiquement les mêmes que pour toutes les autres importations de marchandises. Ces équipements, une fois arrivés au Togo, sont obligatoirement soumis aux exigences douanières en vigueur.

*2. Le bailleur achète lui même le matériel et l'envoie à l'institution concernée.*

Dans tous les cas, les marchandises sont taxées à leur arrivée à la douane. Il existe cependant des dispositions d'exonération dont l'université et les institutions de recherche peuvent bénéficier. Ces dispositions relatives à la franchise douanière ne sont applicables que lorsqu'il s'agit d'un don. Pour ce faire, l'intéressé doit montrer les pièces suivantes aux services des douanes: i) un « État Modèle A » mentionnant clairement le texte d'exonération, c'est à dire le Décret N° 69-221 de 12-11-1969, ii) une copie du texte sous mentionné, et iii) un certificat de donation délivré par le donateur.

Que ce soit dans le cas d'un don ou d'une commande, le bénéficiaire doit obligatoirement payer la « taxe de prestation de service ». Elle représente moins de 5 pour cent de la valeur de la marchandise et comprend, i) la statistique, ii) le payage (si la marchandise passe par le Port), iii) les timbres douaniers, iv) la redevance informatique.

## **La maintenance**

L'utilisation de l'équipement scientifique donne des résultats fiables lorsque le technicien qui s'en occupe est qualifié et qu'il a bénéficié, pendant quelques jours, d'une formation assurée par le fabricant avant la mise en route des appareils nouvellement achetés. Après plusieurs essais, le technicien parviendra à adopter

une démarche logique pour procéder à des analyses de routine à la satisfaction de tous. C'est la maîtrise qu'il aura de l'équipement qu'il utilise qui démarquera sa fonction de celle du chercheur et du directeur de laboratoire. Le chercheur peut être un bon organisateur en ce qui concerne son travail mais n'a pas nécessairement les aptitudes qui font un bon technicien. Un technicien est une personne qui a reçu une formation appropriée et qui a la charge de veiller à la bonne utilisation et à l'entretien de l'équipement scientifique. La durée de vie de l'appareil dépend de la façon dont il est utilisé. Certaines pratiques erronées peuvent concourir à des altérations précoces. D'autre part il est important dans notre contexte de faire le bon investissement en achetant un équipement de bonne qualité.

Très souvent les chercheurs n'ont pas l'expérience adéquate sauf s'ils ont déjà travaillé sur le même équipement et l'équipement de même marque. Le mauvais choix peut provenir d'une insuffisance de ressources financières au moment de l'acquisition. Il est aussi important d'avoir des connaissances suffisantes pour faire un choix. Ce choix doit tenir compte de tous les facteurs indispensables pour conduire la recherche suivant le plan établi et offrir en même temps des options avantageuses. Le chercheur doit donc se documenter suffisamment sur l'équipement qu'il a décidé d'acquérir.

Les conditions d'entreposage peuvent parfois n'être pas satisfaisantes comme dans le cas, par exemple, où la température ambiante est trop élevée. Le technicien doit avoir du flair et être capable de dialoguer avec la machine. Si la durée de vie de l'équipement scientifique dépend de la qualité de l'environnement scientifique, il dépend également de la qualité de l'équipement. Si vous n'êtes pas suffisamment attentif, il arrivera un jour où vous serez confronté à des problèmes que les indications de secours ne vous permettront pas de surmonter.

Vous devrez alors consulter un technicien en maintenance sur place, s'il y en a, ou contacter directement le fournisseur. Au Togo, il n'y a pas de technicien de maintenance accrédité pour les équipements utilisés dans les laboratoires et les centres de recherche. A partir de cet instant, la situation peut devenir cauchemardesque. Le technicien du fournisseur et votre technicien n'ont parfois pas les mêmes priorités. Aucune réponse n'est apportée aux courriers que vous envoyez électroniquement (E-mail:) ou par Fax:. Et lorsque votre correspondant répond après beaucoup d'insistance de votre part, c'est pour vous donner des indications plus ou moins utiles.

Dans les clauses de garantie du matériel qu'ils vous livrent, les fournisseurs offrent parfois des services de révision et de remplacement de pièces défectueuses. Ces visites et services ne sont pas envisageables pour des équipements achetés en Europe ou en Amérique et mis en service au Togo. Le potentiel d'utilisation du matériel scientifique pour des pays comme le Togo est très faible et ne peut justifier pour le fournisseur une prestation aussi coûteuse. Dans tous les cas, il faudra renvoyer l'équipement au fournisseur. Le bilan est lourd quand on additionne les délais d'attente, les frais d'expédition et les formalités administratives à moins d'avoir une solution de rechange ou de dépannage. Le coût financier de l'opération est très élevé.

Le fournisseur dont la politique commerciale est d'inciter les laboratoires de recherche à acheter du nouveau matériel, n'offre généralement pas un équipement absolument identique sur une longue période. La moindre pièce de rechange peut parfois coûter très cher afin d'inciter à l'achat de matériel neuf. Des donateurs généreux (habituellement des laboratoires, des institutions de recherche ou des ONG du Nord) fournissent parfois des équipements anciens à des universités et centres de recherche en Afrique. Dans certains cas, ces équipements arrivent sans notice d'information et sont livrés sans le cordon électrique ou le câble de liaison indispensables. Certains laboratoires disposent d'un volume impressionnant d'équipements inutilisables qui ne serviront peut-être jamais. Pour mieux gérer ces dons et mieux les intégrer dans le parc scientifique, il aurait fallu une évaluation à l'arrivée, sélectionner les appareils utilisables, les soumettre à des tests et les conditionner. Cela suppose un service de maintenance en état de marche. Avec l'aide d'un technicien suffisamment expérimenté, il est possible de modifier ou de remplacer les pièces défectueuses.

La plupart des institutions de recherche n'ont malheureusement pas de service de maintenance. Lorsqu'un service est en place, il est souvent complètement démuné et obsolète. Le chercheur est alors confronté à lui-même: pas de personnel ni de poste de travail pour souffler le morceau de verre nécessaire à la réparation d'une pièce cassée. Parfois, et c'est le cas du Togo, il n'y a aucun service d'appui.

## **Conclusions**

La recherche scientifique en Afrique doit être prise au sérieux et considérée comme un outil essentiel de développement. Les réalités de la recherche scientifique au Togo sont parfois très éprouvantes pour le chercheur. A ce jour les chercheurs ne jouissent encore d'aucun statut particulier et les structures d'appui sont inopérantes. La Direction nationale de la Recherche scientifique dispose de peu de moyens pour honorer ses prérogatives. L'environnement socio-politique difficile du pays au cours des dix dernières années a encore plus altéré les conditions de travail du chercheur.

Très réduit, le parc de l'équipement scientifique n'est pas suffisamment organisé pour être utilisé par un grand nombre de chercheurs. Les sociétés commerciales qui font de la représentation ne sont pas compétentes pour aider les institutions de recherche à acquérir et à mettre en service les appareils dont celles-ci ont besoin. Le matériel scientifique destiné à la recherche ne figure pas sur la liste des produits exonérés de droits de douane. Les conditions d'exonération sont sévères. Le matériel scientifique coûte cher à l'achat et le service de maintenance n'est pas garanti.

Nous recommandons à la FIS d'organiser à brève échéance une série d'ateliers pour former des techniciens spécialistes de la maintenance du matériel scientifique. Des techniciens de plusieurs pays de l'Afrique de l'ouest pourraient, par exemple, bénéficier d'une telle formation dans une ville de la sous région. A l'appui de cette initiative, on pourrait envisager de créer ultérieurement un centre régional permanent de maintenance conjointement financé par des pays africains, l'UNESCO, l'AUA, des ONG et des institutions internationales.

## **Remerciements**

Nous remercions la Fondation internationale pour la science (IFS) de l'appui qu'elle apporte à la recherche scientifique au Togo et de ses actions pour la promotion des jeunes chercheurs. Nous lui savons aussi gré de nous avoir donné l'occasion de participer à ce séminaire qui se tient au Cameroun sur l'achat, l'utilisation et la maintenance des équipements scientifiques.

## Network presentations

The issues of purchasing, servicing and maintenance of scientific equipment in developing countries are already being tackled by a number of networks and organisations.

Four of these presented their mode of operation.

