



***Performance Review of Science and Technology
Policy Institutions in Madagascar, Malawi,
Senegal, Sierra Leone, Zimbabwe
and Gambia***



United Nations
Economic Commission
for Africa



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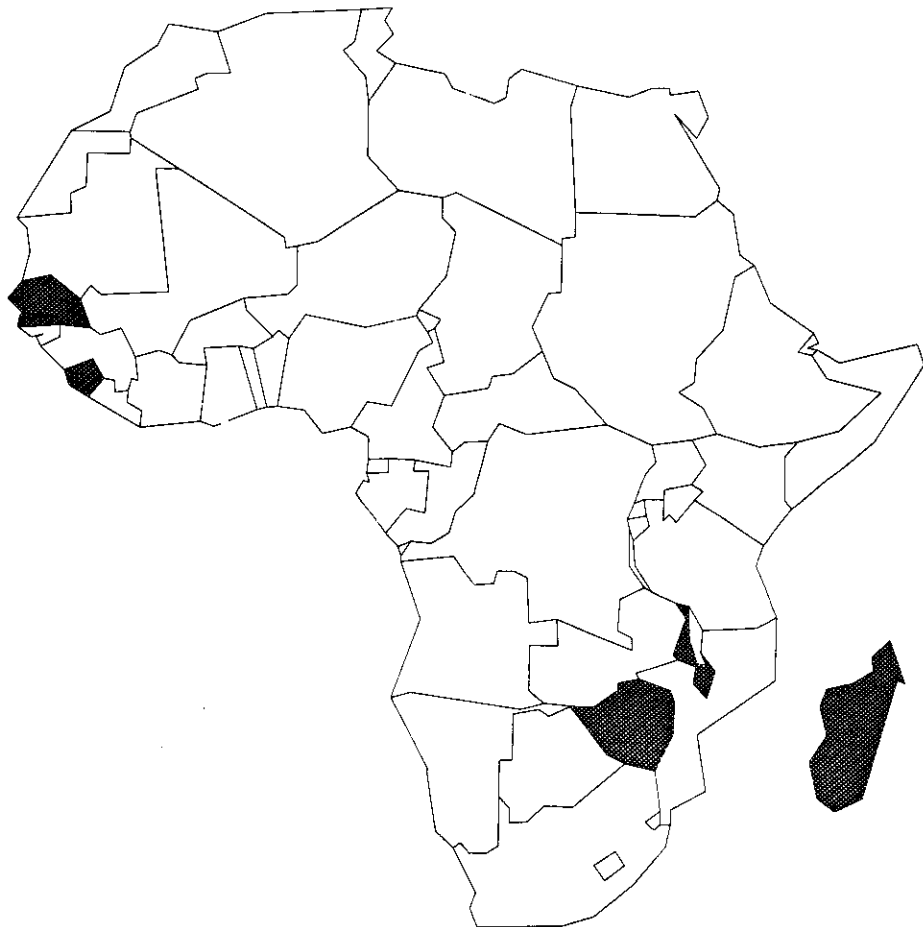


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FOREWORD

This report puts together six studies carried out in 1990-1991 on the past and present performance of the institutions responsible for science and technology policy in **Gambia, Madagascar, Malawi, Senegal, Sierra Leone, Zimbabwe**. It is a continuation of an earlier study conducted by the Economic Commission for Africa, in collaboration with the **Canadian International Research Centre**, covering science and technology policy institutions in **Ghana, Guinea, Kenya, Nigeria and Tanzania**.

The studies were undertaken by the **United Nations Economic Commission for Africa** through a grant provided by the **Carnegie Corporation of New York**.

The Objectives of each study were:-

(a) To ascertain the **statutory** characteristics of the institutions examined in regard to their stated aims and their functions, prescribed organizational structures, the compositions of their Councils or Boards, links with other institutions, existing promised legal powers as well as resource allocations;

(b) To review comprehensively the institutions' past and present activities, highlighting their ways and means for attaining stated objectives in order to establish their **actual** characteristics, to compare these with those indicated by local needs and by the institutions' statutes, to account for disparities, if any, and to relate them to the institutions' past and present performance;

(c) To compare the institutions' statutory and actual aims and functions with those of **other** relevant national institutions, including government departments, in order to determine the extent to which statutory and actual similarities in aims and functions either spawn rivalries or encourage cooperation between those and other institutions;

(d) To study the nature of working of decision-making machineries with respect to institutions for S & T policy in relevant countries, especially with regard to the allocation of resources to those institutions;

(e) From the emerging conclusions and comparisons with successful institutions for S & T policy in other parts of the world, to suggest ways in which African institutions for S & T policy could be strengthened and/or to propose alternative arrangements that would be more effective in promoting and utilizing science and technology for development.

The **Carnegie Corporation of New York** and the **Economic Commission for Africa** hope that the report will be of use not only to researchers but also to policy makers interested in institutions and institutional reform in Africa. Both wish to emphasize, however, that the views expressed here are those of the authors; they do not necessarily reflect the policies of either institution.

