

**REPORT OF THE JOINT AD HOC
COMMITTEE FOR SCIENTIFIC AND
TECHNICAL COOPERATION :**

**Council for Scientific and Industrial
Research of Ghana, Universities of
Ghana, and the National Academy of
Sciences of the United States of America**

Ghana 1975

/ D R A F T /

I N T R O D U C T I O N

The CSIR and the NAS-US have, since 1971, engaged in a joint collaborative programme aimed at relating science and technology more effectively in solving economic and social problems in Ghana.

The cooperative programmes to-date seems to have taken the form of workshops aimed at examining the institutional mechanism for formulating science policy; identifying research priorities and the problems in the execution of research in Ghana; and also finding out how best agricultural research results could be made available to user-agencies.

In July 1974 a Joint ad-hoc Committee meeting for scientific and Technical co-operation between the CSIR and the US-NAS was convened in Washington to review the results of past Workshops, and to determine the future direction of the joint CSIR/NAS-US collaborative programme.

I am happy to present this summary report, of the meeting of the Joint Ad-Hoc Committee in Washington, which contains the thinking of both sides on our past and future activities. It is my desire that such meetings will periodically take place to review our constantly changing national scientific and technological priorities.

(DR. A.N. TACKIE)
EXECUTIVE CHAIRMAN OF THE
C.S.I.R.

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Scientific and Technical Cooperation:**

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**Staff Summary Report of the Meeting of the Joint Ad Hoc Committee
in Washington, D. C., July 1, 2, 3, 1974**

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This report is a staff-prepared proceedings of the meeting of the Joint Ad Hoc Committee of the Council for Scientific and Industrial Research (CSIR) of Ghana and the Board on Science and Technology for International Development (BOSTID) of the U.S. National Academy of Sciences (NAS). The meeting was held in Washington, D. C., USA on 1, 2, 3, July 1974. NAS participation was made possible through funds provided by the Office of Science and Technology, Bureau for Technical Assistance, Agency for International Development under Contract AID/csd - 2584, Task Order 1.

1 Introduction

2 Observations and Recommendations

Planning and Analysis Group

The Joint Ad Hoc CSIR-NAS Committee took note of the progress made by the CSIR in obtaining the Government of Ghana's acceptance of the concept of the Planning and Analysis Group (PAG) as contained in the Report of the Joint CSIR/Universities of Ghana/NAS Workshop on "The Role of the CSIR in Determining Science Policy and Research Priorities" (May 1973).

The Joint Ad Hoc Committee noted further that the CSIR had formally given its consent to, and authority for, the Executive Chairman of the Council not to appoint a Director of the PAG during the initial stages of its establishment.

The Committee recommended that the CSIR continue to draw on NAS assistance as necessary in the development of the PAG.

Savannah Zone Study

The Committee recommended the creation of an ad hoc joint study group to meet in Ghana in October 1974, for a maximum of three weeks and a minimum of two weeks, to assess the present and potential impact of drought on agricultural and rural development of the savannah region of northern Ghana. This study group was charged with the following tasks:

1. To examine the present and potential impact of drought in the savannah region of Ghana with a view to assessing its short- and long-term effect on agricultural production and the well-being of people of the area.

2. To identify specific problems relevant to the causes and consequences of drought.

3. To propose a detailed study plan to assist the Natural Resources Committee to use existing educational, research, and technological resources most effectively in carrying out the necessary studies. Moreover, scientific manpower needs should be identified whenever possible.

4. To suggest specific opportunities for international research cooperation.

5. To prepare a report of its findings to the Executive Chairman of CSIR through the Committee on Natural Resources.

The study group should bear in mind throughout that the ultimate objective is the preparation of a concrete study proposal, including a rigorous budget. Such a proposal will make possible the solicitation of funds necessary for early initiation of the study.

It was agreed that the joint work group should be small, composed of seven members with multidisciplinary backgrounds.

The membership should reflect, insofar as possible, a combination of the following disciplinary areas:

- Soils
- Climatology
- Irrigation
- Resource management (arid land)
- Economics
- Sociology
- Medicine
- Animal science
- Geography
- Range management
- Engineering

In general, membership of the study group should also reflect the following functional areas:

- Fuel and energy
- Resource management
- Land use
- Human resources
- Animal production
- Transportation and communication
- Systems modelling

NAS study group members should include three individuals with experience in systems modelling, resource management, and Sahelian studies; four CSIR representatives will be chosen on the basis of knowledge and experience in the other areas noted above.

Science and Technology Foundation and Alternatives

The Joint Committee was not in a position to make concrete proposals on the subject, but recommended continued attention be given to possibilities for alternate funding mechanisms to support science and technology in Ghana.

The Joint Committee also recommended that the staff of the NAS prepare a background document on science and technology foundations and other mechanisms for the support of science and technology for the Executive Chairman of the CSIR.

Industrial Research

The following three areas of industrial research were brought to the attention of the Committee as possible areas for appropriate PAG consideration.

- Fertilizer production
- Industrial and technical extension
- Development of small-scale industries, including machine tools

Substantive discussion of these industrial research topics was limited by lack of time.

Remote Sensing

In view of the fact that Remote Sensing has proved to be a powerful tool for the inventory, interpretation, and analysis of earth resources the Committee recommended that the CSIR seek ways of utilizing this technology for Ghana's development needs.

Scientific Instrumentation Center

The Committee supported the concept of the Scientific Instrumentation Center and noted with approval the actions already taken by the Government of Ghana and the CSIR towards the establishment of the Center. In particular, it supported the decision to link the Center with UNESCO, and to designate the glass-blowing technology unit and the instrumentation calibration unit of the CSIR as the nucleus of the Center. However, unless an efficient management plan for the operation and utilization of the Center is evolved, the Committee felt the Center would not be as effective as it could be.

Information and Documentation Center

The Committee recognized the preliminary actions taken toward establishing an effective information and documentation center for insuring vital linkages with international bodies working in this area. The Committee was, however, concerned with the current state of dissemination of scientific and technical information within Ghana and recommended that the CSIR find ways of making information collected at the Center readily

available to all users. The Committee further expressed its desire that every effort be made to disseminate results of research in Ghana to the international community.

The Committee next addressed itself to a question not on the agenda, viz., the ineffective process of transfer of results of scientific research to agricultural extension workers and (by implication) to industrial and technical extension workers in Ghana. Though many of the recommendations of the report of the Joint NAS-CSIR Committee on Agricultural Extension and Research (October 1971) seem to have been incorporated into the reorganization of the Ministry of Agriculture, there still appears to be a weak link between agricultural research results and the Extension Division of the Ministry. Consequently, the Committee urged the CSIR to recommend to the Ghana Government, for its further consideration, the unimplemented sections of the Report on the Agricultural Extension and Research mentioned above. (Report, pp. 36 - 37.)

Annual Meeting

The Committee proposed that a CSIR-NAS Committee meeting be held annually, alternately in Ghana and the United States; the next meeting is to be held in Ghana the summer of 1975.

3 List of Attendance

Meeting of the Joint Ad Hoc CSIR-NAS Committee
Joseph Henry Building, Room 600-A
2100 Pennsylvania Avenue, N.W., Washington, D. C.
July 1, 2 and 3, 1974

Participants

Council for Scientific and Industrial Research (CSIR)

Professor A. N. Tackie, Executive Chairman, CSIR
Mr. Emanuel Lartey, Chairman, CSIR Natural Resources Committee
Mr. Quartey-Papafio, Deputy Director for Services, Ministry
of Agriculture
Dr. Robert Dodoo, Secretary, CSIR Natural Resources Committee

National Academy of Sciences (NAS)

Dr. George S. Hammond, Foreign Secretary, NAS
Dr. Jack Johnson, Director, Office of Arid Land Studies,
University of Arizona
Mr. David Beckler, Assistant to the President, NAS
Dr. Donald Barton, Director, New York State Agricultural
Experiment Station, Cornell University
Mr. B. K. Wesley Copeland, Professional Associate, NAS

Invited Guests

Mr. Henry Arnold, Director, Office of Science and Technology,
Bureau for Technical Assistance, Agency for International
Development (AID)
Dr. Edward Ayensu, Chairman, Botany Department, Smithsonian
Institution
Ms. Joan Coe, Officer in Charge, Ghana Desk, Office of Central
and West African Bilateral Affairs, Agency for International
Development (AID)
Mr. Julien Engel, Deputy Director, Board on Science and Tech-
nology for International Development, NAS
Mr. Herman J. Nissenbaum, Loan Officer, West Africa 1B, Inter-
national Bank for Reconstruction and Development (World Bank)
Dr. Charles Weiss, Science Advisor, Economics Department, Inter-
national Bank for Reconstruction and Development (World Bank)
Ms. Judith Werdel, Professional Assistant, Board on International
Organizations and Programs, NAS

12:15 - 2:00 p.m. Lunch

2:00 - 3:45 p.m. Science and Technology Foundations and Alternatives for Scientific Support

3:45 - 4:00 p.m. Coffee Break

4:00 - 5:00 p.m. Food/Agricultural Production in Northern Ghana

--Mr. Quartey-Papafio

--Dr. Jack Johnson

July 2, 1974 (Tuesday)

9:00 - 10:45 a.m. Savanna Zone (Northern Ghana) Study Discussion

10:45 - 11:00 a.m. Coffee Break

11:00 - 12:30 p.m. Discussion of Planning and Analysis Group: Concept and Needs

--Dr. A. N. Tackie

--Mr. David Beckler

12:30 - 2:00 p.m. Lunch

2:00 - 5:00 p.m. Future Program Discussion

A. Industrial Research

--Mr. Julien Engel, Deputy Director, Board on Science and Technology for International Development, NAS. (Brazilian Industrial Workshop)

B. Remote Sensing

--Mr. Merrill Conitz, Physical Scientist, Bureau for Technical Assistance, Office of Science and Technology, AID. (East Africa Workshop)

C. Scientific Instrumentation Center

D. Information and Documentation Center

--Ms. Judith Werdel, Professional Assistant, Board on International Organizations and Programs, NAS. (Argentine Telex System) and (Taiwan Information Program)

July 3, 1974 (Wednesday)

9:00 - 11 a.m.

Formulation of Recommendations

- A. Planning and Analysis Group
- B. Savannah Zone Study
- C. S&T Foundation and Alternatives
- D. Industrial Research
 - I. Fertilizer Production
 - II. Industrial and Technical Extension
 - III. Development of Small-scale Industries
- E. Remote Sensing
- F. Scientific and Instrumentation Center
- G. Information and Documentation Center

11:00 - 12:00 p.m.

Closing Remarks

--Dr. A. N. Tackie

--Dr. George S. Hammond

12:00 p.m.

Adjournment

5 Opening Remarks

Dr. Hammond

It is my pleasure as Foreign Secretary of the National Academy of Sciences to welcome you on my first day in this position. It is particularly pleasing to me that this coincidence occurred because I have been to Ghana twice and so it is one of the relatively small number of countries in which I have been personally involved as part of the program of the Academy.

The U.S. National Academy of Sciences may strike some people as a rather curious and unusual organization because it is a non-governmental agency chartered by the federal government of this country for the purpose of giving advice to the government. The Foreign Office program, built up by my predecessor, Dr. Harrison Brown, has become very much involved in many kinds of international scientific and technological operational and discussion programs. These programs are largely built up on ad hoc bases and as we become acquainted with our counterparts, primarily through the binational format, we seek to find ways to develop a particular kind of profitable program of interaction. I think what we are seeking today is to attempt to see whether there are operational programs that may be undertaken in Ghana with the collaboration of the National Academy.

These matters are very complex and normally involve finding things that seem reasonably good to attempt to do, and developing an organization for doing them, which, of course, always involves seeking the resources to do them. The Foreign Secretary's Office of the National Academy in its own right has essentially no financial resources. It is necessary for us to gather support from other agencies, either in this country or internationally. I think our program for this meeting is, therefore, primarily to talk about what we may do, since we are in no position to make any commitments as to what we can do. However, we have in the past been successful in many cases in collaborating with people from other countries, and in finding resources to do modest programs, which have turned out to be always interesting and sometimes successful.

In Ghana there are some enormous problems of which desertification is probably one of the leading ones at this time. Of course, this problem is international. In this country, for instance, we have a striking example of desertification occurring in Florida, so it is universal enough to attract the attention of all people. It would be fruitful to make decisions soon to do something about this problem rather than to talk about it. This, of course, is easy to say, but I think it should be an objective of this meeting, and although we are not, as I pointed out, a federal agency and cannot make commitments for the U.S. government, we can, hopefully, come up with a program that will enable us to do what we feel should be done.

So you are, indeed, welcome, and I will now turn to my co-chairman of this meeting, Professor Tackie, Chairman of the CSIR, the Ghanaian counterpart of the NAS.

Dr. Tackie

Thank you, Dr. Hammond. Ladies and Gentlemen:

On behalf of the Council for Scientific and Industrial Research of Ghana, I congratulate Dr. George S. Hammond on his assumption of duty today as Foreign Secretary of the United States National Academy of Sciences. By a fortuitous coincidence, today is the first anniversary of my assumption of office as Executive Chairman of the Ghana C.S.I.R. In terms of timing of appointment, therefore, Dr. Hammond and I have a date in common. In terms of general background too, we have something in common, since we both came to our present science administrations from considerable background in university academic work.

The Ghana Council for Scientific and Industrial Research and indeed its predecessor organization, the Ghana Academy of Sciences, have a relatively short but interesting history of contact with the U.S. National Academy of Sciences. The period of effective stabilization of this contact dates from January 1971 when a joint NAS/CSIR/Ghana Universities Workshop on Science and Technology was held in Accra. This was to herald similar meetings held later, the last one in May 1973.

The last workshop resulted in the crystallization of some ideas posed at the earlier meetings, and the formulation of some recommendations for improving the existing machinery for science policy planning and implementation. Concurrently with the consideration of these topics, thought was given to possible sources and means of obtaining much-needed financing for scientific and technological research, having regard to the rather low level of local financial support. Attention was paid to the need for, and prospects of, funding from external sources.

At about the same time, the Ghana C.S.T.R. reactivated its Committee for Conservation of Natural Resources. During the early deliberations of this reconstituted Committee, one problem identified for urgent study was the agricultural situation in the Savannah regions of northern Ghana, and the impact on these areas of the severe drought and desertification phenomena in the Sahel regions of Africa. The magnitude and complexity of the Sahel problem had attracted global attention, and it was thought wise that Ghana should undertake the kind of studies that will enable her to do some long-range planning to eliminate or at least minimize likely adverse effects of the Sahel situation on its northern areas, which border on the Sahel region.