### **The Network of Users of Scientific Equipment in Eastern and Southern Africa (NUSESA): Networking, a solution to equipment problems?**

*Dzengo Mzengeza*  
NUSESA, Zimbabwe

### **Network of Instrument Technical personnel and User scientists of Bangladesh (NITUB): Formation and activities**

*Altaf Hussain*  
University of Dhaka, Bangladesh

### **Soil and Plant Analytical Laboratory Network of Africa (SPALNA): Purchasing, servicing and maintenance of scientific equipment in Africa**

*Gideon O. Adeoye<sup>1</sup> and Joseph I. Uponi<sup>2</sup>*  
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### **Network for Analytical and Bioassay Services (NABSA): Building a regional scientific capacity through networking activities**

*Berhanu M. Abegaz*  
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## The Network of Users of Scientific Equipment in Eastern and Southern Africa (NUSESA)

### Networking, a solution to equipment problems?

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#### Summary

Universities and research institutions in the developing countries are recipients of technology and advanced scientific equipment that comes through donor funded projects. However it has been discovered over the years that research has been held back because equipment is unavailable due to breakdowns and lack of maintenance. Maintenance of scientific and technical equipment appears to be given very low priority in the main activities of universities, and research/technology institutions in Africa. These institutions are expected to train manpower in the fields of science and engineering and to conduct research at a level comparable to that of other similar institutions worldwide, but this cannot be achieved if essential instruments, equipment and facilities are unavailable, e.g. because of lack of maintenance. A number of donors have carried out surveys to establish the state of donated equipment and have instituted programmes to address the problems. Several conferences have been held on instruments, but only a few have had long-term results.

This paper highlights the initiatives taken by the International Foundation for Science in Sweden, and the formation and establishment of the Network of Users of Scientific Equipment in Eastern and Southern Africa (NUSESA). The paper further describes the activities of NUSESA in addressing the equipment problems. The paper concludes with a list of possible regional strategies that could be adopted to address the problems of purchasing, servicing and maintenance of equipment.

#### Résumé

Les universités et institutions de recherche des pays en développement sont dotées d'équipements scientifiques et de technologies avancées dans le cadre de projets financés par des bailleurs de fonds. Au fil des années, on a cependant constaté que la recherche était tenue en échec par un équipement hors d'état de fonctionner par suite de pannes non réparées ou d'absence de maintenance. Il semblerait que la maintenance des équipements scientifiques et techniques ne bénéficie que d'une très faible priorité dans les universités, les instituts technologiques et les institutions de recherche en Afrique. Tous ces établissements sont censés former des scientifiques et des ingénieurs et conduire des recherches de niveau comparable à celui d'autres institutions similaires dans le monde, objectifs qui ne pourront cependant pas être atteints si les instruments et équipements essentiels pour accomplir ces tâches sont inutilisables pour des raisons liées, par exemple, au manque d'entretien. Des enquêtes ont été réalisées par un certain nombre de bailleurs pour déterminer l'état de fonctionnement des équipements dont ils avaient fait don et des programmes ont été mis sur pied pour traiter les problèmes. Plusieurs réunions ont été organisées sur le thème des instruments scientifiques, mais rares ont été celles qui ont été suivies d'effet à long terme.

Dans cette communication, l'auteur fait l'historique de la création et de l'évolution du NUSESA (Réseau des utilisateurs d'équipements scientifiques en Afrique de l'est et en Afrique australe) et des actions et initiatives de la Fondation internationale pour la Science (Suède) à cet égard. Il décrit ensuite les activités spécifiques du réseau et conclut en dressant une liste des stratégies qui pourraient être adoptées à l'échelle

régionale pour traiter les problèmes liés à l'achat, à l'utilisation et à la maintenance des équipements scientifiques.

## **Introduction and background**

During the first training workshop organised by the International Foundation for Science (IFS) in Harare in 1989, emphasis was placed on the need for more information and improved co-ordination of activities aiming to improve the use of the scientific equipment available in the region. Mention was also made of the need to share experiences within the region on issues related to the equipment problem, and to come up with recommendations to alleviate this problem, tailored to the local/regional situation.

To meet these needs the Network of Users of Scientific Equipment in Southern Africa (NUSESA) was initiated with a membership of five countries, namely, Tanzania, Mozambique, Malawi, Zambia and Zimbabwe. In 1991, Botswana joined. At the NUSESA Regional Meeting in Botswana in 1996, the geographical coverage was expanded to include Ethiopia as a member country. Since that time the acronym, NUSESA, stands for Network of Users of Scientific Equipment in Eastern and Southern Africa. At the same meeting, it was decided to give NUSESA a truly independent and regional status. A headquarters was established in Harare, with IFS support.

It was expected that this organisational change would allow NUSESA to approach donors and national or regional authorities from a regional platform, providing skilled expertise from the region to deal with equipment problems, rather than depending on expensive and haphazardly available expertise from overseas. In December 2001 at the NUSESA Annual General Meeting of the Council of National Representatives (CONARE), a constitution was adopted which now forms the legal framework within which NUSESA operates.

## **Membership of NUSESA**

NUSESA now has 15 member countries, namely; Botswana, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Madagascar, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe. Recently Mauritius indicated interest in participating in the Network. NUSESA membership is mainly composed of technicians, researchers and lecturers from the universities and research institutions in the region although its activities have also benefited scientific equipment users outside these institutions. With the adoption of the NUSESA Constitution, the membership has been extended to include suppliers, universities, research centres, maintenance centres, non-governmental organisations and other parties interested in NUSESA's aims and objectives. Affiliate membership is afforded to those individuals and institutions that do not reside in the region but are also interested in the aims and objectives of NUSESA.

## **Objectives**

The Vision of NUSESA is "to become a regionally and internationally competent and renown network of users of scientific equipment for Eastern and Southern Africa that can contribute effectively and efficiently to the development of the Region."

The Mission statement of NUSESA is "to build scientific capacity in the delivery of quality services and products in various aspects of scientific equipment and thus contribute to development and integration in the Eastern and Southern Africa Region. NUSESA is dedicated to serving the scientific community through the establishment of a network for impeccable equipment, application, administration and maintenance."

*The overall objectives are to:*

- *Provide* a forum of information exchange and discussion on the proper purchase, use, operation, maintenance and related aspects of scientific equipment in Eastern and Southern Africa;
- *Strengthen* networking with partners to promote scientific capacity building;
- *Establish and maintain* a comprehensive database on scientific equipment and technical expertise;
- *Forge* closer partnership among Network members, the scientific community and governments to ensure Network sustainability;

- *Sensitise* policy makers and all concerned to the significance of equipment in research as well as to the need for trained, skilled and qualified personnel for various tasks in scientific instrumentation;
- *Encourage research and development* through proper use and maintenance of scientific equipment and, actively seek to improve users knowledge of such equipment and the relevant techniques;
- *Disseminate* information relating to the objectives of the association through the organisation of conferences, printing, publishing, illustrating, translating, launching websites and otherwise;
- *Encourage training of users* of scientific equipment by organising courses, workshops, seminars and scholarships within and outside the region;
- *Co-operate or affiliate* with institutions in the region or elsewhere in all matters related to scientific equipment for the mutual benefit of such institutions and the association;
- *Act as a consultative and advisory organ* to the governments and other non-governmental bodies on matters pertaining to scientific equipment;
- *Promote and safeguard interests* of users of scientific equipment in the region;
- *Ensure and promote* the participation of women at all levels in the Network;
- *Perform any such other activity* as may be consistent with the vision and mission of the association.

## Activities

Details of training programmes and activities organised by NUSESA are available through the NUSESA Secretariat or national NUSESA representatives or contact persons.

### *Regional workshops*

Since the start of the IFS programme some 13 regional workshops have been held for researchers and technicians from institutions that depend on scientific instruments. The participants were taught how to operate and maintain their own equipment. The topics included the use and maintenance of individual equipment such as spectrophotometers, atomic absorption spectrophotometers, flame photometers, microscopes, mechanical and electronic balances, gas chromatographs, HPLC, colorimeters, pH meters, air conditioners, freezers, centrifuges, and mixers. Other topics were i) basic electricity and electronics as background to instrumentation, ii) health and safety in laboratory, iii) procurement and purchasing procedures and, iv) equipment selection and laboratory management.

### *National workshops/seminars*

The regional workshops encouraged the initiation of national workshops. People who attended the regional workshops and saw their value were encouraged to launch national workshops. The local scientific equipment users formulated their own activities according to the local training needs. The resource persons used in most cases were local, some of whom had received training through the regional workshops. The workshop topics included: Information & Technology to cover computers, computer networking and interfacing, vacuum technology, power supply and regulations, use of basic test equipment/tools, to name a few.