LIST OF ABBREVIATIONS

B.R.G.M.	Office of Geological Research and Ministry
C.I.A.T.	International Tropical Agronomical Centre
C.I.R.A.	International agronomical research for Development Centre
C.I.R.A.D.	International Agronomical Research for Development Centre
C.M.C.N.	Madagascar Conference on the Conservation of Natural Resources
C.N.R.S.	National Scientific research Centre
C.R.D.IR	Research Centre for International Development
CENAM	National Centre for Malagasy Handicraft
CORAF	Conference of African Agronomical Research Leaders
D.R.S.T.	Directorate of Scientific and Technological Research
DEA	Degree in Advanced Studies
DVA	Directorate of Agricultural Extension work
ECA	Economic Commission for Africa
EPIC	Public Industrial and commercial Establishment
FAC	Assistance and Cooperation Fund
FAO	Food and Agriculture Organisation
FCP	Counterpart Funds
FNDE	National Development and Equipment fund
GDP	Gross domestic Product
GTZ	Deutsh Gesollechafft Technische Zusammenarlseit
HASYMA	Hasy Malagasy (Malagasy Cotton company)
I.B.P.G.R.	International Board for Plant and Genetic Research
I.C.R.A.F.	International Council for Research in Agro-Forestry
I.G.N.	National Geographical Institute
I.N.R.A.	National Agricultural research Institute
I.P.	Pasteur Institute
I.P.S.T.	Science and Technology Policy Institution
I.R.A.M.	Malagasy Agronomical research Institute
I.R.A.T.	Tropical Agronomical and Food Crop Research Institute
I.R.C.T.	Institute for Research on Cotton and Textile Fibres
I.R.H.O.	Oils and Oil Seeds Research Institute
I.R.N.T.	Inventory of Earth Natural Resources
I.R.R.I.	International Rice Research Institute
I.S.N.A.R.	International Service for National Agricultural Research
I.S.R.A.	Specialised Agronomical Research Institute
IMRA	Malagasy Applied Research Institute
L.N.T.B.	National Public Works and Buildings Laboratory
M.N.H.N.	National Natural History Museum
M.P.F.B.	Ministry in the Office of the President in Charge of Finance and Budget
MINCOM	Ministry of Trade
NGO	Non-governmental Organisation
O.R.S.T.O.M.	Overseas Scientific and Technological research Department
PIP	Public Investment Programme

P.T.A.	Annual Work Plan
S.A.	Approval Service
S.A.G.	General Service
S.C.Pr.	Provincial Representation Coordination Department
S.CNR	National Research Centres Programmes Department
S.F.M.	Trading and Method Department
S.G.F.	Financial Management Department
S.I.S.	Scientific Infrastructure Department
S.L.	Logistics Service
S.M.C.	Malagasy conservation Department
S.M.O.	Implementation Service
S.P.C.	Staff and Chancery Department
S.PR.	Results Promotion Service
S.PR.T.T.	Results Protection and Transfer of Technology Department
S.Pr.	Provincial Service
S.R.I.	International Relations Department
S.S.E	Follow-up and Evaluation Department
S.T.	Science and Technology
S.V. S.	Extension Work and Sensitization Service
SIRAMA	Siramany Malagasy
UFSH	Fishery Science Training Unit
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation
WHO	World Health Organisation

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PERFORMANCE OF SCIENCE AND TECHNOLOGY POLICY INSTITUTIONS OF MADAGASCAR

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PREFACE

Since its accession to independence, Madagascar has recognised the place of Science and Technology in the development of the country. The Government made efforts to encourage its utilisation and promotion.

Over the years, government structures have been gradually set up to ensure the drawing up, implementation and follow-up of a National Science and Technology Policy. In spite of the different names used for those institutions, according to the period and situation in which they were set up, all of them have been called upon to carry out the same functions:

- working out the Science and Technology Policy;
- programming and planning of this Policy;
- coordination of Science and Technology activities;
- evaluation and follow-up;
- promotion, dissemination and popularisation of results, etc..

The present work which we have the honour to carry out intends:

- to consider the present and past performance of the Science and Technology Policy Institution (IPST) in Madagascar by analysing its structure, functioning, activities, influence;
- to identify the assets and weaknesses of this IPST;
- to target the obstacles which arrested, indeed prevented the execution of planned activities;
- to propose solutions to rectify errors, fill the gaps and improve the performance of the Science and Technology Policy.

The text will comprise five major parts which will be sub-divided into a certain number of paragraphs.

After a brief recall of the historical background of IPST in Madagascar, we shall deal with the objectives and functions of the present IPST in the first part. The second part will be devoted to the consideration of its organisation in which we shall look at successively the structure, the composition, the relations and the powers assigned to it. The activities and the attainment of the objectives will be dealt with in Part Three. These steps will then lead us to the analysis of the strength and weaknesses of IPST in Part Four. This analysis will lead to the formulation of recommendations contained in Part Five. It must be noted that the plan of this Report has been the one suggested by ECA.