It was widely recognized that the desertification studies are a multidisciplinary type activity, and, further, that in view of the global scientific attention that the Sahel situation had attracted, Ghana would be well advised to establish contact with, and obtain assistance from, the international scientific community in its Savannah desertification studies. Accordingly, discussions were held with the USAID Mission to Ghana, whose response was positive and prompt. Within a few weeks, contact was established with the Office of Arid Land Studies at the University of Arizona whose Director, Dr. Jack Johnson, made a brief but very useful visit to Ghana and recorded his impressions and first observations on the problem.

In these discussions, the drought studies project was viewed in the light of the overall science policy, implementation, and financing situation in Ghana. This brought into focus the need for making the existing ties between the U.S. National Academy of Sciences and the Ghana C.S.I.R. more productive. Our present meeting here in Washington is a step in this direction.

One of the outstanding recommendations of the May 1973 workshop in Accra was the establishment within the Ghana C.S.I.R. of a Planning and Analysis Group (PAG) made up of a small number of highly talented and carefully selected persons with disciplines in the sciences, engineering economics, mathematics, and systems analysis. The function of this group is the identification, development of priorities, and in-depth studies of research and development needs, as well as projects and submission of eventual reports and advice to the Executive Chairman of C.S.I.R.

I am happy to inform you that the concept of PAG has been accepted by the Government of Ghana, and C.S.I.R. has agreed to establish the Group. We are now at the state of looking for the personnel required, a process about which we have no illusions, since the rare type of personnel prescribed for the Group is not easy to find.

Considerations of the possibilities of research financing from sources external to Ghana converged on the prospect of establishing a Science and Technology Foundation. This Foundation would receive funds from external sources and disburse them for research and development work in Ghana in response to requests.

The present situation in Ghana is that some financing can be provided from Government sources, principally for local costs involved in the conduct of scientific and technological research. But there is a serious problem with the financing of foreign exchange components of research costs due primarily to lack of foreign exchange at the national level. It is easy to appreciate that in such a situation the procurement of foreign financing is a major form of assistance for research work. The establishment in Ghana of a foundation that has the opportunity of receiving external funding for the promotion of research will therefore be a tremendous boost for research and development work in the country.

The Foundation should be set up in such a way that the major portion of the funds it receives goes directly into research work. To achieve this, the administrative costs of the Foundation itself should be minimal. This subject will be taken up in detail during discussions later in the meeting, when the Ghana delegation will supply information pertaining to similar organizations currently operating satisfactorily in Ghana.

The Ghana delegation would like to see the Savannah Desertification Study adopted as the first recipient of research funding from the proposed Science and Technology Foundation. Two other projects that my delegation would put forward for consideration at this stage are the Fertilizer Production and the Machine Tool Workshop projects that were included in the May 1973 workshop.

Our meeting here has been described as a meeting of the C.S.I.R./NAS Continuing Committee. My delegation is aware that this meeting is a continuation of a series, the earlier ones of which were called workshops and were all held in Accra. My delegation feels that at this point in the C.S.I.R./NAS contacts and at this first meeting to be held in Washington, we should take a practical step forward together. For our part, we have come to this meeting in the fervent hope that our deliberations will end in concrete decisions regarding external financial assistance for research and development activity in Ghana. We would naturally feel that the financing that NAS and USAID put into organizing this meeting has been justified, and, indeed, that our visit has been worthwhile, if we are to return home with a clear indication of possibilities in this direction. And we would like to invite our colleagues in the U.S. National Academy of Sciences, USAID, and other financing agencies that may be brought on

board to adopt this same practical approach to the situation so that realistic and meaningful research facilities are established in Ghana soon that will be physical monuments to the results of our collaboration.

Mr. Arnold

I welcome the opportunity to renew my acquaintance with friends from the CSIR, and on behalf of my colleague, Ms. Coe, and myself, to welcome you to Washington.

I might tell you a little bit about USAID's assistance program in science and technology--what we can, and perhaps cannot do. With its finite resources AID has, after much consideration and at the direction of our Congress, concentrated its efforts in three particular areas: food and nutrition, family planning and health, and education. Ninety to 95 percent of the resources of AID go directly toward these three areas. But a continuing theme running across these areas is the emphasis on the rural regions of developing countries, on employment problems, on distribution of population as well as distribution of income.

We view science and technology as a tool to assist in solving some of these and other problems of development. The role of my Office of Science and Technology in AID is rather special. First, it is charged with looking at these three priority areas to see whether we can find new ways to use science and technology for solving problems.

Secondly, we have a charter to explore other uses of science and technology that may be of increasing interest to developing countries in the future. In the latter category there are three special areas that receive

most of our attention. First, the strengthening of institutions and institutional capability in science and technology within developing countries. This includes such organizations as the CSIR, the universities, and the industrial institutions. The second emphasis is on the assessment, conservation and management of natural resources. Agricultural and other renewable resources receive priority, but nonrenewable resources are also included, as well as environmental issues. The third area is in the reduction of costs for public works and the expenditures for public construction. (The principal reason why I was in Accra last week was to attend a conference that Dr. de Graft-Johnson organized on the opportunities for reduction in cost of public works. It was a good conference and I am sure that a number of useful recommendations emerged. There were assurances from your Ministeries of Planning and Public Construction that they were anxious to implement some of these as well.)

To recapitulate, these are the principal areas on which our Office of Science and Technology has focused its efforts: the building of science and technology capability within the country, the assessment and management of natural resources, and reducing the costs of public construction. Because we have a small office, we implement the program through a group of outside agents--perhaps twenty in number. Some of these are government agencies, such as the National Bureau of Standards and the National Aeronautics and Space Agency, which has been assisting us with remote sensing techniques. Universities are also a part of the team. Massachusetts Institute of Technology is working with us on "appropriate technology in developing countries"; Georgia Institute of Technology on "small industry";

Cornell University on "science policy"; and the University of Arizona on "management of natural resources in arid lands." We also have contracts with private industry such as Monsanto Chemical Company for research on roofing for developing countries, and with Arthur D. Little, a consulting firm that is working in Ghana right now on reducing the cost of public works.

The National Academy of Sciences does not quite fall into any of these categories. It is not a government agency; it has a very special role, initiated more than a hundred years ago, to advise the U.S. Government objectively on matters of science and technology. It is an especially valuable member of our group because it advises us on the important task of assisting developing countries to strengthen their institutional capability in science and technology. It is important to note that the Academy has a two-pronged role. They not only advise us but also have a separate role, to provide scientific advice to developing countries or to other parts of AID independently of us. We in AID must be careful not to confuse or infringe upon these traditional roles of the National Academy of Sciences and not to inadvertently establish procedures or relationships that could make it difficult for them to preserve independence and objectivity. Thus, the Academy is always an advisory group, not a programmatic one, as Dr. Hammond said. It is important to view this activity of the National Academy of Sciences very precisely. I see their role as a first step toward alleviating certain problems, toward helping CSIR or other similar organizations identify, define, and analyze the important, high-priority problems. The resulting recommendations, if endorsed by the government of the host country, can become one input to possible future development programs of AID and other donors.

The provision by AID of capital or technical assistance in substantial quantities is regulated by U.S. laws and regulations. It must take place by agreement between the Government of the United States and the government of the host country. Decisions on programs need to be made between those two parties. The USAID Mission in Accra, for instance, is the action agency for decisions of the U.S. government regarding foreign assistance to Ghana.

We in the Office of Science and Technology (OST) and in Ms. Coe's office of the Africa Bureau, are supporting the AID Mission in Accra with policy guidance and with technical assistance, and we, in turn, depend upon all of our contractors for technical advice in science and technology. As you mentioned, Dr. Tackie, the USAID in Accra is very interested in science and technology programs and considers these discussions to be a useful approach to developing better programs in Ghana.

Thus, it is the role of the Academy to provide advice through our office or directly to CSIR which will (1) help the Government of Ghana prepare and present to USAID/Accra or others, effective proposals for technical assistance and (2) to advise AID on matters of science and technology upon request. We recognize that these workshops and this advice are only one of the many sources of consultative advice available to CSIR and we also recognize that the Government of Ghana may not look upon USAID as the only source of technical assistance. Nevertheless, if the joint discussions between you and the Academy are to result in some action programs sponsored by AID (and I am sure this is a mutual goal) it is important that the three parties understand each other as well as possible. For this reason, we appreciate the opportunity to participate in this meeting.

Ms. Coe

I would like to talk specifically about the program in Ghana at the moment and the directions that we see it taking. Mr. Arnold mentioned the areas in which AID is working, namely, food production and nutrition, family planning and health, education, and human resources. Within these four broad areas, in each country in which AID has a bilateral program, we select in concert with the host country--usually on the basis of their own development plans--certain "areas of concentration" for AID activities. Those areas of concentration are determined by host country requirements. In other words, what the problems in the host country are; the kind of expertise the United States can offer, and also what is sought from the United States.

In Ghana we are working in rural health delivery systems, including a very large family planning element, trying to assist the Ministry of Health of Ghana to determine the most cost-effective ways of delivering health services to the rural areas. In addition to that we expect, following the National Nutrition Conference that took place this past April, to begin to assist the Government of Ghana in developing a national nutrition plan. The recommendations of the nutrition meeting indicate that perhaps for the first time seriously in Ghana, the nutritionist and the agriculturalist will be talking to each other so that the nutrition strategy which results will include certain kinds of emphases in agricultural production, for example, high protein foods, as well as the usual emphasis of getting to the people who are nutritionally deprived.

The USAID program in agriculture is much less well developed at this point; we are depending quite a bit on what comes out of the development plan that is now being put together. We expect we will be working in the

training of manpower in the management and development of agricultural development programs. Management has been indicated in Ghana, especially in the agricultural sector, to be one of the important hindrances to effective development programs, so we will be working at the level of training regional directors of agriculture. Through the University of Ghana and the Institute of Public Administration we hope to assist the Ghanaian management training program for those people who will be working in the field in the rural areas of Ghana managing agricultural programs. Discussions are now going on with the Government of Ghana on grains and legume production and also on the provision of agricultural inputs and services, for example, fertilizers, increased seed production and agricultural research. This is much less well thought out and I can only say that discussions are going on. Exactly what the United States' involvement will be is yet to be determined.

How we decide what we are going to do is based on what the problems in Ghana are determined to be by both the Ghana Government and the USAID Mission. This list can always be changed. I think the issue of desertification is a good illustration. Desertification is something we have talked about in Ghana in terms of the AID program only within, say, the last five months. It has come to have a priority at least as high as any of the other established elements of the program. We have also talked about the science and technology area and what should be done in Ghana. The AID Mission agrees with Dr. Tackie's feelings that there needs to be a focus by the research institutions in Ghana on different development problems that cut across the lines of the individual disciplines of these research institutions. We hope during your discussions here

you will spend some time discussing how this may be achieved. I think most of us know that we have been discussing an AID-supported science and technology project and if it results, the kinds of activities undertaken under the project have to be those that fit within what AID and the Government of Ghana define as "critical development problems." Some examples might be the issue of desertification, low-cost farm implements, machinery and their manufacture in Ghana, the application of new food technology, or the development of a documentation and information center for agricultural research. This is the direction in which AID is moving in the discussions with the CSIR.

Discussion

Dr. Hammond

Thank you, Mr. Arnold and Ms. Coe. We appreciate your coming to sit with us. It is quite true that actions that come from whatever wise things we may conclude really does depend very heavily on other agencies for implementation. On occasion the National Academy of Sciences has rendered what seems to be faultlessly valuable, insightful and brilliant advice to the federal government of the United States but it has not necessarily been acted upon. So that is one of the hazards of a discussion like this. It is probably also true that sometimes the National Academy of Sciences has rendered advice which did not look good, so we are not infallible.

We will probably not spend any significant amount of time on such subjects as family planning, health, and education. This is a wide field and we recognize that these are important subjects but we cannot deal with the whole world at once.

Dr. Tackie

The four areas outlined by Mr. Arnold are quite clear to us: food and nutrition, family planning, health and education, etc., but he forgot to mention the idea of the science and technology foundation.

Mr. Arnold

This was a difficult concept for us in AID. Most of us do not understand it on occasion. Most of the funds, 90 - 95 percent, and most of the people in AID (90 - 95 percent) are concerned with those four principal areas mentioned. The Office of Science and Technology has one function: to help those people to work on those four areas. It has another function which is to explore areas which may become of greater interest in the future to developing countries. That exploration takes the form of technical assistance projects, not capital assistance. We can do some special programs but there is one caveat--the program needs to have significance outside as well as within the particular country. This is because we have a mandate to consider worldwide problems, the problems that have applicability in many countries. An example is standards. The development of standards institutions is required worldwide and does not fall in AID's four categories but we do support it within a number of countries in a rather limited way. There are some small programs which we can carry out if they meet certain criteria; first, the country is interested in it; second, there are other countries that may also be interested; and third, that it concerns science and technology.

Dr. Tackie

Am I right to say that you might support recommendations arising out of this meeting you attended on low-cost construction?

Mr. Arnold

Yes, but let me say this, it would be much better if that kind of program were supported by the USAID Mission in Accra, with our assistance and backup.

Dr. Tackie

We might want to talk about subjects which do not fall within food and nutrition or family planning.

Dr. Hammond

This touches upon something else that struck me as being interesting in the presentation that you have given us and that is one area which you did not mention at all--the development of industrial technology in developing countries. People all over the world have come to realize that the food problem would properly take priority worldwide over rapid industrialization; yet the desire for industrialization is still there.

Ms. Coe

The reason for this emphasis in programs is the policy of concentrating on the lower 40 percent of the population and the fact that the majority of these people are occupied in agriculture, thus resulting in a shift away from industry and urban problems.

Dr. Hammond

I am raising the question: "What is the position in this country--AID and also people who study development and work with development in countries--with respect to industrialization which is not going to cease?" What are the chances that we overreact now, essentially forgetting a long-range goal of the people in Ghana to develop a more effective industrial economy?

Dr. Tackie

I think you are right. We have on the agenda for discussion manufacture of machine tools. One area of concern to us is the Institute of Industrial Research, which is relatively weak, where the bulk of technological research should be initiated and then turned over to industry. This is why I seem to be pressing the point that it is not just the nutritional side you should look at but other viable projects, too.