### *Individual training*

A number of people have been sent to other institutions for training through NUSESA. Training has been given at an institution in the region, the Precision Instrument Development Centre (PIDC) in Taiwan, institutions in South Africa, the ICAT Luton University in England, and the University of West of England in Bristol, England.

### *Conferences*

The first NUSESA conference was held in Kampala, Uganda, in December 2001. The theme of the conference was “Maintenance of Equipment for the Advancement of Science”. The conference was well attended with 100 participants including equipment suppliers, network representatives and donors.

### *Spare parts fund*

IFS made a spare parts fund available that helped put a lot of faulty equipment in the region back into working condition. About 100,000 Swedish Kronor was obtained from various donors for the fund. At the beginning of 2002 Dutch Aid provided NUSESA with USD 110,000 for the spare parts.

### *Strategy for purchasing, servicing and maintenance of equipment*

To address the equipment problems successfully, all the stakeholders must be involved and the right policies must be put in place. The suggested groups are: policymakers at both institutional and government levels, donors, suppliers, laboratory managers, departmental heads, users, technicians/technologists, service engineers/technicians and others. The following are suggested strategies:

- Programmes on the importance of equipment policy and maintenance must be organised to train or create awareness within management;
- Managers who sign equipment supply agreements must be made aware of all the implications, including training;
- Management must put in place policies to support a culture of maintenance;
- Management must be urged to increase budgets for maintenance of scientific equipment;
- Donors must be encouraged to discuss the use and completion of equipment with the institutions before delivery;
- Managers should write their own manuals on the care and maintenance of equipment;
- Institutions must give good incentives to technicians that would motivate them;
- A sense of ownership must be inculcated into all users of scientific equipment;
- Suppliers must be consulted with regard to all aspects of equipment procurement and maintenance and should be encouraged to participate in training on equipment maintenance;
- Individuals and institutions must be encouraged to network and become referral points/centres for equipment maintenance solutions;
- Since equipment is instrumental in achievement, results obtained from all equipment should be published, field by field, as a way to monitor and evaluate it;
- Course units for preventive maintenance and maintenance should be introduced;
- Fabrication of basic instruments should be encouraged and information should be published in order to overcome the “black box” attitude;
- Protection of equipment through the use of UPS should be encouraged;
- Suppliers should be encouraged to supply both circuit diagrams and workshop manuals to clients in the correct language, although it was noted that some manufacturers, for copyright reasons, are not willing to release circuit diagrams;
- Needs assessment surveys to determine areas of training in equipment maintenance should be carried out regularly.

## **Conclusion**

Equipment problems can be addressed, and networking is essential in doing this. Continuous sustainable programmes can be put in place, and if funded, will yield positive results. It is important that people develop a culture of maintenance. When a piece of equipment finally “has its day”, it must be said it served its purpose to the full.



## **Network of Instrument Technical personnel and User scientists of Bangladesh (NITUB)**

### **Formation and activities**

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### **Summary**

Network of Instrument Technical personnel and User scientists of Bangladesh (NITUB), formed in 1994, is a learned society dedicated to scientific education and research in Bangladesh. To assure proper use, maintenance and trouble-shooting of scientific instruments, NITUB is conducting training programs on specific groups of instrument for user scientists and technical personnel of Bangladesh. So far, NITUB has conducted 15 such training programs, which have been very much appreciated by the scientists of different organizations. Another main objective of NITUB is to repair non-functioning scientific instrument through its instrument repair program which was launched in 1996. NITUB has already repaired 386 piece of scientific instrument for different educational and research organizations of Bangladesh. NITUB spent only about 18,000 USD to repair these instruments whose approximate market price is 1.6 million USD.

### **Résumé**

Constitué en 1994, le réseau NITUB (Réseau de spécialistes des instruments scientifiques et utilisateurs scientifiques du Bangladesh) est une société savante spécialisée dans le domaine de l'enseignement et de la recherche scientifiques et installée au Bangladesh. Pour permettre une bonne utilisation et un bon entretien des instruments scientifiques ainsi qu'un dépannage éventuel, le NITUB organise des stages de formation qui portent sur des groupes d'instruments spécifiques, à l'intention du personnel technique et des utilisateurs scientifiques du Bangladesh. Quinze stages de ce type ont déjà été conduits par le NITUB et ont été fort appréciés par les scientifiques des autres organisations. La réparation des appareils en panne fait aussi partie des autres grands objectifs du NITUB qui a lancé son programme de réparation des instruments scientifiques en 1996. Au total, 386 instruments scientifiques ont déjà été réparés à ce jour par le NITUB pour le compte de divers établissements d'enseignement et instituts de recherche du Bangladesh. Les dépenses effectuées au titre des réparations se montent seulement à quelque 18 000 dollars US alors que la valeur marchande approximative des instruments représente environ 1,6 million de dollars US.

### **Background**

Like many other developing countries, Bangladesh also needs to improve the capability of proper use, maintenance and repair of scientific instruments. To meet this urgent need, a week-long "Workshop on Instrument Maintenance and Repair" was held on 16-21 November 1991 with the financial assistance of the International Foundation for Science (IFS), Stockholm, Sweden and the International Program in the Chemical Science (IPICS), Uppsala University, Sweden. The 1991 Workshop was organized primarily for the IFS grantees and the IPICS Fellows in Bangladesh. The positive impact of this workshop led to the suggestion of conducting a second workshop, of longer duration, and to include Bangladesh scientists and technicians working in the field of chemical and agricultural sciences who were neither IFS grantees nor IPICS Fellows in Bangladesh. Thus, the second "National Workshop on Instrument Maintenance and Repair" was held on 12-25 January 1994 in Dhaka with practical training sessions in Chittagong, Dhaka and Mymensingh. IFS was the main sponsor for the second workshop, although, UNESCO Delhi office, BCSIR, AEC, UGC and several universities of Bangladesh co-sponsored it.

## Formation of the Network

At the end of the second national workshop, the workshop's organizing committee met with the foreign and local resource persons and a representative from IFS to recommend that a network of user scientists and technical personnel be formed at the national level to ensure the proper use, maintenance and repair of scientific instruments of various educational and research institutions of Bangladesh. On the basis of the recommendation, a draft proposal for the formation of the "Network of Instrument Technical personnel and User scientists of Bangladesh" (NITUB) was made. Later, at the meeting on 18 June 1994 of the Asian Coordinating Group for Chemistry (ACGC) in Melaka, Malaysia, a resolution was adopted supporting the formation of NITUB. NITUB was launched on 19 July 1994, with support from different national and international organizations,

## Aims and objectives of NITUB

NITUB is a voluntary, non-Profitable, non-political learned society dedicated to scientific education and research in Bangladesh. The main aims and objectives of NITUB are:

- To improve the capabilities of the technical personnel and user scientists in handling, maintaining, trouble-shooting and repairing scientific instruments;
- To maintain an inventory of available scientific instruments and its present status in different institutions;
- To maintain an inventory of technical personnel who can offer technical assistance to NITUB;
- To have the technical personnel from the pool of NITUB repair instruments and offer technical services to the different educational and research institutions of Bangladesh and if possible, to procure the services of foreign technical experts;
- To create a stock of spare parts and accessories required for the repair of instruments on a routine basis and make them available to various institutions as and when necessary;
- To conduct training courses for the technical personnel and user scientists on different types of scientific instrument;
- To fabricate scientific instruments for educational and research purposes.

## Activities of NITUB

### *Training program*

Since its inception NITUB has been conducting training programs on specific groups of scientific instruments. The first such training program was on the use and maintenance of gas chromatographs. Because of the large number of applicants from various universities, research organizations and private pharmaceutical companies who applied for the training program, NITUB had to divided the first training program into two batches so that all the applicants could be accommodated. NITUB usually organizes 2 or 3 training programs each year on various instruments such as HPLC, AAS, UV-VIS and IR, X-ray techniques. To train laboratory technicians who are responsible for common laboratory equipment, since 1999 NITUB has been organizing annual training programs on the use and maintenance of common laboratory equipment for laboratory level technicians. NITUB has already conducted 15 such training programs.