Before concluding this Preface, we are particularly pleased to express our heartfelt thanks to all those who, directly or indirectly, have facilitated the realisation of this work.

To the ECA which is the initiator of this Project

To the Canergie Corporation of New-York for its financial support

To the Honourable Minister of Scientific and Technological Research for Development for the trust reposed in us by entrusting this work to us

To the Directors General and the Directors of National Research Centre for their understanding and readiness to help which greatly facilitated data collection

To Professor Soodursun Jugessur, Chief of Science and Technology Section, NRD, who, during his visit to Madagascar, gave us additional information for the accomplishment of this work-

To Mrs. Hanitra Rasamison and Mr. A. Randimbimahenina, competent and devoted colleagues, without whose contribution the investigations would not have been carried out and the work would have been carried out and the work would have been incomplete.

Thank you to one and all.

The Authors.

BACKGROUND

Everybody is sure at present that Science and Technology play a primordial role in the development of people both in technologically advanced countries and in developing countries. However, a problem poses for the latter as about 90 per cent of the world scientific and technological potential is in the developed countries. The developing countries are compelled to import science and technology produced elsewhere technologies which are often inappropriate and ill-adapted to the structures existing in the countries and whose outcome is often disappointing. It, therefore, behooves upon the developing countries to adapt, to their own characteristics and their specific needs, the exploitation techniques they import from abroad. It also behooves each country to formulate its own Science and Technology Policy by taking into account its specificity, natural environment, cultural and social identity so that all scientific and technological activities could contribute fully to the development of the country and in all the fields.

However, whatever be the importance of that policy, its value and effectiveness depend greatly on the organs and structures and on the powers and means given to it. Indeed, several functions devolve upon the institution in charge of implementing the policy; planning (planning and programming), coordination, mobilisation of means, execution, evaluation follow-up, promotion, processing, dissemination of results and so on. The establishment of an effective IPST is, therefore, necessary.

The establishment of a Ministry in charge of implementing the State Scientific and Technological Research Policy bears witness to the will of the Government to consider Science and Technology as "determining factors of national development".

This institution has gone through several aspects in the history of the Malagasy scientific research before assuming its present form.

We shall not dwell at length on what it was before the independence for the working out of the Science and Technology Policy and its programming fell within the competence of the French Government. It was the same for the execution and follow-up of activities.

After its accession to independence, Madagascar took the destiny of the Malagasy Scientific research in

hand and felt the need to have a national body to plan, coordinate and manage that research work.

The Malagasy Scientific and Technological Research then went through two distinct periods:

- the first period, post-independence, covering the years 1960 to 1972;
- the second period stretches from today.

During the first period, Scientific Research was marked by a total dependence on the outside world. In many research fields, several French Organisations, more or less under the government control, dealt with research activities, IRAM, IFCC, IFAC, IRCT, IEMWT, IRHO, CTFT in agronomic research, IGN, IP, LNTPB and ORSTOM in order fields. Other institutes, completely independent, carried out research work practically without the control of the Government. In spite of that, a research coordination structure was set up in the form of a Scientific and Technology Research Committee. Placed under the responsibility of the Vice-President of the Government and headed by a Secretary General, the CRST was composed of small number of scientific personalities. It has a consultative role. Decision-making and definitive orientation of the Scientific and Technological Research Policy fall within the competence of Ministerial Department concerned. It did not, therefore, despite its direct attachment to the Office of the Vice-President of the Government, enjoy prerogatives of a real coordination and management institution.

In 1972, it was the second period which was the logical consequence of the political orientation of the country. A certain number of stages marked that period stressing the difficult development of the Malagasy scientific Research.

After 1972, all the centres held by the Seven French Agronomic institutions merged into a single Research Centre, the CENRADERU/POFIFA. The Centres run by ORSTOM and those by IGN were nationalised. The BRGM, henceforth, operated as a prospecting organisation working on licence. The LNTPB became a national organisation. Only the Pasteur Institute kept its status of origin. Thus these changes led thereby to a reorganisation of the management organisation. The Scientific and Technological Research Committee (CIRST) placed under the indirect responsibility of the

Head of the Government. that Inter-Ministerial Committee, composed of a representative appointed by the Ministry, as headed by the Director of Scientific and Technological Research (DRST). These are five (5) aspects of the mission of the Committee: .

- deliberate on the general policy of Scientific and Technological Research;
- approve the proposed programmes of public and para-statal research organisations upon the report of the Director of RST;
- adopt the proposed amount of overall resources and means allotted by the State for all research activities and decide on their allocation;
- harmonise the working conditions and remuneration in the public and para-statal research organisations, particularly by giving its views on the draft Staff Rules;
- give its views on the establishment of public or para-statal research organisations.