Mr. Arnold

This is very important that you do not let our discussion prevent you from talking about the things you think are important. We very much need to have that kind of feed-back and response. Our own program is as we have described it; we have described it actually and realistically. But I would say that we are neither all of one mind nor are we unchangeable. The program is changing; as of a year ago we had no interest in energy except rural electrification. I can assure you there are a great many people who are worrying about problems of energy and sources of supplies at the moment and there will be AID attention given to it in the future.

Dr. Johnson

Dr. Hammond, I would like to support what you said about not forgetting about industry. I think a significant relationship exists between agriculture and industry and, in talking about them, I think we tend to go overboard in one direction or the other.

Dr. Hammond

I am very impressed with the fact that we are terribly naive about the problems involved in industrial technology transfer. What seemed like

an easy thing a few years ago turns out to be impossible. How do you achieve industrialization in the world as it stands now? Maybe that is one reason we don't talk so much about it.

Mr. Arnold

There is evidence that we are not insensitive to this; at least approximately a third of my office resources goes to exploring problems of industrialization and problems of technology transfer, problems associated with the building up of industries. We do try to put emphasis on rural industries, rather than major industrial operations. These are not major AID programs--major resource transfer programs--they are exploratory; they are on the edge trying to push the frontier of knowledge back a little in these areas. The Academy has been very helpful in these studies.

Mr. Copeland

One point that is quite often forgotten when people talk about agriculture or industrial research, is that one supports the other. If you want to produce more crops in the country you need more fertilizer, which means you have to have some way of producing or buying that fertilizer. If you get into other areas of food production or food storage, you are talking about technology and industry. They go hand in hand with agriculture and to separate them would be a mistake.

7 World Bank and Ghana

Mr. Nissenbaum

Over the past several years the Bank has tried to drastically reorient the direction of its assistance to Ghana, much as it has tried around the world. Historically, the Bank has been regarded as a kind of bricks-and-mortar organization, and it certainly is true that for most of the 20 - 25 years of its existence the great bulk of Bank assistance, whether on hard or soft terms, has gone characteristically in the fields of transportation and power, water supply and, more recently, telecommunications. In Ghana we have tried to change this emphasis, and there have been, over the past 4 years, a series of four loans amounting to \$27 million and some preparations for additional loans that are now relatively well advanced, which represents a larger sum in the areas of fisheries, cocoa, sugar production, and livestock production. I might just say a word or two about each of them to show their composition.

The fisheries credit project, which was the first in agriculture, has had some bureaucratic problems but it is now producing some good yields. Essentially, the fisheries credit project was intended to increase fish catches by modernizing the fishing fleet. We have recently extended or broadened the use of the vessels we helped build and equip so they could trawl as well. The intention of amending the project was to extend the

the fishing season for the fishermen and also, of course, to produce more yields. This has been relatively successful. The boats have now been built, equipped, and sold to the fishermen. Some are now in use, and the limited information we have indicates that the fishermen have done very well and considerable demand has been built up for more boats of this type.

The second project is the cocoa project in eastern Ghana. This is a project for the rehabilitation and replanting of somewhat less than 90,000 acres of cocoa. Its components are twofold: the first concerning rehabilitation emphasizes improvements in capsid control for which we are providing sprayers and insecticides and some extension service assistance; the second concerning replanting is the provision of better seedlings along with credits. Also running through the whole project is improvement of feeder roads in the area so we can get cocoa to the market. This project, in contrast to the fisheries project, has gone exceedingly well.

There was a slight delay beginning this project because of a dispute as to whether the fertilizer should be provided on a pure grant basis in true traditional Ghana custom or whether, as the Bank insisted, it ought to be brought on a credit basis. The Bank view prevailed finally but it took some time; as a result, there was some loss of production and some loss of project progress in replanting. However the rehabilitation results have been attractive.

The third project which related to Dr. Hammond's point regarding industrial rather than agricultural projects (although it may also meet Mr. Copeland's definition because it serves both purposes), is the sugar rehabilitation credits program (15.6 million credit granted two years ago).

Those of you have been to Ghana (certainly our Ghanaian colleagues know them well) may be familiar with two factories that were built a long time ago and that have been far less capable of producing the level and quality of sugar that Ghana desires. The basic intention of the Bank project in this third area is to put the factories and the crops in the fields back into production. We started on rundown, old, out-of-repair services, and had to bring in a reputable sugar producing firm. Through the government services we were able to get a concern which had considerable experience both in Ethiopia and Tanzania. It is now running the factory and is the agent of the institution which is now called GSEL's (Ghana Sugar Estates Limited). Progress is slow but there is better production than there has been for several years. I wish I could say promising things about the factory, but it is going to take a very long time and be a very costly project. If it works, and there is no reason to assume that it will not, it will enable Ghana to reduce substantially the level of imports of sugar--probably within five years. Through the assistance of the Ghana Government in agreeing to some recommendations of the Bank of price policy, I think it is already clear that we can equalize or stabilize the domestic price of sugar and at least end that terrible irony which we found when we first came into Ghana where domestic sugar cost a great deal more than imported sugar.

Finally, I am happy to say that just within the past month, the Board of the Bank has approved a fourth project, which is already under way. This is the project that sets up a Ghana livestock company, essentially a pilot livestock developing scheme, which will operate four ranches in different parts of the country with the hope that in approximately 2 years employing improved animal care techniques and improved

breeds, there will be a substantial possibility of real livestock production in Ghana.

Those, Dr. Hammond and Dr. Tackie, represent the investments the Bank has made to date.

Discussion

Mr. Copeland

Is there a training component within the fisheries project and the sugar factory project to train Ghanaians to use the new equipment on the fishing boats and replace the firm now operating the sugar factory? If this component is present, is it on grant or credit basis?

Mr. Nissenbaum

Let me go over each of them. The fisheries project, for all intents and purposes, is on a grant basis. It consists of three-quarters of one percent interest loans over a 50-year period. The loans are on the most favorable terms available to the Bank. There is not a very substantial training component in the fisheries project. Ghanaian fishermen are very competent. They are very well schooled in their own techniques, and there is a substantial UNDP training facility already in the country; as a result, the only training we have devised within this project is for the improvement of the Boatyards Division of the Ministry, which is the institution that actually built the boats using Ghanaian timber and our foreign exchange for the other inputs.

The cocoa project does have a substantial training component, not only in the use of the seedlings or the other inputs within the extension service, which we are subsidizing as part of the project involving sprayers, insecticide, etc., but the project staff is (with one exception) completely Ghanaian. It represents the Bank's first attempt through this "project development unit approach," to give the government some expertise in large-scale project operations.

The sugar project has a very heavy component of funds which will put the Ghana Sugar Estates Limited completely in Ghanaian hands in the future. This clearly is one of the explicit objectives of the project.

The livestock project, although quite small, is also oriented not only to the training of better care of the herds, but to the establishment and running of the livestock company as well, which will also have specific objectives to be completely in Ghanaian hands within 2 years.

If there are no additional questions on what we have done in the past, let me say that these four projects, we hope, will be followed very soon (perhaps this year) by approval of two additional projects. One is the Northern Region Rice Development project, which is a large integrated project quite close in site as well as in concept to the present Ghana-German Fertilizer Distribution Center; the other is a project for the establishment of an oil palm development production facility in the Kade area. This will be a new Ghanaian entity. I think it will be called Ghana Oil Palm Development Corporation. We have negotiated an \$11 million credit, which will set up a nucleus plantation for the production of palm oil and then give considerable assistance in the outlying area for assistance programs. We hope that this will be in operation before this calendar year ends.

Dr. Tackie

This oil palm project, is it going to use our huge oil palm research project at Kade as nucleus?

Mr. Nissenbaum

I did not work on the development of this project. There is a research component. I just cannot recall at the moment; however, I will check.

I will finish this list by mentioning cotton production. In the Upper Region, we have looked at a pilot scheme for cotton production on more of a plantation basis than on a small owner basis. The report seems to be that technically conditions are perfectly suitable. The government is substantially impressed from the standpoint of the textile industry, and we hope to have a team going back to Ghana in September to complete the negotiation of the project. For the future I would say that agriculture should be as large a portion of our program as possible. In contrast to the past where strengthening infrastructure represented almost two-thirds of our program, I think 40 - 50 percent of our future projects will be in agriculture. I have mentioned to you that we hope there will be a second fisheries project and we have scheduled a mission to Ghana for that purpose in this fiscal year.

The Cocoa Marketing Board is already preparing a second cocoa project, and we are anxious to move ahead with that. There has already been reconnaissance of the second sugar project, which would be much more of a production project and perhaps involve distribution of sugar production rather than the rehabilitation team that we have necessarily concentrated on thus far.

The livestock project has within it the elements of preparation for a second project, as do the oil palm, cotton and rice projects. So we see a wave of succession and extension in broad terms of the projects we have carried. I am very hopeful that we can do more in other fields. Those would be at least twofold. First, we have concentrated on production schemes principally for import substitution purposes with the exception of cocoa. I hope we can now turn, with a little more energy, to the prospects of expanding nontraditional agricultural exports, and I hope we could do something in the fields of cashew production, rubber, or expanded livestock production. In addition, there are some other ways of working in the field of agriculture, which the Bank has already begun to explore. Certainly one of the institutional problems that I can think of in the fields of marketing and credit deserve some attention. We have given a little assistance thus far to the Agricultural Development Bank. The progress that has been made in preparing a program of substantial improvement in that institution, I think, indicates that there are very good prospects of turning the institution around. The government has displayed recently a fair amount of interest in irrigation and in the possibility of building a dam at Kpong. We have made some suggestions to the government about the irrigation potential of the water control at that facility. I am happy to say that the government has agreed with this and they are now broadening the study that is going on for that facility to see whether it could not have irrigation benefits as well. I should at least say that we have begun, through an additional project that we approved about a year and a half ago, to make some contribution to improving and upgrading the secondary and feeder roads,

which fall in our agricultural area and play a very important marketing role. We hope to do more of that. We have been in very close, and I would say, very successful contact with the Building and Roads Research Institute on this project. The Institute is now preparing the feeder road project which we intend to appraise within the year; this will be in line with some future Bank assistance as well.

Finally, we hope to do some work in the broader rural development area but those ideas are still quite vague.

Mr. Copeland

You touched upon telecommunications. Could you tell us what you have in mind on that?

Mr. Nissenbaum

Yes, we have two directions in telecommunications. The first, telegraph and telephone services, which in the past had received a substantial investment and were of first quality in character, have depreciated over the past several years, due to the lack of foreign exchange and maintenance. We have worked with people in post and telecommunications to develop a program for a 4-year rehabilitation effort to replace some of the equipment that was outdated or ineffective and improve the number of switchboards and telephone instruments. That is the physical objective. The institutional objective, coming from the government's direction, is to assist the government to establish post and telecommunications on a self-sustaining revenue-earning commercial basis, one nearly equivalent to what the government has already achieved in power, water, and sewage. The Post and Telecommunications Department has already been set up on a partially commercial basis. It is no longer completely dependent on the

government for budget support, and earns its own operating revenues while still, for the moment, relying on the government for capital investments. I think, as of today, it is now completely on its own and we, with some very good assistance from the United Kingdom, have been able to give them some advanced technical assistance on the setting up of the institution, so we hope to be able to finance the project this year to provide more technical assistance for growth of the institution in a commercial fashion.

Mr. Copeland

Was there any consideration of an international component of that project, such as ground stations for the communications satellites?

Mr. Nissenbaum

One element of the project (and this was the reason it was not moved further), which still has to be settled is whether there should be a microwave link to Abidjan to tie into the Earth Station there, or whether (particularly since, I take it, satellite stations have actually come down in cost) Ghana should not have its own satellite station. There are some dissenting views and some pending opinions, which must be reconciled.

Dr. Barton

Would you tell us about the process for identifying the priority problem areas? How do you select them? How do you bring expertise to bear and how do you interact with CSIR and other elements in Ghana? Could you give us some view of the process of the problem identification and assessment in relation to how you transfer and utilize skills in Ghana?

Mr. Nissenbaum

The process is not really different from that of USAID. The Bank's principal contacts are with the Ministries of Planning and Finance, which signal our sense of direction, and we are heavily influenced by those contacts and by the government's expressions through those organizations. They are, in fact, on our Board of Governors. To get to your point, however, members of the Bank were recently in Ghana with the Economic Planning Commission. They went not only to take stock of the present financial and planning situation, but to discuss and get information from the government on the development plans for the future, and to assess the government needs for assistance. In that connection they explore the given sectors that the Bank and the government generally agree are most important, what the trends in those areas have been, what the needs of the sectors are, what changes in both policy and program seem to be required, and then finally, but perhaps from the standpoint of this meeting most importantly, there is a discussion. Various ideas are explored sometimes conflicting in character as to the first, what the sectors should be that the Bank should concentrate on within those sectors, what areas and then what types of projects, and then, more precisely, what type of assistance. That really covers the process, whether it is agriculture, transport, telecom, or what have you. Within this sort of broad framework--essentially procedurally outlined--there is a very heavy scope of influence and more contact with persons who are important and influential within Ghana.

Dr. Hammond

Heavy emphasis on the agriculture credits issued in Ghana is understandable, for it is consistent with everything I have heard and read

about the problem, but there is also a dilemma. Nearly all the credits are directed toward the development of the larger-scale agriculture, that is, the principal Ghanaian agriculture. We have heard last year discussions about enormously important rural problems, because that is where a large fraction of the actual agricultural production is and where the people are. Has the World Bank found ways of supporting successful programs with that kind of agricultural problem with which we in this country have absolutely no experience?

Mr. Nissenbaum

The Bank is just getting into this area. Recently the Bank set up a rural development unit in my department. They are just getting started and looking at broad programs. To develop agriculture is a very complex process. We are really experimenting in this area at the present time and I think the Bank is moving forward in this direction. It cannot continue with narrow project-oriented types of programs and really get agriculture developing.

Mr. Copeland

Is there any ceiling on the credit to Ghana? Does the Bank establish ceilings, say for countries? I am wondering, if the Ghanaian government came to you with a large project specifically in science and technology, would it be received favorably, since the Bank has traditionally not been heavily involved in science and technology per se?