### *Instrument repair program*

Scientists and technical personnel are often complaining about their non-functioning scientific instrument which prevents them from progressing in their work. The EC of NITUB decided to launch the instrument repair program in July 1996. This enabled NITUB to make headway in solving this most difficult problem facing many educational and research organizations of Bangladesh. In response to a request from BCSIR Laboratories, Rajshahi, to repair their only gas chromatograph, which had not been functioning for a couple of years already, NITUB quickly repaired the instrument. In 1996 NITUB repaired 10 non-functioning scientific instruments from research organizations and universities within a very short period of time. NITUB then started getting requests from scientists from various organizations to repair their non-functioning scientific instruments through its instrument repair program, which now runs throughout the year. NITUB usually repairs instruments in the laboratory since it does not have a workshop yet.

The numbers of instruments repaired between 1996 and 2001 are given in Table 1. These instruments belong to almost all universities and many research organizations of Bangladesh. The instruments repaired are AAS, UV-VIS and IR spectrophotometers, GC, HPLC, X-ray generators, ovens, furnaces, incubators and many other different types of electro-thermal equipment.

Table 1: Non-functioning scientific instruments repaired by NITUB between 1996 and 2001

Year	No. of instruments repaired	Estimated market price of the instruments in USD	Expenditure of NITUB to repair the instruments in USD
1996	10	42,069	529
1997	28	74,914	826
1998	82	326,948	4,904
1999	76	265,483	4,085
2000	126	610,086	5,225
2001	64	271,224	3,190
Total	386	1,590,724	18,732

### ***Installation of instruments***

Although in principle NITUB only repairs non-functioning scientific instruments, it has received requests to install instruments, which it has also done successfully. NITUB feels that during the equipment purchasing process, proper attention is not always given to installation. Unfortunately, in some cases the instruments even became defective and the warranty period was over before they were installed. NITUB recently installed an AAS, an HPLC and some other instruments for the Animal Nutrition Laboratory of the Directorate of Livestock, Government of Bangladesh. NITUB not only installed the instruments but also trained four research officers of the Directorate to operate them properly.

### ***Plan of activities of NITUB***

NITUB hopes to run its training programs on specific groups of instruments regularly and continue its instrument repair program. The Ministry of Health and Family Welfare (MOHFW) has constituted a committee to review the status of the medical instruments of hospitals and public health centers. A representative of NITUB has been included in the committee. The preliminary report of the MOHFW committee reveals the existence of large numbers of non-functioning medical instruments in hospitals and public health centers. Up to now, NITUB has been dealing with scientific instruments of universities and research organisations. NITUB now plans to include medical instruments in its program.

The National University has allocated funds to upgrade the standard of teaching and research in the university colleges where honours and postgraduate degrees are offered. NITUB and the Bangladesh Chemical Society (BCS) were asked by the university to find ways and means to do this. In the first phase of this program, six university colleges have been taken. NITUB hopes to work with BCS and repair all the non-functioning instruments of these colleges.

Research scientists from Nepal participated in some NITUB programs and decided to create a network like NITUB in Nepal. After discussions with IFS, IPICS and NITUB, Professor M.D. Manandhar, Central Department of Chemistry, Tribhuban University, Nepal and her colleagues formed a network called "NITUN" whose activities are similar to NITUB's. NITUB and NITUN have a few regional collaborative programs and hope to continue their collaboration in the future. NITUB also plans to organize regional programs with Bhutan and Myanmar. This will strengthen regional cooperation between the LDC countries of Asia and NITUB. In the near future NITUB plans to open a website.

## **Concluding remarks**

NITUB has had to face problems, especially with its instrument repair program. Initially many scientists and administrators were rather reluctant and had little confidence in the capability of NITUB's technical experts. In many cases experts were not even allowed to look into the instruments, even the ones that had been lying idle for a long time. However, NITUB now feels proud of its technical experts who are constantly being consulted by educational and research organisations of Bangladesh, and the NITUB instrument repair program has become very popular among the user scientists. So far, NITUB repairs instruments without charging any honorarium for the technical experts. NITUB is planning to start charging fees for instrument repairs by its technical experts and thus, hopefully create a self-financed program. NITUB is also looking for places where the technical experts can receive training regularly to update their knowledge.

The Government of Bangladesh has recently recognised NITUB as a learned society and used its expertise to run different projects. NITUB is recognised nationwide as a very effective network thanks to its dedication to scientific education and research. Scientists at home and abroad are citing the example of NITUB especially in the context of the developing countries and are recommending that these countries form such types of networks to promote their scientific activities.

## **Goal**

The short-term goal of NITUB is to ensure that all the scientific instruments of Bangladesh are functioning and that the user scientists do not have any problems with them.

## **Acknowledgement**

NITUB gratefully acknowledges the financial support of all national and international organizations, especially the Ministry of Science, Information&Communication Technology, Government of Bangladesh, IPCS, IFS and UNESCO Delhi office.

## **Soil and Plant Analytical Laboratory Network of Africa (SPALNA)**

### **Purchasing, servicing and maintenance of scientific equipment in Africa**

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#### **Summary**

The Soil and Plant Analytical Laboratory Network of Africa (SPALNA) has been involved in training laboratory technologists in Africa on maintenance of science equipment since 1992. We have observed a wide diversity of makes and models of scientific equipment in various laboratories. This makes a uniform approach to servicing and maintenance a bit problematic. It is suggested that standardization of analytical procedures and equipment be adopted on a regional basis.

To minimize difficulties with maintenance, local development and fabrication of scientific equipment should be encouraged. Regional equipment maintenance centers should be established and staffed with trained maintenance personnel.

#### **Résumé**

Depuis 1992, le SPALNA (Réseau des laboratoires d'analyse des plantes et des sols en Afrique) apporte son concours pour former les techniciens de laboratoire en Afrique à l'entretien et à la maintenance des équipements scientifiques. Cette activité lui a permis de constater une grande diversité de marques et de modèles d'appareils scientifiques aussi bien d'un laboratoire à l'autre qu'à l'intérieur d'un même laboratoire. Comme il semble difficile d'aborder de façon uniforme le problème de l'entretien et de la maintenance, la solution proposée est d'opter pour une normalisation des procédures analytiques et de l'équipement au niveau régional.

Pour atténuer les difficultés liées à la maintenance, il serait judicieux de stimuler les réalisations locales et la fabrication d'équipement scientifique sur place. Il serait bon d'encourager la création de centres régionaux de maintenance dotés de personnel dûment qualifié.

#### **Introduction**

The International Institute of Tropical Agriculture (IITA), through its Group Training Unit and Analytical Services Laboratory embarked on capacity building for National Agricultural Research Systems (NARS) in Africa in order to enhance their research activities. IITA did this by training soil and plant analysis laboratory personnel from all over Africa in basic and advanced courses on the methodology of soil and plant analysis between 1980 and 1991. During the advanced courses held between 1989 and 1991, laboratory managers observed that constraints to good quality data in African laboratories were common.

This idea coincided with the period when IITA decided to decentralise training so that it could be provided in the home laboratories. In 1991 SPALNA was inaugurated at IITA, Ibadan. At the inauguration, 20 African countries were represented. Each country representative was requested to list, in order of priority, the constraints to good quality data in his country. A plenary session was held to collate the responses and the following priority areas were identified:

- Equipment maintenance
- Quality control
- Infrastructure
- Standardization of methodology
- Training of personnel

## **SPALNA Activities**

On the basis of these priority areas, proposals were developed to address the issues. They have formed the activities of SPALNA during the last ten years. The projects which were formulated into activities included training courses for personnel of African laboratories, on:

- Equipment Maintenance and Fabrication,
- Soil, Plant and Water Analysis,
- Good Laboratory Practices and Information Management,
- Pre-owned Equipment Donation,
- Regional Reference Laboratories for Sample Exchange.

### ***Equipment maintenance***

From 1992 to date about 350 technicians from about 30 countries have been trained at national, regional and international courses on equipment maintenance. In addition, we trained over 150 laboratory managers on Soil and Plant Analysis and on Good Laboratory Practices and Laboratory Information Management (GLP-LIMS). We helped laboratories to maintain and troubleshoot their equipment. Examples include NIFOR in Benin-City, the National Cereal Research Institute in Baddegi, Nigeria, the IRAF in Ekona, Cameroon, and the Agronomy Department of the University of Ibadan.

The following topics are studied during the course on equipment maintenance:

- Equipment selection,
- Equipment and laboratory environment,
- Basic electricity and electronics,
- Calibration, use and maintenance of UV-VIS spectrophotometers, Atomic Absorption Spectrophotometers, pH and conductivity meters, flame photometer and balances,
- Heating and cooling devices, e.g. ovens, furnaces, hotplates, refrigerators etc.,
- Mechanical devices e.g. shakers, stirrers, centrifuges etc.