That first stage seemed to be the beginning of the establishment of a genuine institution for Science and Technology Policy with broadened prerogatives turning the Inter-Ministerial Committee into a decision-making and coordinating structure.

In 1976, Scientific Research was placed under the responsibility of a Ministry thus leading to the disappearance of the Inter-Ministerial Committee of RST. That Ministry of Scientific and Technological Research was established to coordinate the research activities of the different research Centres and Organisations using public funds.

But in the face of the importance of University research work, higher learning and scientific research were placed in 1977 under a single Ministry - Ministry of Higher Education and Scientific Research.

In addition to its role of coordinator of University and extra-University higher education, it is also in charge of coordinating the Scientific and Technological

research activities of Organisations using fully or partly public funds, whether they are Centres or laboratories having autonomous financing or services directly attached to other Ministries.

Thus, the Organisational Chart of the Ministry has seen, among others, the establishment of a Directorate of Higher Education and a Directorate of Scientific Research. The mission of the latter was:

- the planning, programming and budgeting of Scientific and Technological activities;
- the application, transfer and evaluation of Science and Technology;
- orientation of the general policy.

However, in the face of higher education problems, the research aspect was somewhat hidden and the activities of the Centres almost submerged.

Conscious of the role that Scientific research should play in the economic and social development of the country, the Government established a Ministry of Scientific and Technological Research for Development in 1983 thus marking a redefinition, at national level, of the importance of the place of Scientific Research which is "considered, not as a luxury but as one, if not the first, of conditions for a controlled and ensured development".

That new redefinition logically led the Government to raise to the rank of a Ministry, the National Research Planning, Coordination and Management Body.

Established by Decree No 83353 of 21 October 1983, the Ministry of Scientific and Technological Research for Development saw its role of IPST confirmed by Decree N0 89139 of 31 May 1989,

decree laying down the functions of the Ministry of Scientific and

Technological Research for Development as well as the general organisation of its Ministry, factors that will be detailed in the following chapters.

CHAPTER 1

OBJECTIVES AND FUNCTIONS

1.1 Mission of the IPST

Under Article 1 of the Decree establishing the IPST: "the Ministry shall implement the State Policy on Scientific and Technological Research for development. It shall be in charge of the promotion of Scientific and Technological Research for Development and to that end shall coordinate the scientific and technological research activities of Organisations using fully or partly public funds whether they are centres, laboratories or institutions having financial autonomy or services attached to Ministries".

1.1.1 Objectives and Statutory Functions

The objectives laid down by the MRSTD are in close correlation with the major aspects of the National Policy on Research-Development. They are given the concrete form of Integrated Research Programmes for Development (PIRD) which comprise seven aspects, namely:

- Food self-sufficiency
- Development of Export crops
- Development of Natural Resources
- Improvement of living conditions
- Integrated Regional Development
- Adapted or Appropriate Technologies
- Support for Research

All the Scientific and Technological Research activities should lead to one or several of these PIRD.

With regard to the statutory functions, it is recommended to understand well the organisational chart of the MRSTD (cf. 4.2.1). Indeed each Organisation has well-defined statutory functions, particularly:

- preparation of policy and decision-making;
- planning-programming;
- follow-up and evaluation;
- logistics and financial support;
- development, promotion and protection of results;
- execution at the level of CNR

The first function falls within the competence of the Ministry job Scientific and Technological Research (MRSTD) assisted by its Cabinet, the Secretary

General in permanent consultation with the Directors in the Ministry.

The following four functions devolve upon four technical Directorates successively: Directorate of Planning and Programming (DPP), Directorate of Support Services, Follow-up and Evaluation (DASE), Directorate of Administrative and Financial Matters (DAAF) and Directorate of Extension Services, Promotion and Protection of Results (DVPPR).

The last function is assigned to the National Research Centres (CNR), including:

- Foibem-pirenena ny Fikarohana ampiharina amin'ny Fampanandroana ny eny ambanivohitra (FOFIFA) or National Centre for Research Applied to Rural Development (CENRADERU);
- National Centre for Pharmaceutical Research (CNRP);
- National Centre for Oceanographic Research (CNRO);
- Science and Technology Information and documentation Centre (CIDST);
- National Centre for Industrial and Technological Research (INRIT);
- National Centre for Research on Environment (CNRE);

The statutory functions of each CNR are the following:

CENRADERU/FOFIFA

Established by Decree No 74184 and restructured by Decree No 90317 of 10.07.1990, it is requested to:

- implement the National Rural Development Policy;
- ensure, within the framework of this National Policy, the definition, orientation, promotion, control and coordination of all research activities concerning particularly: agronomy, zootechnology, forestry science, protection of nature and production factors, soil conservation and fish farming, agricultural hydraulics, post-harvest processing and conservation technology, agricultural engineering;
- contribute to the Science and Technology staff training;

- participate in the conservation and rational utilisation of the Scientific and Technological heritage.