Mr. Nissenbaum

The Bank does not work in terms of very rigorous fixed ceilings. We do have a planning system. We are working with the idea of certain

magnitudes of assistance to particular countries, but this is largely determined on a year-to-year basis and, since the Bank, unlike AID, works in terms of large discrete capital projects, most of which take well over a year to develop, shape, and bring to the point where we think they are ready, we do not really have the flexibility, in many instances to move as rapidly as AID or bilateral agencies. Also, the form of our aid is somewhat confining in a fashion; but whenever we talk about Ghana, which like so many other countries has been receiving only IDA assistance in soft credits over the past several years, the situation is now changing very drastically. The rates of inflation over the past two years and a number of other factors are now making it abundantly clear that future loans to Ghana from IDA will not be adequate to cover requests by any means, even though they total 4 or 5 billion dollars over the next four years. As a consequence, there will be much stiffer competition for IDA funds. I would have to say frankly that, given the results of the recent debt renegotiation, Ghana will have to have some blend of hard Bank terms as well as IDA resources if we are going to maintain the increased level that we would like to see. But coming back more precisely to your point, Mr. Copeland, we could fairly readily encompass science and technology projects, which, I take it, would not be of magnitudes greater than that of, say, \$500,000.

8A General Review of CSIR-NAS Cooperative Programs

Dr. Hammond

My comments will be brief, simply to relate my experience and to follow from the first workshop, which was held in 1971. It was suggested then that we assemble a binational ad hoc committee to discuss ways in which the Government of Ghana might develop the strategy for producing science and technology national policy as a part of the national development program. Mr. Dowuona (former Chairman of the CSIR) carefully tried to guide us away from designing developmental policy, by rather asking us to consider ways in which a policy might be created--a mechanism within the country for having a dynamic ongoing policy forming apparatus. I think for the most part in our meeting, which was held in March 1973, we managed to be faithful to this principle. Obviously, there were times in the speeches and the report that show clearly that you cannot resist the temptation to get into some details of what policy might be. Probably the leading suggestion was that within the CSIR an organization be established called the planning and analysis group. This group would be charged with producing studies on research priorities and other assignments and provide the CSIR with what might be a powerful capability for dispatching the Council's charter responsibility within the government of the country to give advice, on demand, and to provide guidance on science and industrial research.

I do not want to attempt to review the report in detail. It dealt with some other things, in addition to the suggestion that a planning and analysis group be established, but they are secondary. We also gave a substantial number of examples of problem areas in which the PAG might well be expected to do analytical work and to render recommendations at various times. Two of these areas are fertilizer production and the establishment of a more extensive small machine tool capability within the country.

Dr. Tackie

For the benefit of members who are perhaps not very familiar with the functions of the CSIR, I would like to quote the first main function of the CSIR, which is to advise the government of scientific and technological advances likely to be of national importance to Ghana and in particular to advise the government or other agencies of the government on scientific and technological matters affecting the utilization and conservation of natural resources in Ghana.

We really had not been effective in advising government, which was one of the main reasons why the meeting was convened in Accra, and a lot of time was spent discussing how best the CSIR could carry out this particular function, among others. Now, during the discussions in January some attempt was made to identify areas of weakness within the CSIR and the scientific community in Ghana that militated against achieving the stated goals of the CSIR. As you know, the greatest number of research institutes in the CSIR are agriculturally oriented, and it was therefore appropriate that the first outcome of the recommendations of the committee, held in January 1971, was to set up the special committee, which

met in October, to look at some of the weaknesses in the area of agricultural production. Food production is not progressing as it should. Moreover, we need raw material to feed our industries. It seems to me that there is some weakness in the extension services in the country, and my colleague, Mr. Quartey-Papafio, will be talking briefly about what the setup now is to help us discuss more effectively.

The follow-up of the '71 October meeting was the '73 May meeting, which to my mind was a very vital meeting held between the Ghana group and NAS. This was a meeting at which the Ghanaian planning and analysis (PAG) was proposed, the functions of which include the identification and analysis of problems and priorities of research. We feel that the PAG will help towards the development of the economy of the nation. I have already said this morning that the Government of Ghana has accepted the idea of the formation of the planning and analysis group within the CSIR to advise the chairman, who will, in turn, advise the Council so that they will be in a position to carry out the functions outlined in Article 4a of the Decree 293.

Now this is the point at which I believe the NAS will be invited to give us some advice on how to get this PAG working. I have already said that we are now in the process of trying to find suitable personnel, and according to the recommendations contained in the report, these people should be talented, experienced, and have a broad outlook on problems as a whole. Such personnel are not easy to come by. I know the Committee also might want to solicit the help of outside personnel if Ghanaians cannot be found, and I would like us to discuss some of the ways of trying to identify such personnel, since the Council has now asked me to look into the appointment of such a group.

I have already indicated that industrial research, to my mind, is an area where the NAS could give us assistance. I am hopeful we could center research activities around some areas of research identified at the workshop in 1973, in order to achieve quick and relevant results. We will have the opportunity at this meeting to discuss some of these areas such as agriculture, tools manufacture, fertilizers, sugar cane, and, of course, industrialization.

Now, as far as I can see, at this stage, our relationship with NAS has helped us to identify some of the shortcomings in our setup, and with the introduction of the PAG we are hoping to tackle some of the objectives and attain results. To my mind, however, the PAG alone will not be sufficient to enable us to carry out all our functions. I am thinking particularly of encouraging and coordinating research activities within the scientific community in the country. I believe that out of our joint collaboration programs has emerged the idea of a science foundation. I hope the CSIR, by participating in the disbursement of funds, might be in a position to monitor the type of research being done and control the type of research we think will help the nation's development.

Dr. Hammond

I think these may be simple straightforward objectives that we may not be able to accomplish entirely because of the complications behind them. I believe the last points you made are significant. If there is a new funding mechanism established in Ghana, such as the Ghanaian Foundation for Science and Technology, obviously the relationship between it and the CSIR will be very important. Funds from the foundation surely will go to the reserach institutes, and if the CSIR becomes

a very powerful advisory group in the area of science and technology, with the PAG becoming central to the dynamic formulation of the nation's policy for science and technology, it would probably possess overwhelming influence on the way in which the size and the directions of the budgeting go into the science foundation. So it will be a complicated two-way relationship, which must be thought through and understood to see how it will work in principle and then also take care of the political interactions, which inevitably arise.

8B The Planning and Analysis Group

Dr. Tackie

I have looked at the proposals for setting up the PAG. We had discussions with the Commissioner for Planning, and the government has discussed the concept of the PAG as outlined in this report. The Council has agreed that we set up the PAG. The PAG is a tool for assessing and analysing any project that might come before the council for execution, which would improve our decision making processes and also enable us to discharge our main function of advising the government on research work that should be supported.

Now, I support setting up a PAG because it seems to me that some of the research that has been done is not based on proper analysis and determination of how it fits and helps the development of the economy. I think I am right in saying that with the introduction of the PAG we will be in a position to exercise our functions effectively and this is why government has also accepted the idea of the PAG.

The question was raised this morning about funding and whether the PAG is going to start operating this year. I am not quite sure whether I can give a straitforward answer because we will now go back to government and inform them that the Council at its last meeting agreed to set up the PAG and justify its functions and operating costs, including the cost of paying the salaries of the type of personnel required to carry out their functions. We expect the PAG to function closely with the

Ministry of Economic Planning, because I think one of the functions of the PAG is to collaborate with the Planning Commission of the Ministry of Economic Planning on all aspects of the economic level that might require such support.

Mr. Beckler

This concept is one that is taking on increasing importance. I think it is fair to say that most countries are in trouble in trying to relate their scientific and technical capabilities to the broader needs of their society. The methods for doing this have not been very well worked out. I have just been involved in a study in the United States, which has resulted in a report during this past week, and I will give you a copy of this report. It is called "Science and Technology in Presidential Policy-Making: A Proposal," in which one of the central recommendations was that there be a Council for Science and Technology within the Executive Office of the President. You will recall that President Nixon terminated the former Office of Science and Technology in the President's Science Advisory Committee. To point out with a very cogent argument the reasons why the scientist and the engineer cannot be as we call it "on tap but not top", it is not enough to say that the policy makers will identify a problem and then find a scientist or engineer to help them. There has to be a full partnership in this process, a give and take discussion, so that the problem can be perceived by the scientist and engineer, which might escape entirely the non-scientist or others who are more generally accepted as part of this policy making process. And in one of the recommendations they offer a corollary suggestion for a capability for policy research and analysis, which they say that the White House desperately needs and

does not have, so I think that you can at least take some comfort out of the fact that you are not behind in this type of mechanism and that you have a real opportunity to help shape this kind of capability, which we hope will also be shaped in the United States.

Well, having said that, I think we need to recognize that the techniques for doing this are not well developed; we are still trying to learn how to relate scientific and technical considerations to economic, political, institutional, social, human, and other factors, but the emphasis here is more on analysis than on planning. The point is, and I think this report points out quite well, that the scientist or the engineer is not going to be the dominant voice in the final decision but must be very much a part of the analytical capability to explore various alternatives, recognizing that the final choice may well be made by others but hopefully on the best possible analysis of the problem. And the selection of the problem has to be done in close consultation with people who are concerned with the broader types of social and economic development. Therefore, the point I would like to leave here is that, in my view, if at least we do not have a precise prescription about how this can be achieved, we do know it is important that we achieve it, and that perhaps if we can work together in trying to develop the capability in Ghana, that you will in effect be a pioneer and will help to lead the way and, in a broader sense, show the way to couple the scientific and technical capabilities with the development opportunities in your country and in other countries as well.

Discussion

Dr. Hammond

I can only second that. I think that in the discussions last year a Ghanaian colleague was sometimes a little shocked to learn that our own mechanisms for having a continuous national policy of science and technology are so primitive, but that is the way it is.

Dr. Tackie

We should have the opportunity to see if we can develop some mechanisms for tackling this problem, because we have accepted a principle based on the nine functions listed in this report.

Dr. Barton

In addition to our not having a well-defined analysis mechanism here, another contrast that could be pointed out is that we do have heavy funding for research from the national level. One thing that came out loud and clear to us as we talked to research people in Ghana was a very sincere desire to work on research in the national interest, but funds channeled through the CSIR to the institutes without some opportunity for the university involvement of research was a very real limiting factor. In the functioning of the Council itself, getting cooperation from the researchers in the universities would really be a tremendous asset for the country.

Mr. Nissenbaum

Recognizing that the PAG does not now exist, and since we in the Bank would be very interested, could you say in what fields or what kinds of questions you think you might want the PAG to address?

Dr. Tackie

The CSIR is not making an impact on development in the country by coming out with scientific research results because research topics have not been selected based upon sound analysis. It is hoped that the planning analysis group will go to the Ministry of Economic Planning and discuss with them the general development program of the nation to find out in what areas we can offer assistance. For instance, you have mentioned a number of your development programs in Ghana. We would want to be quite sure that we carry out relevant research, and therefore the planning analysis group would be required to undertake the rough study and analysis and submit their findings to the Council. We will take the recommendations to the relevant institute that has the money to work on the identified research area.

Mr. Copeland

The Government of Ghana formed a planning commission about a year ago. Professor Tackie is a member of that planning commission. Now if the FAG is set up and doing its job properly informing him about aspects of science and technology as they relate to governmental plans formulated by the planning commission, a dialogue will be possible involving the scientific community.

Mr. Arnold

I find myself endorsing Mr. Beckler's comment that the analysis part of such a group seems to me a very important section, more important than the science and the planning part of it that will take place in other groups. I am thinking now of research in the rather classical sense--the acquisition of new knowledge--and our experience in other countries is that research

often can make its most effective contribution by finding ways to apply existing knowledge, existing technology, to problem areas. Perhaps 90 percent of research effort might well go in that direction rather than on pure research. Would you comment on this?

Dr. Tackie

I have held the view that when the Council for Scientific and Industrial Research was established, the emphasis should be and was on applied, not basic research. A good way to catch up as we endeavor to develop is to use already developed technologies and adapt these to our own situation. We will not emphasize pure research. Universities are at liberty to do this type of pure research. I believe our research institutions should know their research results are to be applied, and it is therefore important to analyze whether any project to be advanced will have some relevance to the national needs.

Dr. Hammond

I think it is important to retain some communication of responsibility to the mandate of this particular group. Plans formulated by the group may not be implementable, but experience is that groups which do analytical work only, with no responsibility for thinking about implementation, frequently come up with analyses which are too aloof to be very effective. The relationship between the analyses and the responsibility for translating them into plans is, I think, so important that I would like to see the present title retained, if solely for reminding the analysts that they are a part of a planning group.

Mr. Arnold

I agree with that comment. I think your spirit is really analytical for planning, recognizing that planning itself must have a broader involvement of other people. I would like to also add this point, that in order to assess technology, even if it exists on the shelf, it is very important to have people who are involved close to the applied research and development type of activity, because they are often in the best position to assess the adequacy of technology. In a number of cases one will find that technology developed elsewhere may not be sufficient to deal with the long-term, awful problems (certainly true of agriculture) and suggestions will be coming out of these analyses and assessments for new directions in priority research problems. I think there needs to be intimate involvement of people close to applied research in the analysis to make it really successful and give it a longer perspective than the ad hoc situations sometimes suggested.

Dr. Tackie

Well, I think this group has been very useful. The Council would rather not appoint a Director of the group at this stage. It looks on the PAG as an experiment with the minimum number of personnel (three or four at the most) and the chairman of the CSIR involved. I cannot see myself getting very deeply involved collecting data by running up and down to the Ministries but I would certainly be involved in the meetings to see how the initial stages develop and will report to the Council. I reluctantly accepted this role because I did not want to jeopardize the PAG's creation. When it starts functioning we might get in touch with Mr. Beckler to see if he could assist the group.

Mr. Beckler

Well, what I had in mind is whether one might identify a problem on which we might work cooperatively to demonstrate how one would go about analyzing it. But we move ahead faster now that we have determined what problems are important in Ghana. Last year we thought the relationship between the planning and analysis group and the Economic Planning Office was important, and I wonder if you would comment on whether you see a problem identifying specific studies needed. Is it possible to derive some problems from your general economic planning? For example, is the problem of small machine tools industry identified in terms of the economic and industrial development in Ghana, as a critical problem area?

Dr. Tackie

I think this is a problem area in some directions. The report talks about machine tool industry but started by describing the production of spare parts for vehicles and other machinery. I do not think this is the way this project should be tackled because there are so many types of vehicles in Ghana it is very difficult to know which types of spare parts to make. But one could think of small farm equipment, machines to help the farmers more effectively than using the cutlass and picking things by hand, using the same old-fashioned methods. This I feel should be considered first.