All the participants in this course receive a repair kit that contains basic tools like screw drivers, spanners, a multimeter and soldering/desoldering tools, etc.

SPALNA has also taken step to encourage indigenous fabrication of pH meters and colorimeters. In the module on equipment fabrication, participants are taught how to make printed circuit boards. Each person has to assemble a pH meter and a colorimeter from basic electronic and electrical components. In the latest training course held at the Service and Training Centre, University of Nigeria, Nsukka, all the components used for the course were obtained from local electronics market in Nigeria. When the course on Equipment Fabrication first started, we depended on the University of Delhi, India, for resource persons. Now we have a local crew of trained persons who handle every aspect of this training in Nigeria. We also have some resource persons in Niger, Burkina-Faso and Zimbabwe. In Zimbabwe and Zambia, we have had good collaboration with NUSESA in organising training workshops.

In addition to training courses SPALNA has sent resource persons to national institutions to assist with equipment installation, trouble shooting and repairs.

Problems we have identified in the course of our activities include:

- The wide diversity in the makes and models of equipment in the different institutions,
- Lack of service manuals,
- Lack of log books and standard operating procedures (SOP) for the instruments,
- Lack of or inappropriate spare parts and supplies,

- Lack of properly trained personnel to handle the equipment since some of the trained personnel easily find better paid jobs in private companies,
- Funding unavailable for instruments that need to be upgraded.

## **Suggestions of regional strategies for the purchasing, servicing and maintenance of scientific equipment**

Standardisation of analytical procedures and equipment should be considered for different regions for the following reasons:

- It will facilitate exchange of mutual experiences;
- Equipment similarity leads to easier and less expensive servicing arrangements, and pools of spares can be maintained;
- Procurement of new equipment can benefit from bulk buying.

Regional networks and organisations should try to generate a functional database of equipment in member laboratories. Such a database should include information on initial cost of equipment, analytical range, precision, accuracy and speed. The sources of supplies and spare parts for the equipment and contact address of sales and service personnel should also be included.

Many science institutions in Africa depend largely on donor funding for the purchase and maintenance of science equipment. Since they have insufficient financial support from their government or local sponsors, they use this equipment beyond the expected life span. As the equipment gets older, spare parts and other components become less available in the market. It may be worthwhile to purchase a good quantity of spares and supplies at the time of the initial purchase.

Subscription to equipment magazines and buyers guides should be encouraged especially where Internet facilities are lacking. This will provide a good source of current information on available options before purchasing decisions are made.

With respect to maintenance of scientific equipment, the following strategies may be considered:

- The establishment of a maintenance crew at the local, national and regional levels. The levels of expertise required may range from low (routine maintenance) at the local level to high (repair and refurbishment) at the regional level.
- Regular training of local maintenance crew to keep them abreast of changing technologies.
- Local development and manufacture of scientific equipment should be encouraged using low cost and indigenous materials as much as possible.
- The establishment of a regional science equipment maintenance centre should be encouraged to minimise duplication of efforts and maximise the use of human and material resources.
- The use of online advisory websites for consultation could be helpful.

## **Conclusion**

Although efforts have been made by different organisations to tackle the problems associated with the procurement, servicing and maintenance of scientific equipment, it has become apparent that these efforts have met with limited success. The opportunity provided by this workshop to evaluate the successes and failures of previous strategies will prove to be an invaluable experience. SPALNA is ready to collaborate with other organisations in this effort to make our science laboratories more functional.

## **Network for Analytical and Bioassay Services (NABSA)**

### **Building a regional scientific capacity through networking activities**

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#### **Summary**

NABSA is a network established to ease the problems of scientists, who are trying to do research in the field of chemical sciences in facility-constrained work places. This is done by helping with the generation of literature, NMR and MS data, inviting scientists for short research visits, and organizing symposia specifically for post-graduate students. The NABSA concept – the provision of the services mentioned above – is relevant to the aims of the Cameroon workshop. This contribution, therefore, will be focusing on capital items of equipment like MS and NMR, which are of central importance to S&T capacity building. The number of such items is now significantly rising in the continent, a situation which is fraught with difficulties: Is it the right equipment? Is the back-up service reliable? Does a given piece of capital equipment duplicate or complement what is available regionally? The basic concept that will be brought to the attention of participants is the experience of NABSA with respect to sharing already existing equipment and how some of the lessons learned can be used to find solutions to the questions above.

#### **Résumé**

Le NABSA (Réseau de services d'analyses et essais en laboratoire) est un réseau créé pour faciliter la vie des chercheurs en sciences chimiques qui font de la recherche dans un environnement de travail sur lequel pèsent des contraintes. Cette aide prend la forme de livres, des données de RMN et de spectromètres de masse, d'invitations faites aux chercheurs pour de courtes visites de recherche, de symposiums organisés spécifiquement pour les étudiants du troisième cycle. Le concept NABSA – l'offre des services susmentionnés, va dans le sens des objectifs de l'atelier du Cameroun. Il sera donc surtout question, dans cette communication, de biens d'équipement comme les spectromètres de masse et les RMN, qui sont d'une grande importance pour le renforcement des capacités scientifiques et technologiques. Le nombre d'équipements est en augmentation considérable sur le continent. Néanmoins, les efforts déployés sont en butte à d'innombrables difficultés: choix de l'équipement, fiabilité du service d'assistance, complémentarité ou double emploi de cet équipement avec ce qui existe sur le plan régional. Le partage d'équipements existants et l'expérience acquise par le réseau NABSA dans ce domaine constituera le thème essentiel de cette communication qui montrera aussi comment tirer parti de l'expérience ainsi acquise pour remédier aux difficultés mentionnées ci-dessus.

#### **Introduction and background**

The Network for Analytical and Bioassay Services in Africa (NABSA) was founded in August 1992 and was established for the purpose of finding ways of assisting scientists working in isolation and in various constrained environments in Africa. The strategy adopted was to identify centers in Africa, which were functioning reasonably well and to find ways by which they could help other scientists. Accordingly, four centers that had modest to excellent facilities agreed to generate analytical and bioassay data on samples originating from these scientists.

During the initial period, the Addis Ababa University offered 90 MHz NMR, optical rotation and Infrared measurements, the University of Nairobi availed its insect antifeedant and mosquito larvicidal assays and



electronic spectra services, ICIPE (Nairobi) furnished MS and GC/MS analyses while the *Institut Malagache de Recherches Appliquées* (IMRA) in Antananarivo provided antimalarial assays. In 1994, The Coordinator moved to the University of Botswana, and NABSA expanded its scope of services.

NABSA, during its ten years of existence, has made significant contributions to promoting cooperation among African scientists. Many theses written in Tanzania, Kenya, Cameroon, Nigeria, Senegal, Botswana, etc., strongly acknowledge the assistance received from NABSA. Several publications resulting from the research visits of postgraduate students as well as senior staff have appeared in peer-reviewed international journals, and national and regional publications, acknowledging the support received under the auspices of NABSA. NABSA is now a familiar name for many African scientists and institutions, and most of the search engines in the Internet easily pick the acronym and lead to our website: <http://www.ub.bw/news/conf/nabsa/index.htm>.

### Short presentation of the objectives of the NABSA network

The mission of NABSA may be stated in one short phrase *promoting intra-African cooperation*, through the major activities mentioned above, and demonstrating that scientific work of reasonable quality can be performed in African laboratories through such cooperation.

The objectives of the NABSA Network are:

- To promote the development of scientific activities of reasonable quality in Africa by supporting the efforts of active scientists with analytical, bioassay and CD-ROM literature support services;
- To cooperate with active scientists in joint short-term intensive research undertakings by inviting them to the reasonably well equipped laboratory in Botswana;
- To promote the Professional development of young scientists by arranging sub-regional symposia specially designed for presentations and discussions by junior faculty members and postgraduate students.

### Presentation of activities related to the scope of the workshop

NABSA has a variety of programs of which the one relevant for the present discussion is the support to scientists who need analytical and bioassay services. The Network has collaborated with a number of laboratories in Africa (Addis Ababa, Antananarivo, Gaborone and Nairobi) to offer these services. Bioassay services were offered from IMRA in Antananarivo and the University of Nairobi, while the other centers offered analytical services.