CNRP

Established by Decree No 76634 of 01 October 1976, it is requested to:

- participate in the drawing-up and implementation of the National Scientific and Technological Research Policy;
- ensure, within the framework of this National Policy, the definition, orientation, promotion, coordination and control of all the research activities concerning medicinal plants (ethno-botanical and botanical chemical ect... studies), animal and mineral products having therapeutical properties;
- contribute to the study of and improvement in the cultivation of these plants and their use;
- contribute to the drawing-up and implementation of measures for marketing and industrial use of the said plants and products and the pharmaceutical and medicinal forms;

-contribute to the Scientific and Technological staff training in relation with the Ministerial departments concerned;

- contribute to the collection, processing and dissemination of Scientific and Technological data.

CNRO

Established by Decree No 77081 of 04 Avril 1977, it is requested to:

- participate in the drawing-up and implementation of the National Scientific and Technological research Policy;
- ensure, within the framework of this National Policy, the definition, promotion, coordination and control of all

Research-Development activities and the rationalisation of the use of marine and fishery resources;

- contribute to the necessary Scientific and Technological staff training for development, the rationalisation of the use of marine resources in relation with the Ministerial departments concerned;

- contribute to the collection, processing and dissemination of Scientific and Technological data on the sea.

CIDST

Established by Decree N0 87145 of 05 May 1987, it is requested to:

- give its technical support to the result dissemination services;
- meet the needs of researchers, decision-makers and economic operators of the government or private sector in Scientific and Technological data;
- manage the bank data on Scientific and Technological work carried out in Madagascar;
- publicise the ongoing research and disseminate the Malagasy research results at the national and international levels;
- prepare all useful documents for Scientific research and development;
- establish, with the different libraries and documentation units existing in Madagascar, a relation network for the establishment of a Central Scientific and Technological documentation data base;
- cooperate with the data bank of the State to put at the disposal of the researchers data on the human and natural resources of the researchers data on the human and natural resources of the country and on the economic activities.

CNRRIT

Established by Decree No 87288 of 28 July 1987, it is requested to:

- participate in the drawing-up and implementation of the National Technological Research Policy supporting the industrial and agro-industrial development;
- promote the economic use of research results and ensure for that purpose the cooperation of government or private, national or foreign partners;
- contribute to the Scientific and Technological staff training in the above-mentioned fields;
- contribute to the collection, processing and dissemination of Scientific and Technological data in relation with the CIDST/MRSTD;

- develop and apply the research results for the needs of economic agents.

CRNE

Established by Decree No 88183 of 03 May 1988, it is requested to:

- contribute to the drawing-up of the National Environment Research Policy in conformity with the National Economic Development Policy within the framework of the PIRD;
- contribute to the implementation of the Malagasy Conservation Strategy (SMC) defined by the documents of the Madagascar Conference on Natural Resources Conservation (CMCN) in the service of sustainable Development;
- prepare, evaluate and carry out or have an evaluation of all National Research Programmes whose fields are related to environment;
- contribute to the improvement of Science and Technology Information for the establishment of a data collection and exchange structure, data bank, dissemination system in relation with the CIDST in the fields that concerned them;
- give its assistance to research training and through research work of researchers and technicians in the following fields:
 - *research on the rational use of natural resources having an impact particularly on human health, food and nutrition;
 - *research on ecosystems to determine the ecological bases for space organisation, development and rational management of land and water, control and monitoring of environment;
 - *research on impact of human activities on the ecological systems in its harmonisation perspective between the possibilities of the natural environment and with the production systems, development techniques and socio-economic and cultural needs.

1.1.2 Analysis and Comments

1.1.2.1 Mission of IPST

The MRST constitutes the National Central nucleus responsible for the coherence and general consistency of all the activities identified with regard to the RSTD.

The tasks assigned to the said IPST, because of its mission, make several Organisations intervene:

- the institutions upstream: the Universities of Madagascar act in their capacity of potential partners in the field of training of senior officers and the implementation of some research programmes (associated research teams);
- the institutions downstream: the State, semi-private and private Organisations, grouped under the term "users of research results", also contribute to the rationalisation of research for the improvement of production for the integrated socio-economic development of the nation.

There are two aspects to the mission assigned to MRSTD:

- promote Science and Technology at the national and/or international levels;
- ensure the transfer of achievements to the different S and T institutions and to the economic Organisations, operators or developers.

1.1.2.2 Objectives and Statutory Functions

Although the mission assigned to the IPST is vast, it is limited to seven priority programmes in its execution: the Integrated Research Programmes for Development (PIRD). The aim stated in those objectives and the policy implemented by MRSTD converge towards the same final aim: "that of integrating Scientific and Technological research into the Malagasy socio-economic and cultural process" that is consider the RST as a "basic factor" for development.

The PIRD have been deemed adequate to meet that final aim, whatever be the national political context and that until the present structural adjustment policy. In that case, they were prepared to be compatible with the different situations of national scope and with various socio-political fluctuations. finally, at the internal selective level, each PIRD has the same degree of priority in the implementation of the MRSTD general policy.