Mr. Beckler

What is your view of consultation with the Economic Planning Division and the Ministry of Finance and Economic Planning to obtain their agreement on the social problems to be attacked. Last year we listed a number

of possibilities and studies. Do you think it is important to get their assessment of the priority problems that might be assisted by technological development in Ghana?

Dr. Tackie

I think this is very important. This is one of the reasons why we are under the Ministry of Planning--to help the nation develop in a scientific and technological manner, and since they directed me, by letter, to look into the possibility of establishing the PAG, I presume they expect us to collaborate with the Ministry.

I also see the PAG advising the CSIR in which areas to work.

Mr. Quartey-Papafio

I feel strongly that the PAG would serve a useful role in the solution of problems. It would better inform the institutes and ensure that they get the right priority research problems for examination. The present situation does not lead itself to very close collaboration between the research institutes and the Ministry of Agriculture.

Mr. Beckler

You do not feel that the management committees can do this?

Mr. Quartey-Papafio

It is true that on each of the research institutes the Ministry has representation on its management boards. But where are the funds for carrying out research coming from? You know they are not controlled by the Ministry of Agriculture. It is very difficult for the Ministry to indicate the priority areas of research to the institutes. I believe the PAG would be in a position to help us get the results of their investigations for solving our agriculture problems.

Dr. Tackie

I think the PAG would relate to the various Ministers and relay their findings to the institutes. It should be possible for the organizations, like the Ministry of Agriculture, to discuss in some detail what they want and what they expect the institutes to do for them. The PAG in its analytical findings would make this quite clear to the Council, and therefore we would be alerted to what is expected from the management when it comes to the use of money.

Mr. Beckler

What you are saying, though, implies that the Council will, in effect, determine the distribution of funding for the various institutes.

Dr. Tackie

I would hope this is the case.

Mr. Copeland

Professor Tackie, you have well in mind the role you see for the PAG and I wonder what our cooperative program can do to assist in any manner.

Dr. Tackie

I thought the whole relationship of the CSIR to the NAS was to help us achieve the best in our research endeavors, and I find here that the relationship is one of the tools that will help us reach these objectives. I can foresee difficulties arising in carrying out some type of analysis and us saying, look, this is the problem we have; we have carried out the studies to this extent, now what do you think you can contribute? How

can you also complement these studies to make it work? I might not have a systems analyst, for instance, who has experience in industry and who will want to look at the agro-industrial business. We will probably want somebody who is in a pretty good position to analyze the different materials for us. It may be a general systems analyst and here we might come to you for assistance.

Dr. Dodoo

Do we have the type of people needed in Ghana for the PAG?

Dr. Tackie

We will look around. The qualifications for the people described in the report are quite numerous, and the report said it is very difficult to get people with all these qualities. It will not be easy to locate economists and systems analysts.

Dr. Dodoo

I do not think that people who merely have degrees, working in industry will be able, without training, to analyze the work of research officers and their institutes systematically and objectively.

Dr. Tackie

There are people in the Ministry of Economic Planning who are systems analysts, so there are some. Whether you can attract any of them will depend on the level of money the government will give us to employ the people.

Dr. Dodoo

Well, I was thinking some people should actually be sent out to acquire training.

Mr. Beckler

There is one other possibility suggested in the report and that is to invite a consultant, someone you have identified as having the ability to deal with a certain problem to augment you staff for that particular study. This I think could make it easier for you to move ahead if you are limited in hiring full-time people on a permanent basis.

Dr. Tackie

This would be a very good idea, otherwise we will be enlarging the group without any limits. When you have a problem to solve you bring in a consultant while retaining your small core staff.

Mr. Lartey

At this stage, we ought to take note of progress made: first, the Government of Ghana has accepted the concept of PAG and, second, the CSIR has agreed to form it. The CSIR is gradually going through the recruitment process.

Dr. Hammond

Would it also be appropriate to say that we also note with some regret the decision not to, at this time, create a position of Director?

Mr. Lartey

Oh yes, that definitely should be noted.

Mr. Quartey-Papafio

The agriculture report, which was issued in September 1971, had the following specific terms of reference to this committee:

1. To study, in depth, the organization and methods for agricultural research in Ghana, including the structure of relevant agencies, research-extension relationships, agricultural education of extension personnel, and the process of communication.

2. To analyze agricultural extension in Ghana into its main elements and goals.

3. To consider how far the objectives are being achieved, and, in the light of the examination, recommend ways in which the mission and goals of agricultural extension can be most effectively accomplished, and, in this connection, recommend the role of agricultural stations in extension work.

4. To consider and recommend machinery for a continuing process of evaluation of the effectiveness of agricultural extension.

There has been a reorganization of our Ministry and the main purpose of which was to make the extension services more effective. I can only also guess that the recommendations might have been considered in restructuring the Ministry, which, before 1973, had several divisions: animal husbandry, animal health, cocoa, produce special division, fisheries,

economic and marketing services, supply, irrigation, training and manpower division, and information and publication. All of these divisions had regional and district branches. Quite apart from the general extension services then being performed by the Crop Production Division, all these other divisions also had their own specialized extension work to do in the district.

The farmer who needed extension advice would have to consult each of the heads of these divisions. You will agree that that really confused the farmer. The extension officer had to provide advice, had to staff a demonstration class, and organize farm inputs for the farmer; it became very difficult for an extension officer to carry out all these functions. In fact, by 1971 the ratio of extension officers to farmers was within a range of 1 to 1,500 or 1,600 and the situation is not very much improved. It is, therefore, obvious that before extension services, which are vital to the peasant farmer, can be improved it will be necessary to bring all extension services under one umbrella.

In Ghana we lack basic infrastructure and services. The extension man has to perform the function of advising as well as arranging for the farmer to get his inputs. Because of the low level of the education of the average farmer, it is very important to have the right caliber of extension officer at the grass-roots level. I believe that in addition to the difficulty in getting the extension staff organized and under one specialty, there was also the problem of inadequate training for the extension officer. He has to be a person who will be in a position to direct and to give informed support in all the fields of activities of the farmer. With the redistribution of the extension staff from other divisions, it became very clear that something had to be done.

In February 1973 the Ministry felt that the whole setup should be reconstituted, reorganized with increased emphasis on extension services. Therefore, all the extension work was centralized under one person in the region instead of having 10 divisions with their own specialized extension services. Most of the 12 divisions were, therefore, abolished in terms of their own organization but not in terms of their function. In the region we now have one person in charge of all extension services. This individual reports to the Deputy Director, Extension Service, at the Ministry. The District Director is responsible for the coordination of the functions of the extension activities in the country.

This is what we have been able to achieve in strengthening extension services at a grass-roots level. One important point I would like to mention is that in view of the reorganization we had a lot of surplus personnel at the Ministry headquarters who were sent down to the regions to help strengthen extension services. We are trying to upgrade the caliber of those in charge of the district and the subdistrict. The reorganization has not solved all extension problems. I would also like to mention that we still have a gap between the research findings and the application of these findings to practical use. I think this gap exists in our system because in the Ministry we have little influence on the type of research program our research institutes carry out, and because of inadequate staff within the Ministry, it would be very difficult for us to have a group of people to translate research findings into readable material for use by our extension personnel at the grass-roots level. This is an area where we want to get together with the research institutes to find out how we can best organize ourselves so that there is a two-way communication.

Another area where we need coordination is between the Ministry set-up and the other production agencies or development boards, such as the grains, legumes, and cattle. They are all supposed to do some extension and developmental work within their areas of responsibility. I believe there should be effective coordination between the ministries and the other agricultural agencies.

Finally, we are not recruiting sufficient extension officers because they are attracted to better service conditions elsewhere. However, we are trying as much as possible to increase the number of our extension staff.

I believe that the report contains useful information, which should be implemented, but I believe that we in the Ministry have started along the right lines and, with time and patience, we will be in a position to implement most of these recommendations.

Dr. Barton

I feel tremendously encouraged by what I have heard. I have a copy of the chart of the structure of the Ministry of Agriculture. At the time we made it we had considerable problems getting such a chart designed, even though the Ministry was organized in the fashion the chart finally shows. I notice one very striking change, which might have influenced our recommendations if we had known such a change might come about, and this is the reduction in the number of divisions. This really posed a very real problem to us. Another problem was to devise an extension service out of the separate extension enterprises that were being set up by commodity boards. This essentially gives you a non-direct extension of an activity over which the Deputy Director for Extension would have

no direct authority himself, but otherwise, I think your reorganization has followed rather closely some of the lines suggested in the report. I detect one difference; you are still using, down at the district level, extension specialists in a dual capacity as service suppliers and extension people. I would hope that as time goes on and trained personnel become available, that it might be possible to split this off. It does seem that you have the direct line of authority from the Deputy Director to a Regional Officer and that the Regional Officer then has a program responsibility in districts. This is, I think, a very real step.

The liaison between research and extension is never an easy one. This is not a direct authority relationship. The Director of Research has the authority over the research and, as you say, it has to be a two-way street. If the compelling argument for the need for research is made by the extension people, you have to hope that the Director of Research is going to respond and recognize that this is in the national interest. So, I feel very encouraged that this move is in the right direction.

Discussion

Mr. Copeland

I find what you have said about the reorganization to be amazingly close to what was recommended in the agriculture report; however, I do not want to imply that the report had anything to do with it. At the time the report was written, Dr. Agble had a subcommittee on agriculture that was planning what should be done in agriculture, and the two groups discussed the needs. There was a good exchange on what might be recommended. Also, at that time we met with the Minister of Agriculture.

So while there is never a direct line between cause and effect, I think the agricultural committee will feel heartened by what you have said here.

Mr. Quartey-Papafio

I would not be surprised. We might have collected some ideas from the report.

Mr. Nissenbaum

When you were reorganizing the agricultural extension functions at the local level, did you give thought to hiving off those divisions concerned with the provision of agricultural inputs so they would be completely and separately handled? From time to time questions have been asked about whether some of those functions should in fact be handled commercially-- tractor repair, the possibility of selling fertilizer and all those kinds of things. Did that enter into consideration at all?

Mr. Quartey-Papafio

It did not because we knew we would have to perform these functions anyway. As to the commercialization of some of the extension services, I do remember there were some discussions along those lines but they never got too far. We would like, for instance, to hive off irrigation and mechanization services into a commercial undertaking.

Dr. Barton

One of the reasons the joint team suggested that the extension should be developed all the way to the farm level, as a separate item, is that extension really works more than the individual. Its true function in

rural development and in community development is community services. The extension officer, who is also involved in providing services, does not have a vested interest in these services, and his job, in a way, depends on the retention of those services as a subsidized state function. A true extension officer operates as an educator. He is educating businessmen as well as farmers, and in this educational process he can divorce himself from the bias of being a supplier of a service.

r. Quartey-Papafio

This is very important. I believe we have realized that it is wrong to confuse the question of providing essential education with supply services.

r. Johnson

Do you have a mechanism within the Ministry of Agriculture to influence what is offered in the universities in terms of education of people for extension?

r. Quartey-Papafio

Yes, we do in the case of the middle-level extension staff. We always cooperate with our universities in arranging suitable training programs for our middle-level extension officers.

r. Ayensu

The University of Science and Technology in Kumasi was heavily involved with that and they have a comprehensive program that I think is exceptionally useful. I do not know to what extent your Ministry has been involved in the presentation of that curriculum.

Mr. Quartey-Papafio

Do you think it is designed for the Ministry's staff:

Dr. Ayensu

No. This is a program the universities have developed to train people for you.

Mr. Quartey-Papafio

Well, this is exactly what I am referring to. Both at the University of Ghana and the University of Science and Technology we have this program in which we have arranged with the university authorities to train our senior staff, and they come out with a diploma.

8D Science and Technology Foundation and Other Alternatives

Mr. Copeland

Approximately two years ago, during our meeting on Science Policy and Research Priorities in Ghana, a number of discussions were held with the then chairman, Mr. Dowuona, about mechanisms for funding science and technology in Ghana, specifically the foreign exchange component. In your briefing book you have a copy of his paper in which he gives some thought to a science and technology foundation, where it might lead, and how it might be organized.

There is another paper in your book that Dr. Ayensu and I put together, giving our views as to what such a foundation might look like, given the political situation in Ghana. We believe that in order for science to really get moving in Ghana it is going to have to have an entity set up to support it with outside money. We knew, and still believe, that the Government of Ghana lacks hard currency for funding science and that they are not prepared to supply research funds, even though they are paying the salary costs of the scientists at the universities and the research institutes. There are also many other things that such a foundation might do. Specifically, one thing that has intrigued me since I worked on a project in Brazil, "Sao Paulo project in science and technology," is the possibility of finding a mechanism for channeling public funds through a private group, which then channels that money

back into the public sector. I will give you an illustration of what I have in mind. In the Sao Paulo project they have the Council for Science and Technology, which will loan money to an industry that needs to have research done; however, they stipulate that the research be conducted in a public institution, such as a research institute or a university. That forces these two bodies, which usually do not talk with each other--the research institute or university and the industry--to come together on a proposal that is submitted to the Council for approval, and it keeps these two organizations working together to ensure that the research conducted is in the interest of the industry.

There is another component: the government is supporting the public institution anyway; this gives the research institution additional funds that it might need for specialized equipment and other support. One of the other necessities for a science and technology foundation in Ghana, as Mr. Dowuona envisioned it, was that it be autonomous. Because of the governmental nature of the CSIR, it is not free to do the innovative kinds of things that an autonomous agency could do. Therefore, there was a definite need for a group with outside funds working very, very closely with government, possibly even sharing some of the facilities of the CSIR--to prevent administrative costs from skyrocketing--that would be free to experiment with innovative concepts and ideas that would be impossible for any governmental unit.

Discussion

Dr. Tackie

I saw an earlier proposal, which has since been slightly modified, and the impression I got about the science and technology foundation is that a foundation would be set up to provide funds to individuals and

institutions to carry out research to enhance the development of the nation. Now Wesley was right to say that it is not an easy thing to approach a government and get money for research, and this is also true in the universities. The amount of money provided at the universities for individual research is insignificant. The result of lack of funds for research is, to my mind, hampering the development of research in the whole country. For example, it is difficult in Ghana to approach the government for money to purchase simple but vital equipment necessary for research, such as nuclear magnetic resonance (NMR), a simple tool that is used even in undergraduate work. When you want to get some solvents or chemicals from outside the country you have to go through a long process that might take two to three years, by which time your ideas might have changed or your inclination might be quite different. We accept the idea of the science and technology foundation, which would introduce the government to the need for research funds not controlled exclusively by them. I am confident that as long as the government realized that research results could come from such an endeavor it would embrace it.