Reference will be made to the NMR and services from the University of Botswana. Scientists/researchers send their samples to the MS and NMR Center in Botswana. The samples are analyzed and the hard copies of the data are sent by courier. The number of such measurements for the last three years (Table 1) and the breakdown of source countries (Table 2) are shown below.

Table 1: Number of analytical services rendered by the NABSA Centre from Gaborone to various scientists in Africa

Year	NMR services	MS services
1998	236	50
1999	476	124
2000	844	206
2001	967	
2002 (Sept.)	910	

Table 2: NMR Samples analysed under the auspices of NABSA

Country	No. of spectra		
	2000	2001	2002
Cameroon	171	420	224
Kenya	8	---	37
Nigeria	66	---	6
Senegal	9	---	---
South Africa (UNW, UCT)	---	4	79
Tanzania	493	428	483
Zimbabwe	97	115	81
Total	844	967	910

In view of the high demand for NMR services from Tanzania, NABSA and the University of Dar es Salaam have recently set up a NMR workstation in the Department of Chemistry at Dar (Acknowledgements of assistance to Dr D. Mueller of Bruker and Dr J. Wolbrandt). This has enabled Dar scientists to receive NMR raw data (fids) from Gaborone, either electronically or on CD, and to manipulate and process their own data.

NABSA's contribution has been the inception and development of the idea to set up a remote workstation somewhere in Africa (in this case at Dar), inviting a Dar scientist to come to Gaborone for training and familiarization with the vendor software, negotiating with the vendor to acquire the license for the remote workstation and securing a significant discount for it. The Dar project will probably stimulate further interest in setting up other workstations.

### Suggestions for regional strategies

- The sharing of capital equipment at the regional/sub-regional level. Mass spectrometers (High resolution and inductively coupled plasma spectrometers), high field NMR spectrometers (500 MHz and above), various hyphenated configurations of these (LC-NMR, CE-MS, etc), Scanning and Transmission Electron Microscopes, X-ray Diffractometers, etc., are rather expensive instruments and may not be easily available to poorly resourced institutions in many African countries. However, the building of scientific capacity and the undertaking of research of good quality will require access to such instruments. Many countries do not have scientific manpower available in sufficient numbers to justify the acquisition of such expensive instrumentation at national level. Can others practice the NABSA style of sharing instruments?
- Consultation on regional level prior to purchase of capital equipment. NABSA was extensively consulted prior to the purchase of a high field NMR spectrometer in Addis Ababa. NABSA invited one staff member from Addis for three weeks to familiarize himself with many aspects of NMR, which was regarded as a helpful experience during the installation in Addis Ababa. Can such consultations be considered among institutions?
- Training in equipment operations and preventive maintenance at established and well functioning centres within the region/sub-region.

### Conclusions

The ultimate objective of the workshop is to promote high-level scientific activity to solve problems of society and to improve the quality of life by contributing to basic societal necessities. The purchasing, servicing and maintenance of scientific equipment is an important aspect of the above objective. The purchase of items of capital equipment such as those raised in this paper has been a major source of concern. Some institutions have poured their hard earned funds into the purchase of such equipment only to find that they cannot use it for a variety of reasons. The contribution of this paper is to bring in the element of regional cooperation to find answers to questions such as: Is it the right equipment? Is the back-up service reliable? Does a given piece of capital equipment duplicate or complement what is available regionally?

## Appendix 1

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## Appendix 2

### Opening speech by the Host, Dr Dorothy L. Njeuma Vice Chancellor, University of Buea

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Hon. Members of Parliament,  
The Divisional Officer of Buea,  
The Lord Mayor of the Buea Rural Council,  
His Royal Highness, the Paramount Chief of Buea,  
Distinguished Guests,  
Dear Participants,  
Ladies and Gentlemen,

It is indeed a great pleasure for me to welcome our honourable guests and the participants of this workshop to the University of Buea and to Cameroon. We are particularly happy to receive the recently appointed Minister of Scientific and Technical Research, His Excellency Zacharie Pérévet, on his maiden visit to the University of Buea. I might add that it is in fact the first ever visit undertaken by a Minister of Scientific and Technical Research to our campus. Your Excellency, you are welcome.

We wish to seize this opportunity to publicly acknowledge the institutions under your jurisdiction in the South West Province with whom we have been carrying out very significant research. In this connection we wish to highlight research work carried with IRAD Ekona, CDC, on rubber and that with the Oceanography and Fisheries station at Batoke in Limbe on marine studies along the coast.

The present “International Workshop on the Purchasing, Servicing and Maintenance of Scientific Equipment in Western Africa” brings together, on the one hand, stakeholders who are involved in the purchasing, servicing and maintenance of scientific equipment, and on the other hand, experienced organisations in the maintenance of scientific equipment. These participants will review the problems that various parties have experienced, the approaches which have been adopted, and advance new solutions. It is our hope that at the end of this workshop we will have been able to articulate appropriate policies and strategies to alleviate those problems encountered in the purchase and maintenance of scientific equipment in the region.

Ladies and Gentlemen,

Let me begin by outlining our experience here at the University of Buea, for we have come a long way and we still have a long way ahead of us. As an institution which started in 1993, we have moved in leaps and bounds to bring the University to acceptable standards in terms of teaching and infrastructure. This effort, in the last two years only, has amounted to some 350 million francs in buildings and the acquisition of equipment for Internet services at the University of Buea. The government, foreign organisations, the University, and other stakeholders have played very significant roles in this venture.

As you would imagine, our greatest concern is not just with the purchase, but also the maintenance, of such equipment. What kind of equipment do I refer to here? –Equipment that is in daily use in the University and which includes photocopying machines, computers, basic science laboratory equipment and, of course, specialised equipment that meet the research needs of post-graduate teaching in specific departments.

The technicians who carry out the repairs often have not acquired any specialised training. The result is that equipment breaks down shortly after they have been repaired; some end up not being repaired at all, or take a long time to repair because the necessary parts are either scarce or not available locally.

It is our hope that this workshop will propose solutions to some of our headaches. Rapid communication is an asset in this age of technology where the whole world has been reduced to a global village through the Internet and modern telePhone: network. Hopefully, this would help shorten the time required for all transactions relating to the purchase and maintenance of our scientific equipment.



Of recent, there has been increased enthusiastic demand for the University's services from individuals and organisations/institutions. In the Faculty of Science, for instance, there are short courses in the use of computers organised during the long vacation. There is also a CISCO Local Networking Academy at the University of Buea, which is a four-semester course delivered as a web-based curriculum and which gives students the chance to acquire valuable skills in networking and the internet. The faculty of Social and Management Sciences and the Advanced School of Translators and Interpreters (ASTI) have short Professional courses and consultancies. Such great demand for our services necessitates that our scientific equipment are fully operational at all times.

Ladies and Gentlemen, it should be our determination as universities, research institutions and specialised organisations to ensure proper functioning of our offices and laboratories through efficient methods of purchasing and maintenance of scientific equipment. The realistic approach to attaining this objective is what we expect as the outcome of this workshop.

We are grateful to the following agencies for their role in organising this workshop:

The International Foundation for Science, in collaboration with  
The International Science Programme in Uppsala,  
The Third World Academy of Science,  
The International Organisation for Chemical Sciences in Development,  
The Organisation for Chemical Sciences in Development,  
The Organisation of Islamic Conference Standing Committee on Scientific and Technical Cooperation,  
L Institut de Recherche pour le Développement,  
Organisation for the prohibition of Chemical Weapons,  
The University of Buea, Cameroon

The workshop is supported financially by:

The International Centre for Theoretical Physics,  
The Wellcome Trust,  
Bruker Biospin SA.

We wish to acknowledge the patronage of the Minister of Higher Education, Professor Maurice Tchunte, and his predecessor, His Excellency Atangana Mebara, Minister of State and Secretary General at the Presidency of the Republic of Cameroon, for their tireless efforts in promoting excellence in Cameroon's Higher Education system. The practical preparations for the workshop have been in the hands of the Local Organising Committee whose efforts we deeply acknowledge. We would like to sincerely thank the organizers of the workshop for choosing the University of Buea as the venue for this historic rendezvous. We hope you will have a very exciting and fruitful stay at the University of Buea.

Thank you very much.