As regards the statutory functions, each MRSTD organ has clear and precise functions. To avoid encroachment, the statutes governing them have been prepared on the same basis; that is the front line defining the functions of each CNR delimits the sector or field in which it must act. The drawing-up of the Statutes took into consideration the following criteria:

- competence
- specialisation
- complementarity.

1.2 Operationalisation of the Mission

The implementation of the State policy on RSTD requires the adoption and establishment of a coherent operational system.

The MRSTD organises consultation and working sessions with all the national or foreign partners involved in the field of RSTD. Science and Technology events, regular meetings, consultative

commissions have been established to discuss and consider the related problems.

The orientation and preparation of the MRSTD general policy are effected during the Cabinet meetings, meetings of Directors, Executive Boards (CA) and the Scientific Orientation Councils (CSO).

Each organ of IPST must define the tasks devolving upon it. In the field of execution, each CNR prepares its Research masterplan (PDR) or its plan of action and operations (in case it has not yet prepared its PDR or it is executing a specific operation). The related documents will be considered and studied by the DPP which ensures the planning and programming. That Directorate is also responsible for the search of financing and their coordination. The duly approved projects or programmes are executed by the CNR. The DASE ensures the follow-up and evaluation while the DVPPR deals with all the issues relating to the results; promotion, protection and dissemination.

In brief, the operationalisation system adopted by the MRSTD is the following:

-encourage multidisciplinary approach of RSTD by opening up to all the Science and Technology Sectors in general and to the national and international R and D Sectors in particular;

- establish, within the MRSTD, a coherent and operational system which is intelligible and effective at all levels;
- establish a continued and adequate training principle.

1.2.1 Objectives Perceived

The perceived objectives should, in principle, be directing towards the Statutory Objectives. In spite of this, their rationalisation and attainment depend partly or fully on the approach methods of the heads. An approach has been chosen by the MRSTD since its inception, which is to consider, study the operations, programmes proposed by the CNR and the Science and Technology institutions under other units, to see if they are in line with the objectives of the development plan, taking into account the available financial and human resources. Each Organisation has all the latitude to define and lay down its objectives.

1.2.2 Analysis and Comments

Within the MRSTD unit, the perceived objectives consist of:

- the execution of the PIRD;
- the establishment of a rationalisation system of all short, medium and long-term Science and Technology activities and the related Science and Technology potential.

The statutory and perceived objectives should be the same but the investigations carried out made it possible to note that the latter are not fully in conformity with the first ones particularly at the operational level (problems of means and different constraints); for example, some CNRs are compelled to shelve or scale down the subjects related to the attainment of their objectives. Consequently, the statutory objectives remain unchanged but their attainment is determined by several factors, depending especially upon the availability of the necessary resources for their attainment.

CHAPTER 2

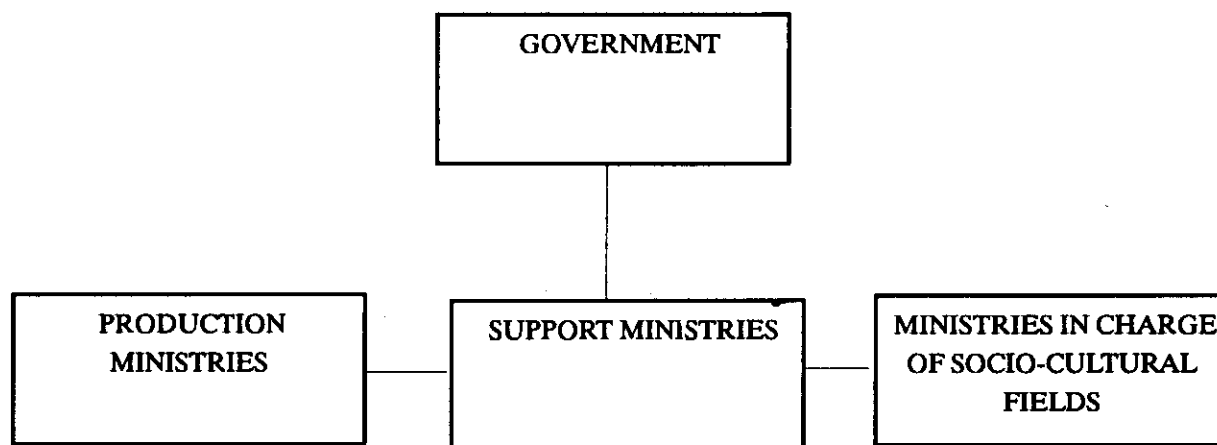
ORGANISATION

2.1 Structure

2.1.1 The Place of IPST in the Structure of the Government

One of the objectives of the National Policy is to improve the economic and socio-cultural level of the nation. To attain it, the Malagasy government has set up the following structure:

Considering its historical background and the mission assigned to it, the MRSTD places itself in the second category. It ensures the promotion and coordination of all the scientific and technological activities to attain the national development objectives. To that end, all the sustainable development plans, programmes or projects in all the fields (economic, social, cultural) must be designed in consultation with the MRSTD. The MRSTD acts, consequently, in the



1. Ministry of Production:

Ministry of Animal Production (Live tock and fishery) and Water and Forestry (MPAEF) - Ministry of Agriculture and Lands (MINAGRI) - Ministry of Industry, Energy and Mines (MIEM)... are the "Leaders" in the field of Economic Production of the country.