Dr. Hammond

The principal purpose is to establish, in Ghana, a stronger research capability. In Ghana there are more people to do more things than have access to supplies with which to do them. The foundation would be the groundwork for a strong research facility that is more or less separated from the question of what research is to be done. The second purpose, I would judge, is to try to find some device for feeding into this foundation some hard currency for the acquisition of needed research equipment and materials.

Dr. Tackie

The problem is our involvement in multidisciplinary research such as the desertification study, crops research, soil research, economics, and what have you. The Ministry of Economic Planning will not provide the funds for this type of research. We think the foundation concept is vital, considering this project request from the Natural Conservation Committee of the CSIR on the desertification and food production in northern Ghana. Here you find a classic example of a multidisciplinary research project worth funding. If there had been a research foundation, perhaps it could have been approached for support. At least we could raise the support for the northern Ghana study to prove that something valuable could arise from the foundation.

Dr. Hammond

Let us take the example of desertification study. Would the foundation vehicle accomplish more than could be done by the CSIR directly by creation of new institutes if an equal amount of additionally needed money could be made available to do it?

If the desertification research comes to an end after 4 to 5 years and the work ceases, the CSIR would have to look into other directions with the foundation. One would not have to wait till the annual budget hearing to put in his request for funds to pursue relevant research.

So that makes the foundation a special device for creating some manageable funds, funds which may or may not be appropriated in a sense.

Dr. Johnson

How would the foundation make decisions amongst competing demands for the available funds?

Dr. Tackie

The idea is to have an independent, autonomous body within the CSIR, but if you did that then I can see government trying to control the fund. We want to make sure that the money would be available to the universities and to industry to undertake research projects of interest to them, and that would help our economic development. It would be possible to do this much more easily within a foundation than with CSIR or university funds earmarked for particular projects. This is why I think an autonomous, independent entity would help in science and technological research.

Mr. Lartey

My institute is nearly 6 or 7 years old and we still do not have the basic heavy pieces of equipment we require purely because there just is not the foreign exchange allocation. If you have a project that is multi-disciplinary in nature, you do not really have the machinery to go to government to seek the funds to do this kind of research. The argument seems to be for and against the foundation's being completely independent. If you make the foundation completely independent, it may be fine as far as receiving money from outside is concerned, but then you are assigning to a second body outside CSIR some of the functions that in your Decree have already been assigned to the CSIR--the advice that would lead to decision making, as to what kind of research should be conducted in a given time, and need not be conducted at a given time. So it seems to me we have to think of providing some definite linkage, linkage between what type of body we agree to set up and the functions of the CSIR.

Dr. Tackie

This is why I prefer a number of people from the CSIR, the policy making body, serving on this committee so that they ensure that the type of research proposal that is being put before them fits within the general structure of the research activities they have already on record.

Dr. Ayensu

I think there is a very serious danger for anybody to assume that because we have got CSIR in Ghana that moneys of this nature should be controlled by them. In the first place, I do not think CSIR is going to give its money to any of the university people to do research. Secondly, you said a few minutes ago that if the government knew that you were controlling such external funds or such foreign exchange funds I can bet you they will cut your budget so fast it would not be funny. The importance of an independent body (and by independent it does not mean that the people who are going to look after these funds are not going to include in it an advisory capacity people from CSIR and the universities and other research organizations in the country) it should be independent enough that government does not even rely on these funds.

I have had experience with the National Science Foundation, having served on their panels for a long time. The Foundation works in a very attractive way. Although the funds are appropriated by Congress, there is an overall scientific philosophy running through the country that people who are doing specific research, engaging in scientific research activities that form part of a total package, can go to the NSF with very specific proposals and say, Mr. Lartey, this program is very important; it will have implications on this and that; therefore, we fund

it to the extent that you would not be able to get such funds from Dr. Tackie. I think this is the idea I have with respect to such foundations. I do not think an ordinary secretary could handle such a job. You need some sort of council. I am not saying they should be paid at all; you can tap Dr. Tackie's staff; you can tap some staff from the universities, but I think you could do a pretty good job when they know that the money does not belong to one institution, and that there would be checks and balances also so that everybody would not say that all the money is going to the CSIR organizations, but the university research organizations would also have access to them.

Dr. Tackie

But, I do not think I was advocating that the money should be given to CSIR as their money.

Mr. Beckler

In a situation where you have very limited resources, there is a need to provide another channel for people doing research to get funds. There is a natural preference, on the parts of funding authority in government, for short-range, rather conservative programming. Hence, there is a need for an alternative funding mechanism to be more imaginative and longer-range in their view. The private foundations performed very admirably here in the United States before the government began very heavy investments in science. The government investment, in effect, took over much of the job of what the private foundations were doing in earlier years. But you have a situation in Ghana now where you do not have the major governmental support, and there is a much greater premium then on the possibility of providing alternative channels of support for individuals who cannot get it through the normal process.

This is a very attractive concept. It can be a real catalyst for change if decisions are taken with a view to not only support research but to try to elicit more government funding by different kinds of innovative funding arrangements--joint arrangements, to bring in more money from the government to go with institution-foundation support. You have a real opportunity here to take major advances in Ghana through this type of foundation.

Dr. Hammond

I think the foundation that would exist should be funded partly by domestic funds and partly by foreign funds, since the sum of the expenses will be of the kind that can be conveniently met from external sources.

Mr. Copeland

If we could design this proposed concept in such an imaginative way that we could show the donor organizations of the world that this is a demonstration project that would have value to other countries by starting a pilot project in Ghana and showing how multidisciplinary research can be done pulling the elements of the country together, they would come around to providing some funds.

Mr. Beckler

In theory, at least, if you really want to do this logically, you would have your project set up under the CSIR framework as the planning analysis group, and you would have some money--something like the French have in their Action Concerte Program--that is, the government would set aside a certain fund to move ahead with large coherent programs, which are developed as a consequence of the PAG kind of operation. A science

foundation would really be catalytic in looking around to find places where foreign exchange might be helpful to get critical kinds of research done and so on, but not only in support of high priority, large projects. You have to have both kinds of capabilities covered. These larger projects require certain management skills, and I do not necessarily think you will find those on the staff of a science foundation. I am troubled by the notion of trying to make this science foundation serve all of these needs.

Mr. Copeland

I am not quite sure that is true. The desertification study would be financed by the foundation, but run by the CSIR. They have the capability of running such a project, and they would apply to the foundation such as the university might apply to the foundation, or anybody else might apply to the foundation for support. Essentially, you need have only a small core of people in a foundation because they would not actually operate anything. They would be a channeling mechanism for funds for projects that have been identified as being in the national interest. The six purposes that were drawn up for the foundation might give you an idea as to what the thinking has been.

- ° To support but not substitute for other organizations, scientific and technology research aimed at increasing the economic development of Ghana in industry and agriculture.

- ° To contribute to the development of capabilities in industry, government, universities, and research institutes to use science and technology and to provide an increased proportion of this research from Ghanaian sources.

° To focus efforts on those industrial and agricultural programs that hold promise for rapidly improving Ghana's economic growth largely through improving the capacity of the commercial firms to compete successfully in domestic and world markets.

° To support activities in science and technology that have a direct linkage with the national plans of Ghana.

° To act as a catalyst in Ghana to promote closer ties between science and technology institutions and industrial firms requiring technical assistance.

° To mount intensive attacks in critical problem areas in Ghana such as agro-business activities, industrial extension services, standards and quality assurance, information and dissemination, and research management.

Dr. Barton

To define functionally what is required in Ghana, one needs to relate to the new PAG mechanism and give it reality through some time of flexibility in the budgeting, as you suggested, Mr. Chairman. There are other functions that will have to be performed and they can be spelled out. If this is done, one has a balanced charter for the organization. Whereas AID may wish to finance only those functions that relate to particular problems, you still have a sufficiently broad charter that you can seek funds from wherever they can be found to do the other things that AID may not wish to do. I would list all of these functions, and I think the one on the PAG will probably be more appealing to the AID agency, whereas some private foundations may be interested in helping to finance other aspects that relate to procurement of scientific instruments and a few other things that the U.S. government may not wish to fund. I think we

can do all of these things in the foundation, but the vehicle for launching it with pretty good justification would be the job that is related to the major problem area.

Dr. Tackie

When we started discussing the foundation it was quite clear that we wanted the money to deal with an organization that would fund research in other areas, not just one identified research project that would be multidisciplinary. It became clear, after Mr. Arnold had put in the four categories where AID will normally put in money, that our best approach would be to consider the foundation as a separate entity and this desertification research as a separate entity. I think it was even suggested that we do not want to come back again and start discussing the foundation concept and, therefore, we should accept it in principle. I suggest we separate the two at this stage because we cannot go on indefinitely discussing this foundation concept. Let AID go ahead and fund the desertification study. Meanwhile, we will prepare a paper on the subject and at some later date it will be discussed more fully.

Mr. Lartey

I go along with this suggestion. This is the first time that a body has really taken a look at the foundation idea. It has been talked about independently among a few people, but this is the first time we have really got the whole range of minds and it has come out clearly, after two days of discussion, that we really need to look at it again. It will be best that we separate the two.

9 Agriculture and Savannah (Drought) Study Project in Northern Ghana

A. Food/Agriculture Production in Northern Ghana

Mr. Quartey-Papafio

Agriculture has been recognized by successive regimes in Ghana as the economic backbone of the country. With the decrease in the country's foreign exchange earnings from cocoa, it has become necessary to increase the production of such agricultural commodities as maize, rice, live-stock, fish, vegetable oil, fibre, and sugar cane in order to reduce the country's reliance on imported food and agricultural raw materials and thus permit the limited foreign exchange earnings to be utilized for the development of other sectors of the economy.

Northern Ghana, which comprises the upper and northern regions, is assuming an important role in this exercise and has the prospect of becoming, within the next decade or so, the bread bowl of Ghana. It lies within the Guinea savannah zone and covers about 37,800 square miles, which represents 41 percent of the total area of Ghana. The population of the two regions is about 1.6 million or 20 percent of the entire population.

Rainfall totals between 40 to 50 inches (about 1,000 to 1,250 mm) annually and occurs in one single season of 6 to 7 months, with the main precipitation occurring between May and September. Temperatures range between 91-100°F (33-38°C) in the dry season and 84-95°F (30-35°C)

in the wet season. The months of December and January are cool because of the Harmattan and relatively low humidity is experienced during the dry season. For agricultural purposes, soils in the area may be divided into upland and valley soils. The former tend to be light, shallow, and concretionary in certain parts, whereas the latter are generally heavy textured, compact, and poorly drained. These factors considerably condition the pattern of agriculture in the two regions.

As already mentioned, government agricultural policy is directed towards self-sufficiency in the production of food and agricultural raw materials and diversification of exports. The operation "Feed Yourself Program," which was launched by the government in February 1972 is designed to act as the springboard for the achievement of this objective. Northern Ghana is playing a vital role in this program by expanding its production of millet, sorghum, yam, rice, groundnuts, beans, vegetables, and livestock, but it is in the production of rice that it has achieved the most remarkable success. Both small- and large-scale farmers are involved in this lucrative enterprise. The Ministry of Agriculture and the Ghanaian-German Agricultural Development Project are providing extension and direct services to these farmers to boost their production. The banking institutions have also been granting short- and long-term loans to farmers. Within the past 3 years, the total area cultivated to rice in northern Ghana alone has increased from 78,000 acres in 1971 through 90,000 acres in 1972 to over 100,000 acres in 1973.

There are, however, several factors that pose serious constraints to agricultural production in northern Ghana. First and foremost is

the complete lack of rainfall in the area for 5 to 6 months of the year, during which period agricultural activities almost come to a standstill. In addition to the construction of more water conservation structures, it is suggested that investigations should be conducted into drought-resistant crops for both humans and livestock that are adaptable to conditions in the dry season. Livestock production is another area requiring further research. Soil erosion and indiscriminate burning and destruction of vegetation needs to be controlled if production levels are to be maintained. Further, the extension services of the Ministry of Agriculture would have to be enlarged and intensified, and there is an urgent need to support agricultural production in northern Ghana adequately with agricultural infrastructure and basic services such as storage facilities, feeder roads, and distribution centers.

B. Desertification (Drought) Study in Northern Ghana

Dr. Johnson

In Appendix B of our briefing package is a 4-page report of my assessment of the desertification process in Ghana, whether or not it is really occurring, in my opinion. I would say that depending upon how you define desertification you certainly would have to say that, yes, deterioration in the area of northern Ghana, particularly the Upper Region, is occurring and has occurred. Whether this is the first stage of desertification, is a bit difficult to say.

According to a few of the people in some of the areas around Bawku and Bolgatanga, rivers that just a few years ago were perennial streams are now terminal. They shut down around the dry season, and it would

appear that the process that has caused this is that there is a deterioration of the soil, and then, when rainfall comes, it runs right off the top, eroding away the soil quickly into the stream channel and out of the basin.

It must be recognized that as long as Ghana has land use practices that are going to increase soil erosion, it is going to cut down on the life of every dam they build, even the small ones, so that it certainly is a significant problem. The public health aspects are something that I, of course, was quite concerned with. There are high clay soils in the flat beds and river beds in that area which are excellent, but due to river blindness and schistosomiasis, they are not useable. I doubt if there is anything we can do except recognize that it is a constraint on what we can do. It is certainly a constraint to developing the agricultural basins in those clay soils.

I stated in my report that science and technology are not the key problems within Ghana. The problem of coordination of research programs and the dissemination of research results to users may be more important. It is not going to do any good to do all that research without a supporting documentation center, so some kind of a documentation center is necessary.

There needs to be more data collected on a repetitive basis. The research from both the Crop Research Institute and Soil Research Institute is providing some valuable data, but they are going out on a one-time basis. Repetitive collection of data is necessary for results to be useful and significant.

Finally, some of the general problems--in addition to schistosomiasis and river blindness--are persistent adherence to the dowry system and Ghan's reforestation program.

You cannot just say the dowry system creates problems; you have to figure out what to do about it and how to handle it. You need social scientists. Quite clearly when you have a dowry system where the health of the cattle is not important, just the numbers of them, and they consume feed and grazing land for no purpose but for the purchase of wives, you may then have to consider some change in the cultural system.