## Appendix 3

### Opening speech by His Excellency Mr Zacharie Perevét, Minister for Scientific and Technical Research, Cameroon

The Governor of the South West Province,  
The Vice-Chancellor of the University of Buea,  
The Scientific Secretary of the International Foundation for Science,  
Representatives of International Organisations and Networks,  
Distinguished Participants,  
Ladies and Gentlemen,

Permit me first of all, to thank you, Madam Vice-Chancellor for the kind words of welcome which you have addressed to me and my entourage. It is my greatest pleasure to be in the refreshingly pleasant campus of the University of Buea, this young and dynamic institution which has grown to a place of prominence among institutions of its type in our country and sub-region.

Ladies and Gentlemen,  
The Ministries in charge of Scientific and Technical Research and Higher Education have **mutual** affinities by virtue of their respective missions. Teaching at institutions of higher education cannot proceed satisfactorily without the conduct of scientific and technical research. Conversely, in their daily activities research scientists need the human resources available in their universities. They also participate in training students through internships and research in the various laboratories.

That is why we encourage formal agreements between our Minister for Scientific and Technical Research and the Ministry of Higher Education to enhance cooperation between our countries in science and technology for sustainable development. And you certainly agree with me that joint use of equipment and joint implementation of scientific projects are examples of such cooperation.

The Government of the Republic of Cameroon is determined to encourage multi-disciplinary and inter-institutional research teams that can offer the critical mass needed to provide the technological expertise required to reduce poverty in our countries by working through priority sectors such as food and agriculture, public health, housing, research infrastructure and training.

With this in mind, your workshop on policies for scientific equipment is very timely since in the Third Millennium no sound scientific project can be successful without the use of appropriate equipment.

Resource-poor countries such as ours should develop rational strategies for the acquisition, use, and maintenance of costly equipment, both in the short term and in the medium term. In the long term, our countries should develop the capacity to manufacture and even export some of the equipment we need in our daily activities. Such development, of course, cannot be achieved in isolation. It will need contributions from willing international partners.

We want to take advantage of this opportunity to acknowledge and pay tribute to the contribution made by the International Foundation for Science (IFS) in Stockholm. IFS has been a partner of Cameroon since the 1970s. By 1997, IFS had already given 60 research grants, with an average of US \$40,000, for each young Cameroonian scientist's project. A certain number of Cameroonian scientists have received the highly coveted IFS/Danida award for work funded by IFS, and carried out here in Cameroon.

So this workshop is to be added to the list of workshops that IFS has held in our country. But, most important is that Cameroon seems to be among the ten countries that have received the most grants, grants that have become a mark of scientific excellence. We most heartily thank IFS for its unfailing confidence and support. Our gratitude also goes to the Third World Academy of Science and other international organisations attending this workshop.

During the next few days, you will be sharing ideas and experience. We are looking forward to your final recommendations for the follow up. I wish you welcome to this important scientific meeting and declare the International Workshop on Purchasing, Servicing and Maintenance of Scientific Equipment in Western Africa open.

Long live international cooperation.

Thank you.

## **Allocution d'ouverture du Ministre de la Recherche Scientifique et Technique, République du Cameroun**

Monsieur le Gouverneur de la Province du Sud-ouest,  
Madame le Vice-Recteur de l'Université de Buea,  
Madame la Secrétaire scientifique de la Fondation Internationale pour la Science,  
Mesdames et Messieurs les représentants des réseaux et des organisations internationales  
Mesdames et Messieurs les participants,  
Mesdames et Messieurs,

Permettez-moi tout d'abord de vous remercier, Madame le Vice-Recteur, de vos aimables paroles de bienvenue à l' Université de Buéa. C'est un très grand plaisir pour moi que de me trouver sur ce campus si agréable et verdoyant, dans une université jeune et dynamique qui est devenue l'un des établissements les plus réputés de sa catégorie dans notre pays et dans toute la sous-région.

Grandes sont les affinités entre le ministère de la recherche scientifique et technique et le ministère de l'enseignement supérieur, en raison même des missions qui leur ont été respectivement confiées. Les établissements d'enseignement supérieur ne sauraient assumer pleinement leur tâche pédagogique sans l'apport de la recherche scientifique et technique.

Réciproquement, les chercheurs, dans leurs activités quotidiennes, ont besoin des ressources humaines disponibles dans les universités ; ils participent également à la formation des étudiants dans le cadre des stages et des recherches effectués dans les différents laboratoires.

C'est pour cette raison que nous encourageons des accords formels entre les départements ministériels chargés de la recherche scientifique et technique et ceux chargés de l'enseignement supérieur pour le renforcement de la collaboration au profit de la science et la technologie pour le développement durable dans nos différents pays. Et vous conviendrez avec moi que l'utilisation des équipements et l'exécution des projets scientifiques en commun constituent une des manifestations de cette collaboration.

La volonté du Gouvernement de la République du Cameroun est d'encourager les équipes de recherche multidisciplinaires et interinstitutionnelles qui offrent la masse critique humaine nécessaire pour la constitution d'expertise technologique pour la réduction de la pauvreté dans nos pays à travers des secteurs prioritaires tels que l'alimentation et l'agriculture, la santé publique, l'habitat, l'infrastructure de recherche et la formation.

A cet égard, le présent Atelier sur la politique d'Équipement Scientifique est plus qu'opportun en ce sens qu'au troisième millénaire, aucun projet scientifique raisonnable ne peut aboutir sans l'utilisation d'équipements appropriés.

Les pays faiblement dotés en ressources, à l'instar des nôtres, doivent développer des stratégies rationnelles pour l'acquisition, l'utilisation et l'entretien d'équipements coûteux à court et à moyen terme. À long terme, nos pays devraient développer la capacité de fabriquer et, pourquoi pas, d'exporter certains des équipements dont nous avons besoin dans nos activités quotidiennes. Évidemment, cette évolution ne peut s'opérer isolément, mais exigera nécessairement des apports de la part des partenaires internationaux amis.

Nous saisissons cette opportunité pour reconnaître et saluer la contribution positive de la Fondation Internationale pour la Science (IFS) de Stockholm, qui est un partenaire du Cameroun depuis les années 70.

Vers 1997, l'IFS avait déjà accordé 60 bourses de recherche d'un montant de 40.000 dollars des Etats Unis en moyenne par projet à des jeunes scientifiques camerounais. Un certain nombre de chercheurs camerounais ont remporté les très convoités prix de l'IFS/DANIDA pour des travaux financés par l'IFS et réalisés ici au Cameroun.

Le présent Atelier vient alors s'ajouter à divers autres que l'IFS a organisés dans notre pays. Par dessus tout, le Cameroun semble figurer parmi les 10 premiers pays bénéficiaires des bourses de l'IFS lesquelles sont devenues une marque d'excellence scientifique. Nous remercions vivement l'IFS pour la confiance et le soutien continus dont nous jouissons de sa part. Notre gratitude va également à l'endroit de l'Académie des Sciences du Tiers Monde et des autres organisations internationales présentes à cet Atelier.

Dans les jours à venir, vous échangerez des idées et des expériences. Nous attendons vos recommandations finales pour le suivi. Tout en vous souhaitant la bienvenue à cette importante rencontre scientifique, je déclare ouvert l'Atelier International sur l'Achat, le Dépannage et l'Entretien des Equipements Scientifiques en Afrique de l'Ouest.

Vive la Coopération scientifique internationale,

Je vous remercie.

## Appendix 4

### Opening speech by Prof. Vincent P. K. Titanji, Vice-Chancellor (Teaching), University of Buea

Your Excellency the Minister of Scientific and Technical Research,  
Your Excellence Governor of the South West Province,  
The Vice Chancellor of the University of Buea,  
The Scientific Secretary of IFS,  
Distinguished Guests and Colleagues,  
Ladies and Gentlemen,

After the extensive introduction by the two previous speakers, it is my pleasant duty to describe to you the circumstances under which we prepared the present International workshop in the Purchasing, Servicing and Maintenance of Scientific Equipment, to share with you on our perception of the subject and to introduce some of the participants at the workshop.

When we received an is any invitation from the IFS to help organize the workshop, we thought that some mistake had been made. As a relatively young University, we are not yet well equipped, I thought, and it might have been better indicated to go elsewhere. But after a little thought it became clear that Cameroon as a site is as competitive any other. We had organised in 1994, with support from the IFS, a workshop on the purchase, use, and repair of scientific equipment. We had also set up a rather sophisticated Biotechnology Centre at Nkolbisson, Yaounde, most of which equipment remained in a good functional state during its first ten years of existence.