2. Support Ministries:

Ministry of Economy and Planning (MEP) - Ministry of Information (MININFO) - Ministry of Posts and Telecommunications (MPT)... are the necessary supports for the attainment of the objectives set by the National Development Policy.

3. Ministry in charge of Socio-Cultural Fields:

Ministry of culture and Revolutionary Art (MCAR) - Ministry of Higher Education (MINESUP) - Ministry of Secondary and Basic Education (MINESEB) - Ministry of Health (MINSAN) - Ministry of Population, Social Welfare, Youth and Sports (MPCJS) - Ministry of Defence (MINDEF)...

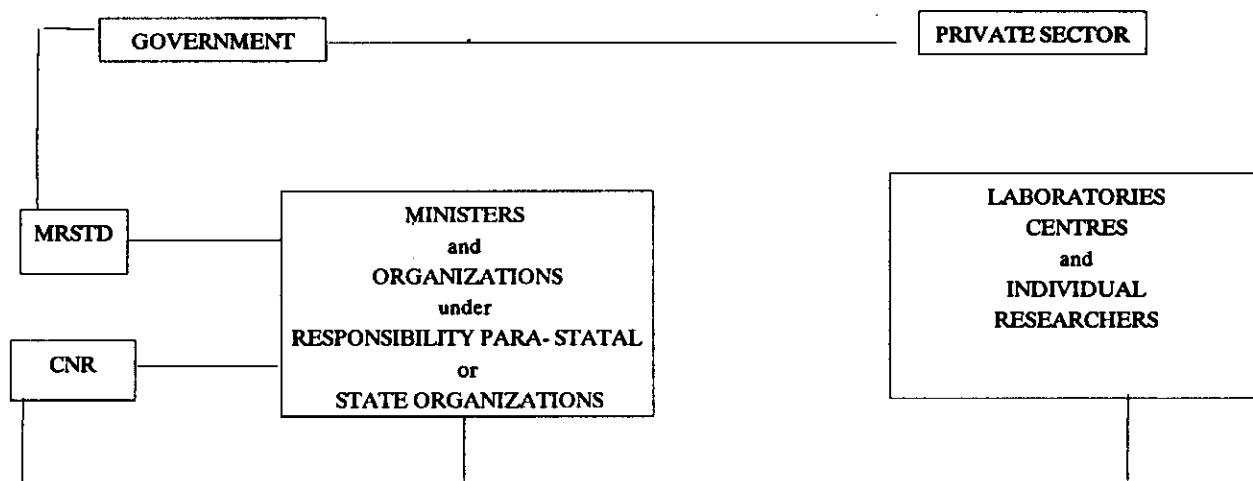
rationalisation of the scientific and technological potential of the country and represents one of the supports of the Government policy for sustainable development.

2.1.2 Sectoral Articulation

By its very mission, the MRSTD should intervene in the various Scientific and Technological Research (RST) Sectors existing in Madagascar.

The following organisational chart makes it possible to understand this sectoral articulation.

Comments: The MRSTD is in charge of coordinating the Scientific and Technological research activities of National Research Centres placed under its responsibility but also those of Organisations depending on other public Ministries or Organisations using fully or partly public funds. This coordination is also extended to individual researchers from the time they benefit from a financial support in the form of a Research Support Fund (FAR).



2.2 Composition

2.2.1 Organisational chart (cf. Annex I)

The general organisational of the MRSTD is as follows:

1. Cabinet of the Minister:

It is composed of Technical Advisers, Inspectors, a Press Attaché, a Personal Secretary and constitute the administrative and political staff of the Ministry.

2. General Secretariat:

The General Secretary assists the Minister in the exercise of his functions. He plays a technical and political role and to that end serves as the bridge between the four MRSTD Directorates and the coordination of CNRs. Furthermore, it has under its authority services whose functions support the functioning of other organs.

3. The Directorates:

The MRSTD is composed of four technical Directorates: DAAF, DASE, DVPPR and DPP. Each of them has a support and animation role for the Ministry and particularly the CNRs. These Directorates comprise different services which act in the execution of functions assigned to them.

4. The Organisations under the responsibility of the MRSTD

2.2.2 Policy Formulating Organ

The general policy of the State on RSTD is adopted in the Government Council. The implementation is entrusted to the MRSTD whose functions are laid down by its decree establishing it. The latter thus draws up the implementation policy during the various Cabinet meetings chaired by the Minister. The General Secretary, the Technical Directors and the CNR Direc-

tors participate in these meetings and closely in the drawing-up of the policy.