Take a look at the reforestation programs. There are a lot of programs in Ghana having to do with forest products removal, and some are simply setting certain sections of the forest on fire to get charcoal out. This may not be the best use of the forest, and if you cannot stop practice of this sort, maybe at least some reforestation program could be initiated that would keep the forest up. The missionaries are concerned that the shea nut tree, which a lot of people in the upper region depend on for food products, is in danger of extinction. These trees have been burned off time and time again and there are no young shea nut trees in that area to replace the old shea nut trees.

Discussion

Dr. Barton

How did the production potential look to you in that part of the country? Fair? Good?

Dr. Johnson

Well, it looks a lot better than a lot of land we have in Arizona. One of the problems is that in a lot of the areas where fertilizer is being utilized, the fertilizer subsidized by the government is primarily chemical fertilizer, which does a pretty good job of putting nutrients into the soil but does not do anything for soil stability and soil organic structure. This practice will eventually destroy the soil. In addition, with rising costs, even with the Ghanaian Government subsidy, the farmers can hardly afford fertilizer.

Dr. Barton

What kind of potential do you have for fertilizer.

Mr. Quartey-Papafio

I think that we have quite an opportunity. At the moment we are negotiating with certain firms to establish fertilizer plants in the country.

Dr. Barton

Well, there are certain types that take a lot of power and you have got the power available.

Dr. Johnson

Is there any natural gas?

Mr. Quartey-Papafio

No.

Dr. Johnson

I want to mention that there has been a recent study of fertilizer in Ghana; there was no recommendation for the construction of a fertilizer production plant made. They did recommend, however, the construction of a fertilizer mixing plant.

Dr. Hammond

The question of deterioration in the land, in the northeast especially, and Jack Johnson's comments about the potential desertification of the north, must seem very, very threatening in view of the extensive deterioration that has gone much farther in adjacent countries of West Africa. Despite the fact that the area is productive--in terms of rainfall and the basic conditions, etc., being appropriate for very fruitful and long-term agricultural development--it is not going to work out that way unless suitable measures are taken to learn what is happening and find out what must be done to preserve the natural resources of the area.

The first priority on the problem of desertification is identification of the process of land deterioration, and the second part is the problem of establishing ongoing programs for research and development including all the accompanying factors such as education, agricultural compilations of information, and extension of any other kind of programs.

I think I reflect the attitude of the American members of this committee when I say that we are most anxious to think of ways in which we can provide help here, as individuals, thinking about strategy in this meeting and attempt to support whatever pursuit you may want to undertake as a nation to go about working with some of these problems. I

think we obviously are also prepared to give assistance and perhaps-- I feel fairly optimistic about assistance--gather some American support, especially from AID for the actual costs of doing the studies.

[At this point in the proceedings of the meeting a series of informal discussions on the Savannah (Drought) Zone Study took place, during which certain decisions were made that are summarized below.]

The Joint Committee recommends the creation of an ad hoc joint study group to meet in Ghana for a maximum of three weeks and a minimum of two weeks, in October 1974 to assess the present and potential impact of drought on agricultural and rural development of the Savannah Region of northern Ghana. This study group will be charged with the following tasks:

1. To examine the present and potential impact of drought in the Savannah Region of Ghana with a view to assessing its short- and long-term effect on agricultural production and the well-being of people of the area.
2. To identify specific problems relevant to the causes and consequences of drought.
3. To propose a detailed study plan to assist the Natural Resources Committee to use existing educational, research, and technological resources most effectively in carrying out the necessary studies. Insofar as is possible, scientific manpower needs should be identified.
4. To suggest specific opportunities for international research cooperation.
5. To prepare a report of its findings to the Executive Chairman of the CSIR through the Committee on Natural Resources.

Throughout the exercise the study group should bear in mind that the ultimate objective is the preparation of a concrete study proposal, including a rigorous budget. Such a proposal will make possible the solicitation of funds necessary for early initiation of the study.

It was agreed that the joint work group should be small, composed of seven members with multidisciplinary backgrounds.

The membership should reflect, insofar as possible, a combination of the following disciplinary areas:

- Soils
- Climatology
- Irrigation
- Resource/management (arid land)
- Economics
- Sociology
- Medicine
- Animal science
- Geography
- Range management
- Engineering

In general, membership of the study group should also reflect the functional areas identified below:

- Fuel and energy
- Resource management
- Land use
- Human resources
- Animal resources
- Transportation and communication
- Systems modelling

NAS study group members should include three individuals with experience in: systems modelling, resource management, and Sahelian studies. Four CSIR representatives will be chosen on the basis of knowledge and experience in the other areas noted above.

Some of the relevant background information on the above conclusions follows.

Mr. Beckler

You want people who are steeped in one discipline, who also have a broader management point of view as to how to apply the knowledge of their discipline to action programs.

Dr. Johnson

This whole project is obviously going to boil down to a National Resource Management Plan.

Dr. Barton

I think it is important that membership on the committee should have expertise that spans the entire scope of the problem--the ability to identify areas that require intensive investigation and then proceed to set up specialized studies.

Dr. Hammond

I think we also have to remember we are not going to ask them to run a 5-year project. We are simply going to ask them to design a 5-year project that will work. Now some of them might become so fascinated that they would want to participate in the operation of the project, but that is a secondary thing.

Mr. Lartey

We should be careful to set up a group of people who will come up with some real indicative reports and not the kind of report that calls for yet another report.

Mr. Beckler

One of the problems here is coming out with a manageable program. If you get some people together who are experts in drought-resistant plants, I am sure they could design a research program that would consume all the resources you have. They would design that part of the report.

Dr. Tackie

The whole idea was to get this group to design a project that would provide the maximal use of land in the north in order to provide food and livestock and advise how best to avert problems that may arise for the present or possible Sahelian-type of conditions moving down south.

Dr. Hammond

We have been talking about keeping the study group small, then co-opting the services of other people in Ghana to help with specific areas.

Mr. Quartey-Papafio

Instead of shortening the period, we could keep the period and change the agency that is putting the people together.

Ms. Coe

I think we should agree at this point that we will do the best we can, both AID and NAS, to meet your time and personnel requirements. Who does the job is a matter of secondary interest.

Dr. Tackie

As Dr. Hammond suggested, we would then expect the group to come by October. If they cannot come then, we hope Ms. Coe would be able to assemble another group to come to Ghana by October because there is a very important time factor and we must have this report before December.

Dr. Dodoo

The remote sensing program I am thinking about is more involved than just the use of the techniques in the desertification study. The United Nations Development Program (UNDP) is establishing a receiving station in Africa, and one is to be located in West Africa. They are presently considering establishing a station in Chad. Ghana seems to have been left out in these initial discussions. The East Africans are more involved in the use of remote sensing for natural resource studies. One of the things that I want to introduce to the National Resources Committee, along with the one on drought, is remote sensing. I am thinking in terms of the use of remote sensing in natural resource studies. The idea must also be sold to the government, since we have to make use of the receiving station wherever they may decide to put it. I think somebody or some institution in Ghana should get involved in this and that the CSIR--since this is a new scientific and technological tool--though perhaps it's involving itself in the Natural Resources Committee, should introduce the tool into scientific research in Ghana. And I believe one of the reasons USAID sponsored my training program is to make sure that there is somebody in Ghana who understands the subject, is interested, and is prepared to contribute toward the exposure of other people in Ghana to this new tool.

Discussion

Dr. Hammond

When you come to the possibility of establishing programs such as this, you do cost analysis--what you get out of it, what you put into it, and so forth--and it is obvious that you should do this. I simply hope you will not forget to evaluate the benefits. One of the things that should be counted is the fact that remote sensing, combined with ground knowledge, contributes to world understanding; remote sensing makes this possible in a way that has never been done before.

Dr. Johnson

It seems clear to me that Ghana can use the remote sensing technology to her benefit. I believe the question is whether or not it could be used without purchase of a tremendous amount of equipment and the need for ground truth. I think that it can, with a simple life table and nothing else. A life table can be built in Ghana. Ghana can get something out of remote sensing, certainly not as much as can be obtained with a more sophisticated instrumentation, but I see it as a technological tool that is coming more and more into use. Ghana should prepare herself to take advantage of that push. Utilization of remote sensing can greatly extend the amount of environmental information acquired from ground truth, so where it used to cost maybe several hundred thousand dollars to put together a map of some particular resource, it can now be gotten for much, much less.

Mr. Quartey-Papafio

I thought that for the people who have to take a position on this and who are not aware of the benefits we can derive from remote sensing, it was suggested that since Dr. Dodoo has been involved in this he should write a report from his experience and send it to the Chairman so that he can take up this matter.

Dr. Dodoo

Yes, but that is the normal report that a participant to a meeting has to get out. I would think that this group should recommend that the CSIR explore the possibility of using remote sensing techniques in research, agricultural research, savannah studies, and so forth. We could also recommend along the lines of the science foundation that we explore the subject further and that, in due course, a proposal on remote sensing be submitted to Dr. Tackie, hopefully, for further action.

Mr. Copeland

I would feel delinquent if I did not say that there is a rumor that after the next satellite is put up there are no more plans for another one. Satellites have a life span of approximately 2 years even though they usually will last longer. So I would caution that serious consideration be given to the long-term development of this whole area because I do not think we would want to suggest that Ghana get involved in this thing and then have a huge investment and no satellite after another 2 years.

Dr. Johnson

There will always be either a high altitude aircraft or satellite data that would be giving remote sensing data. The kinds of satellite

that they are not going to send up anymore, or at least that are being erased from the existing plans, are the 18-day repetitive. One frame of data from one of these satellites has more bits of information on it than all of the remote sensing data combined in prior history. On digitized data there is stuff on there that we still may be looking at in 10 years and trying to get the information off it. I do not think that you are going to gear up for remote sensing capability and then find out all of a sudden there is no remote sensing data.

Dr. Hammond

I think we can compromise between making a very strong statement and leaving the issue open if we say that in view of the fact that remote sensing has proven to be a very powerful tool for study of the kinds of problems of which Ghana has many, the committee recommends that Ghana look very carefully for ways of making valuable entry into this field. We can say that this has proven to be of great power and value in other parts of the world for problems similar to those in Ghana; therefore, Ghana must look at it.

Mr. Lartey

I agree. So that will set the recommendation down. When you, Dr. Dodoo, return home and submit your report, this is where the SCIR will make a start.

11 Industrial Research

Mr. Engel

Since there has been question of conducting a joint CSIR-NAS exercise on industrial research, it might be useful to say something of prior workshops the NAS has had on this subject with Brazil, Indonesia, the Philippines, Taiwan, and India. The one furthest in time, and the one we are told has had the most beneficial effect, is the NAS-Brazil Joint Study Group, which met in the period 1966-1968, with meetings here and in Brazil and much effort expended by our Brazilian colleagues on their own throughout this period. Quite apart from the substance of our report, but to my mind of equal importance, is the cohesion and commitment our counterpart Brazilian group achieved in working together. Collectively, they became in subsequent years influential and successful advocates of the recommendations contained in the report. The Brazilian National Research Council gave wide dissemination to the report and promoted many discussions among the sectors that are involved in or affect industrial research: government, industry, education, science and technology establishments, development and funding agencies, etc. The joint committee addressed issues of interest to all these sectors and within their competence to act upon them; for example, the financing and commissioning of R&D by government agencies and public funding institutions; fiscal incentives to industry to promote private-sector investment in R&D;

improvement of research management capabilities and the education and training of researchers; and organizational and management changes in the existing governmental research institutes and in the national scientific technical information and documentation system. Basically, the committee sought to identify the many factors that affect the environment in which industrial research takes place--an environment characterized in this instance by a very large private industry sector. The recommendations were designed to foster effective and productive interactions among the sectors and to get them to recognize the need to concert their efforts.

In the case of the Indonesia workshop, where the panel had to contend with industry predominantly in the public sector and with government playing a comprehensive economic planning role, the approach was somewhat different. An important area of emphasis concerned the planning of R&D programs in relation to overall development strategy, and the particular problems and plans within specific industrial sectors of concern to government such as food processing, textiles, pulp and paper, chemicals, etc. Much attention was also given to the industrial and technological research system in Indonesia and to factors conditioning R&D and the technical transfer process. The workshop in Taiwan and the Philippines generally covered similar ground with subject modifications reflecting individual circumstances. Finally, the workshop in India was confined to a relatively narrow segment of this normally quite broad spectrum of issues, namely, the organization and management of industrial research at the institutional level and interactions with user communities.

It should be noted that all of these countries have industrial sectors of significantly larger scale than Ghana's and, with perhaps one exception, research sectors similarly at a more advanced state of development. Nonetheless, a country like Ghana can profit greatly from strengthening its capabilities in this area, for industrial research, as we have defined it in our exercises, embraces activities that surely engage Ghana's scientific establishment today. We define industrial research to mean the following: discovery of new products; the exploration and use of raw materials; the development, improvement, and adaptation of production methods, techniques, and processes; pilot scale experiments; operational research; establishment of standards; quality control; market research; and feasibility, project, and productivity studies.

12 Scientific Instrumentation Center

Dr. Tackie

The idea is the setting up of an instrumentation center to pool expensive resources and instruments together in one area so that they will be available to the whole nation. We are aware of the short supply of funds in our country, and although we should have the proper instruments in each research institution, we cannot justify the expense. As I mentioned, we do not have a single NMR. We might want to have in such a center not an assembly of instruments such as you have at the Research Triangle Institute, but at least some of the useful but expensive instruments which every university and research institution can use. We hope also to train technicians to use and repair these instruments because we feel that this is one of the areas that is militating against advancement in research. Here I would also like to add that we propose that our industrial research institute's calibration unit and laboratories form the nucleus of this instrumentation center.

Discussion

Dr. Hammond

It is my feeling that the committee is enthusiastic in support of the idea and notes that some action has been taken. The only thing that

I would add as my concern that no matter how good this is in principle it will fail unless it is very carefully managed. The management of such a center, so as to keep all facilities operating, is going to be difficult. Although I cannot recommend details for management, I think that we should recognize that the management problems be considered most carefully and in great detail because no matter how much money you put into the facilities, if you do not have proper management, they will be no good to you. One further point: some instrument centers are well run, but the reason everything is in order is that nobody uses the center. Some managers protect their instruments from users, thereby saving the equipment but completely negating the purpose for the center.

Dr. Barton

This is quite appropriate. Our own concern with electronic repair has led us to develop our own electronic repair service rather than rely on companies for this type of repair on quite a large range of instrumentation and, with the magnitude of the problem you have with distance, it would seem logical to train electronic repair specialists.