In fact many years back when I landed in the laboratory of one of Cameroon's foremost scientists as a post-doctoral fellow, I was surprised to find that he was trying to unravel the secrets of cancer in a laboratory that contained at most three equipment items: a fridge, an incubator and small desk-top centrifuge.

"How can you work in such a sparsely furnished lab which has only three pieces of equipment?" I asked "You are wrong in your counting" he replied. "There are five equipment items, including your head and mine".

Although this comment was made as a joke to allay the fears of an anxious post-doc. Returning to Cameroon from a well-furnished laboratory in Europe, I was pregnant with meaning. First of all the scientist's mind is the most important equipment in the laboratory: it has to be well informed, upgraded from time to time, and of course physically well sustained. Secondly important, work can be carried out in modest settings with a rather limited supply of equipment. We cannot wait for the day when all our laboratories are equipped with expensive NMR machines, x-ray diffraction equipment, sycontrons, before we start doing something for example about the opportunities for exploring our rich natural resources. Yet it must be admitted that a minimal portfolio of equipment is required to teach and do research in the basic and applied sciences.

It will be one of the main challenges of the present workshop to provide guidelines on the minimum requirement in terms of equipment that is required for example in a typical chemistry, physics, life sciences laboratory in a resource poor country such as ours. Given the wide variety of equipment in the international market such a task is rather daunting. But given the calibre of experienced persons here present I have no doubt that much will be achieved towards addressing this question.

At this juncture permit me to recognise a number of persons who have been instrumental in preparing the workshop:

- Cecilia Öman, an environmental chemist and Scientific Secretary (Natural Products and Water Resources) of the International Foundation for Science, Stockholm. Together with Ms Jenny Lindholm, they have been the main driving forces behind the present workshop.

- Dr Malin Åkerblom of the International Science Programme, Uppsala University, represents an organisation that has more than forty years experience in capacity-building and sustaining scientific environments in the

developing countries. The ISP currently supports two main projects in Cameroon, respectively at the University of Dschang and the University of Buea.

- Prof. Lars-Ivar Elding is a physical organic chemist Professor at the University of Lund, Sweden. He represents the Uppsala University (ISP)

- Prof. Mohammad Ali Mahesar represents the Islamic Conference Standing Committee on Scientific and Technical Cooperation.

- Dr Jean Lorquin and Ms Perine Sanglier represent the French Institut de Recherche pour le Developpement (IRD)

- Dr Damian Tonon and Dr Ghirma Moges represent the Organisation for the Prohibition of Chemical Weapons.

- Mrs Elisabeth Auger and Mrs Tilly Gaillard will do the bilingual (French/English) interpretation.

We also wish to acknowledge the presence of colleagues from other countries, notably from Nigeria, Ghana, Togo, Benin, Burkina Faso, Bangladesh, Mali, Senegal and Zimbabwe.

The local organising committee is larger than has been indicated on the program. We wish to acknowledge and thank all of them for the hard preparatory work that they have done. You can easily identify them by their badges. We especially thank Prof. Ntoko, Dean of the faculty of Science, and Dr Nalova Lyonga, Director of Academic Affairs, whose staffs has formed the backbone of the local Organising Committee.

Before taking my seat permit me to introduce our keynote speaker, Professor Berhanu Abegaz. After earning a PhD in the USA Prof. Abegaz started his career as a Natural Products Chemist in native Ethiopia, before moving to Botswana where he is currently Head of Department of Chemistry at the University of Botswana and Secretary General of the Network for Analytical and Bioassay Services in Africa, NABSA. Prof. Abegaz needs no introduction for those working in the field of natural products after his publication of more than 70 research papers in some of the most prestigious journals of his fields. Ladies and gentlemen let us listen to Prof. Abegaz.

Thank you.

## Appendix 5

# Réunion de synthèse du groupe de la sous-région Sénégal - Mali - Burkina Faso

### Introduction et objectifs

- Créer un espace de communication et de coopération entre les pays de la sous-région.
- Définir la stratégie et les activités à court terme et à long terme.
- Volonté d'extension aux pays voisins tels que la Côte d'Ivoire, le Niger et la Guinée.
- Mise en place d'une organisation aux plans national et sous-régional afin de permettre la mise en œuvre des stratégies opérationnelles.

### Mise en place de l'organisation

- Coordonnateur de la sous-région :
  - Modibo HAÏDARA (Mali)
- Coordonnateurs nationaux :
  - Abdoulaye SAMB (Sénégal)
  - Yvonne BONZI-COULIBALY (BurkinaFaso)
  - Modibo HAÏDARA (Mali)

### Plan d'action

1. Identifier les sources de financement.
2. Créer un site WEB régional.
3. Planifier :
  - les formations.
  - les remises en état.
4. Mise à jour du parc d'équipements (achats).

## Appendix 6

### Action plans for Benin, Ghana and Togo

Each participant, on return, is to use existing communication channels to get together policy makers, technicians and researcher to formulate institutional policy on equipment purchasing that will address problems relating to, i) the participation of all stakeholders, ii) customs duties, and iii) commercial and logistical aspects of purchasing equipment.

As feedback, results of the national meetings from the different countries should be collated, and this may form the beginnings of a regional network.

Out of the national meetings and their follow-up activities, information on scientists' research projects, technicians' competence and specialization, equipment type and category, and suppliers of equipment, can be put in databases which may be shared by members of a regional network of users of equipment that should be established, with a secretariat to ensure coordination. Organization and management of the databases may require funding.

The regional network, when established, will identify competence for writing good proposals, in different countries; this will attract funding National/regional workshops to teach researchers t how to write good proposals will be organized with external funding.

Each country will identify competent technicians for additional training in specialized laboratories in order to upgrade their skills and on their return, they should become trainers of trainers. Training activities can be initiated by researchers, suppliers or the network. Depending on need, sponsorship may be required for the training.

The network will initiate training workshops on Good Laboratory Practices for its technicians and researchers.

At the national level, the performance Profile of equipment and researchers that are in the national databases will be put into the network for others to use.

Participants are to help strengthen the purchasing and management system related to the ordering of equipment.

Codes of conduct for technicians and for researchers should be prepared, taking into account the proper role of the technician in the end results of the research, and in the installation and commissioning of equipment.



## Appendix 7

### A Tentative Checklist for the ordering of Scientific Equipment

*Prepared for the IFS Workshop on Scientific Equipment by V.P.K Titanji*

The checklist should be used for items costing USD 1,000 or more and can be completed by the scientist and/or the technician. It should then be up to the Authorising Officer (Policy Maker) to ensure that the form is satisfactorily completed.

1. Name of Equipment
2. Name and full address of supplier
3. Catalogue Number
4. Purpose for which equipment is to be employed
5. Approximate number of users per year
6. Have you ordered any spare parts? Specify
7. Have you signed an after-sales maintenance agreement?
8. Who will provide training for the use of the equipment?
9. Who will install the equipment?
10. Where will the equipment be placed?
11. Have you verified the voltage specification?
12. Have you made provisions for a surge protector?
13. Have you designated a member of the group to be in charge of this equipment
14. What is the estimated cost of this equipment?
15. How does the cost compare with offers by at least two other competing suppliers?
16. Who is providing funds for the equipment?
17. Have you ordered a service manual?
18. Have you ordered a circuit diagram for the equipment?
19. Have you talked with your maintenance technician/engineer about potential faults for which spare parts could be ordered in advance?



**INTERNATIONAL  
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SCIENCE**

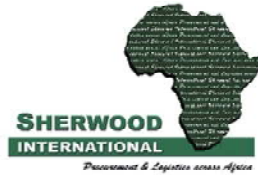
The International Foundation for Science (IFS) supports scientific capacity building in developing countries. Established as a NGO in 1972, IFS is today funded by more than 15 donor organisations and has provided over 5,500 research grants and supporting services to young researchers in some 100 countries in Africa, Asia, the Pacific, Latin America and the Caribbean.

IFS identifies promising young scientists working in fields related to the sustainable management of biological and water resources in their early careers and helps them become established and recognised nationally and internationally.

The IFS research grants are awarded through a careful selection process, which relies on a broad network of world-renowned scientists who assess the scientific and developmental value of all proposals. Their feedback and suggestions are provided to all applicants, both successful as well as unsuccessful.

Read more about the IFS granting scheme on [www.ifs.se](http://www.ifs.se)

University of Buea Cameroon 5-9 November 2002



The Abdus Salam  
International Centre for  
Theoretical Physics



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