13 Scientific Instrumentation Center

Ms. Werdel

Before I discuss specific BOSTID activities in this area, I might make some general comments on the development of national scientific and technical information services and the role of a national documentation center in these efforts.

Increasingly, it is recognized that national policies relating specifically to the development of national scientific and technical information systems and services are needed. The UNISIST program (a Unesco program of international cooperation in scientific and technological information) is encouraging the member countries of Unesco to establish national focal points for information policy planning and development.¹

The Organization for Economic Cooperation and development (OECD), through a series of "confrontation meetings" has also encouraged its member countries to examine their processes, procedures, and policies

¹United Nations Educational, Scientific and Cultural Organizations, (UNESCO). UNISIST Steering Committee. Information Policy Objectives (UNISIST Proposals). Paris, April 1974, 26 pp. (SC/74/WS/3).

for handling scientific and technical information, and for developing national information infrastructures.²

I understand the CSIR has accepted the UNISIST "national focal point" role for Ghana. The question is: what mechanisms should CSIR use in implementing this role, and what should be the functions of the proposed documentation center in this regard.

There is included in the briefing book for this meeting, an advisory report of an Ad Hoc Committee on Scientific and Technical Information, submitted to CSIR in August, 1973.³ This committee has identified a number of problem areas in providing scientific information services in Ghana, and has made a series of recommendations to alleviate some of these problems.

²The Information Policy Group of the Organization for Economic Cooperation and Development has carried out Reviews of National Scientific and Technical Information Policies for Canada (1971); Ireland (1973); and Spain (1973).

³Scientific and Technical Information in Ghana. A report of an Ad Hoc Advisory Committee set up by the Legon Workshop on the Pooling of Resources. Sponsored by CSIR, the University of Ghana, the University of Science and Technology, and the University of Cape Coast, Accra, 1973, 10 pp.

I think it is useful to review them briefly, because they suggest new or continuing activities that the new documentation center might undertake.

Problem Areas

Some Proposed Activities

Information Resource Identification and Sharing

- identification of indigenous information resources
- location of required foreign information resources
- elimination of unnecessary duplication in acquisition and handling of information

- union list of scientific periodicals
- union catalogue of scientific books
- coordination of acquisitions of foreign periodicals
- acquisition and control of indigenous report literature; information on research in progress; and information on meetings, seminars, and symposia in Ghana
- linkages with foreign and international information sources.

Dissemination of Scientific Information

- interinstitutional sharing of resources
- preparation of specialized information services
- application of information technologies in support of dissemination processes

- greater publicity for existing information services
- preparation of on-demand bibliographies, abstracts, literature searches, and selective dissemination of information
- encourage review articles in indigenous journals
- installation of adequate photocopying facilities in major libraries
- elimination of legal and economic barriers to information dissemination

Manpower Development

- improvement of professional capabilities
- improvement of morale

- institution of specialized courses in scientific information
- recruitment of science graduates into information work
- encourage and recognize professional advancement

Information Policy Formulation and Implementation

- establish permanent national committee to advise, renew, and assess cooperative ventures in scientific information.

In a workshop on scientific and technical information needs and resources which we undertook recently with the Republic of China, many of these same problem areas were identified, and suggested actions proposed.⁴ The purpose of the workshop was to examine the various components and requirements of a national scientific and technical information system in the Republic of China, and to make recommendations directed toward ensuring its effective development. The development of a national information system is similar, in many ways, to the development of other sectoral areas, or the solution of other sectoral problems. It requires adequate planning (both short- and long-term); it involves the coordination and cooperation of several ministries, universities, research institutes, industry, etc.; and it requires adequate inputs of human and financial resources to succeed. The functions and activities of the Republic of China's national documentation center were viewed within the larger context of the national system. As a result, the workshop recommendations defined a somewhat broader role for the center than might have traditionally been assigned. The center was seen as having a pivotal role, not only in providing information services, but in stimulating national coordination and cooperation among various information resources; in education and training; and in national information policy formulation. Similar functions might also be envisaged for the CSIR's Scientific Documentation Center.

⁴Academia Sinica, Republic of China and National Academy of Sciences, United States of America. Scientific and Technical Information Needs and Resources in the Republic of China (Taiwan). Report of a Sino-U.S. Workshop, Washington, D. C., 24-26 April 1973. Washington, D. C., National Academy of Sciences, 1974. 77 pp.

Discussion

Dr. Tackie

We think we know some of the problems and we know that we have to build up a documentation center so that all concerned can obtain the information they require.

CSIR has promoted the idea of having a central reference library situated within the CSIR to provide information to scientific researchers. If we look upon the CSIR as the national focus of scientific activities, then it stands to reason that many people would come to this source to get scientific information. The Council, therefore, decided to extend the concept of library facilities to include the establishment of a national documentation center. It is expected that such a center will improve the acquisition and dissemination of scientific and technical information in Ghana, as well as train people in the information and documentation field.

Ghana, through CSIR, is also affiliated with the UNISIST program of Unesco, from which we hope to receive guidance and ideas concerning the development of information activities.

Mr. Copeland

There are two key components that we have been discussing for some time now which are going to require an information resource; the PAG will need a vast amount of information in order to achieve its best results, and Dr. Johnson has stated that the desertification project will need documentation. Would these two concepts be useful growth points for a national

documentation center? Also, it is important to ensure that the documentation center be user-oriented and not one that collects data, books, and journals. I suggest that you select information for which there is a direct need. You will have a mental image as to what you want the center to look like in the future, but focus on the real needs now, and adopt a modular approach rather than collecting information that you hope somebody is going to use in the future.

Ms. Werdel

A single center can never hope to have all the information required--even to satisfy the needs of the PAG or the desertification project. It is more important to develop the capability and the facility to know where and how to obtain needed information. That is a different process altogether from collecting, cataloging, and storing. It is developing a referral network--an intelligence network--that does not stop with national boundaries but is worldwide. As priority research areas are determined, would be helpful at the same time to examine the informational needs specifically relating to those research areas, to anticipate requirements for several months, several years hence. If analysis of information requirements is coupled with the planning of each research project, and method is established for satisfying those requirements, the scope is narrowed and there is no need for a whole world of "on-site" information.

Mr. Lartey

Would it be out of place for the proposed center to translate scientific information into readable form for use in extension work? The Agriculture Ministry has had a lot of reports coming from the universities

and scientific institutions couched in terms unfamiliar to extension officers who might otherwise be able to utilize scientific information.

Dr. Tackie

This is quite a monumental task to undertake. It is an admirable task but I do not think this type of documentation center will be readily equipped to provide this sort of service, generally. In January we discussed setting up a public relations center in the CSIR to translate some of the research results from the institutes into nontechnical language.

Mr. Lartey

Such a translation would be done, not as part of the documentation center, but as an extension of the particular institute concerned. To use the staff and facilities of a documentation center for such translation would open the documentation center to a whole variety of disciplines.

Mr. Copeland

Probably each department within the university and each research institution would have its own specialized library. Certainly it would be desirable to develop the capability of sharing information and personnel in these libraries, thereby building a network of information resources and personnel, rather than trying to accumulate everything in one place.

Dr. Johnson

I do not want to imply that this proposed desertification project is a panacea. Within the project we have talked very specifically about the

need for documentation and the importance of translating research results into language understandable by the nonscientist user. The mechanism to best accomplish this in Ghana might be through a pilot project approach such as the desertification project. I foresee the responsibility for translation of data into a form usable by extension agents as the responsibility of the Ministry of Agriculture to hire technical writers who review the research data and translate it into nontechnical language. This is the way it is done almost every other place, and the people who are manning the documentation center cannot be expected to do this job for the Ministry.

Dr. Ayensu

One of the biggest problems in Ghana is that a lot of the pertinent data is locked up in the Ministry of Agriculture and is not available to research scientists who are working on various crops. Right now we do not even know what type of information we have in Ghana or where it is. I often get requests for information, for publications on a particular topic, from my colleagues. I believe information is logged in libraries in Ghana, but retrieval systems are almost nil, and we do not know what research has been done or is in the process of being done. Scientists make some attempt to locate information, then start writing abroad, and yet probably 80 percent of what they want from abroad is available within the country.

Ms. Werdel

These problems will not go away; and Ghana has already taken steps to resolve some of them, and the advisory committee has identified additional projects to be undertaken. It seems to me that appropriate administrative and financial support is required now to carry them out.

Discussion

Dr. Hammond

I think we should consider the status of this committee; it is called a Joint Ad Hoc Committee. I do not feel such committees necessarily should continue forever, and we should consider whether or not a group of this kind should plan meetings in the future or whether this committee has carried out its principal responsibilities and disband it.

Dr. Tackie

I do not see anything wrong with this kind of arrangement. I am not quite sure, Dr. Hammond, that you mean that we should have a permanent standing committee and then bring in people as we come to discuss a specialized subject, or whether this should be an ad hoc sort of committee. You know each time you meet you have to appoint different people altogether; I am not quite sure.

Dr. Hammond

I mean a permanent continuing committee with a changing membership with ad hoc participants. But I simply think that any committee which automatically schedules its next meeting should stop and think at least briefly "Are we necessary?" Otherwise, you go on forever, assuming that every committee that exists should continue to exist. I am not really saying that I have deep concern or reservations about it; I simply say

that this is a question I always have. So I open the question, not as a specific criticism of this committee, but as something I always do.

Dr. Tackie

I think I would like to say the committee should continue on the basis indicated by Wesley. (A permanent continuing committee with changing membership.*) We have just started to work with you, since 1971. This is a pretty short time, and I remarked yesterday to Mr. Arnold that I think there would be some useful things coming out of this joint committee meeting and cooperative efforts. I cited the PAG as a very useful example. I also cited the special workshops held earlier and, therefore, we will be in a position to say whether these meetings are just superficial or not and, therefore, they should be abandoned or not. But it is too early yet to say that nothing is really coming out of it.

Dr. Hammond

I think I would agree with that. I think that probably we should schedule a meeting of a continuing committee sometime next year in Ghana.

Dr. Tackie

I think so. About the same time, if this would suit your group or if you let us know what would be the most suitable time for your people....

*Added for clarity.

Dr. Hammond

Summer is likely to be a good time, but for a one-week meeting, it is not very important. It is relatively easy to get Americans to take one week at other times of the year.

Dr. Dodoo

Well, before every meeting you write to negotiate the time. The summer is agreeable.

Dr. Barton

As long as it is scheduled far enough in advance, this is important. There is one more item that I would like to inject here. It has occurred to me that as PAG becomes a reality, some of the assessment that it is going to make of problems and priorities is going to need as background material just what research is being done, perhaps by activity, perhaps by commodity, or perhaps by scientific discipline. At some point it might be of interest to you and the management of research to account for what people are doing by the kinds of activity, and it is possible to classify research projects so that when it is asked, "How much are we doing in breeding?" you come up with the answer. I think that as time goes on you are going to find that the kind of information that a PAG asks is going to be more detailed in terms of the scientific input and the budgetary input. So this whole area of research management could well become an area that could be in working relationship between the Academy and the CSIR. Showing alternatives in research management could be chosen by the administration of the CSIR.

r. Hammond

It is an interesting subject, one that is very active in this country
t this time.

r. Barton

It is much more highly evolved here than Ghana would expect to be,
ut you can start with a procedure which will allow refinement in time.
am suggesting that it might be desirable to, at least, show alternative
hoices that could be made in research management and then a decision
nternally would be how far do we want to go in refinement.

r. Copeland

Are you suggesting this be done as a possible agenda item for the
ext meeting?

r. Barton

I guess that is the reason it came to mind right now. That is the
ind of thing that I could prepare a background paper on and present as
possible contribution to the next program.

r. Tackie

I think the idea is noted. Yesterday, I said that we are in the
rocess of forming the PAG, and when we started working we were not sure
aether we would get it off the ground and everything would be rosy. We
re likely to encounter difficulties and if this is one of the areas
ere we must look carefully, in order not to make a mess of the whole
ing, I do not think it would be out of place to note this and look

at this idea at the next meeting. When the PAG is formed or is about to be formed, we will think of the ways and means it is going to function and we will take note of this, but we will need to be prepared with information on how best to organize work in the PAG.

15 Closing Remarks

Dr. Hammond

It has been, as I expected, a special pleasure to host this particular meeting with Ghana as my first official action as the Foreign Secretary of the U.S. National Academy of Sciences. I only wish I could think that all the things I will do as Foreign Secretary would be as interesting and as genuinely a pleasure as this. I doubt that I will be so fortunate because I do not think I have ever encountered before, in any such contexts, people or individuals who are nearly as open and direct and good about getting to the point as the people of Ghana. This, then, makes working with Ghana a particularly pleasurable experience.

We may not arrive at final solutions and good strategies; however, because of the directness of our discussion we know that the problems are very difficult. I have a feeling that when we finish this meeting, as I have felt in my previous meetings in Ghana with Ghanaians, that we've gone as far as we possibly could have hoped, given the circumstances, the time limit, and so forth. I simply want to thank you for coming to Washington to take part and, again, assure you that, within the limited capabilities of the Foreign Office of this Academy, we will respond in helping the CSIR and Ghanaian science as needs arise.

Do not hesitate to share with us your desire when a need is identified; if we cannot fullfill it, we will be equally frank in saying so.

Dr. Tackie

I believe the meeting has been very fruitful. During the past three days of our deliberations we have discussed some important topics, notably the desertification study, which, we hope, is going to offer us tremendous experience in tackling multidisciplinary problems in the future. It is also our fervent hope that the outcome of this desertification research program might make it possible for us to justify the creation of a science foundation, which we have, for the time being, shelved for further examination. I believe that whatever we will be able to achieve in the execution of the desertification project will go a long way in providing some of the ideas and the working principles that may be introduced into the science foundation concept.

We proposed a couple of topics--the Scientific Instrumentation Center, the Information and Documentaion Center--which we considered to be of pressing and potential importance to the overall needs of Ghana and vital in supplementing the efforts of our scientists in achieving maximum results. The participants from Ghana are pleased with the frank and valuable discussions on these topics, and we are going back with some useful ideas. When the report is completed we will carefully examine it and try as much as possible to implement all the recommendations made.

At this time I would like, on behalf of myself and my delegation, to express our thanks to Dr. Hammond for chairing this meeting and our

gratitude to all the American participants. I have been impressed by the fairness and the open-mindedness which have characterized our discussions. I hope this sort of atmosphere will pervade our future joint activities. I would also like to thank the NAS and USAID for making this meeting possible. Thank you.