With regard to planning, the working out of the Scientific and Technological Research for Development plan is adopted in consultation with the General Directorate of Planning, the users, the Research Units and the Finance.

The CNR is in charge of the implementation of the policy laid down by the cabinet meetings.

2.2.3 Committees and Commissions

Each CNR is administered by an Executive Board and a Science Orientation Council. FOFINA/CEN-RADERU, in addition to the EB and the CSO, has set up the Committee on Research Financing (COFIRA).

The Executive Board (EB)

the role of the Executive Board is to consider and determine the human, financial and material resources to be placed at the disposal of the CNR. That decision must be in line with the general orientation adopted by the Cabinet Council.

The Executive Board is composed of:

- representatives of the MRSTD;
- representatives of Ministries users of the research results;
- representative of the Ministry in the President's Office in charge of Finance and Budget (MPFB);
- a Government Commissioner; and
- if necessary, the representatives of economic operators and Universities.

This composition may vary from one CNR to another but its general design involves all the organs

concerned about all the research activities of each CNR.

The Science Orientation Council

The CSO is in charge of examining the technical documents to be presented to the Executive Board and the research activities presented by the CNRs. That organ should also see the conformity of the programmes with the research means and policy adopted by the Cabinet Council. The opinions put forward by the members of the CSO are submitted to the Executive Board. It is chaired by a Technical Director of the MRSTD and comprises members from other technical Ministries or Research Institutions whose activities were close to those of the CNR.

The Agricultural Research Financing Committee

The COFIRA is in charge of coordinating and orientating the funds intended for agricultural research carried out by FOFIRA.

The Directorate

Each CNR is led by a Director or Director General and comprises the classical services of the administration and technical Departments of Research.

In Addition to the Statutory committees: EB, CSO, the CNRs set up, according to their needs, the different commissions of follow-up, evaluation, orientation and management of projects. They establish scientific cooperation with the different national and foreign partners. In that case, technical Committees are set up

CNR	DEPARTMENTS
CNRP	Ethnobotanical and Botanical Extraction and Chemistry Pharmacodynamics Chemical Experiment Galenic Pharmacy
CENARADUERU	Zootechnological and Veterinary Research Foresry and Fish Farming Research Research and Development Technological Research Agronomic Research Rice Research
CNRI	Energy Informatics Metallurgy Materials Chemistry
CNRE	Environment and Biological Resources Natural Ecosystems Spatial Development and Socio-Cultural Environment Environment and Quality of Life
CNRO	Fishery Biological Physical and Chemical Oceanography Marine Geology
CIDST	Acquisitions Data Processing Data Bank User Service Publication - Printing and Dissimination

2.2.5 Personnel

The surveys made it possible to obtain the following data regarding human resources in the CNRs.

CNR Categories	Scientists and Researchers	Technicians of Different Level	Support and Administrative	Total
FOFIFA	119	93	812	1024
CNRP	14	17	57	88
CNRO	12	5	59	76
CNRIT	37	79	74	190
CNRE	32	24	58	114
CIDST	14	31	37	82
TOTAL	228	249	1097	1574

and convene regularly for consultation or evaluation Sessions.

2.2.6 Analysis and Comments

On the Organisational Chart:

Considering:

- the place of the MRSTD in the Government structures;
- the statutory functions governing the activities of the IPST;
- the new orientations of the National development policy;
- the internal structure of hybrid nature;
- the organisational chart of the MRSTD evolves towards the search for a stable balance to ensure appropriately the necessary activities.

Committees/Commissions:

It is noted for some CNRs that the establishment of a CSO is underway (case of CIDST and CNRO). The establishment of non-statutory Committees is at present increasingly according to the needs of the CNRs.

Concerning the composition of the Executive Boards, a reorganisation of membership was carried out to assign an important, if not majority, representation of users of research results or economic operators.

2.3 Relations

A Science and Technology institution falling back on itself is generally doomed to failure. The quantitative and qualitative importance of relations it established justifies fully its very being. For Madagascar, it is far from being exhausted in this field. The MRSTD has

continued to strengthen and improve the new relations with the outside world, particularly regarding the relations of knowledge and know-how exchange of sophisticated technology.

In addition to the existing relations between the six CNRs under the responsibility of the MRSTD, the latter establishes relations particularly with:

(i) the local Science and Technology institutions;

- the six Malagasy Regional University Centres;
- the Research Institutes (Pasteur Institute, Malagasy Applied Research Institute...);
- the different public, semi-public or private Research Laboratories (LNRT, LNTPB, OFAFA...);
- the Science and Technology institutions under the responsibility of other public Ministries and under some NGOs existing in Madagascar;
- finally some Science and Technology units, associated teams of research, indeed, individual researchers.

(ii) the external Science and Technology institutions;

- the Universities and Specialised Colleges of different countries like France, Italy, Germany, Switzerland, Kenya, Ethiopia, Senegal, Libya, USA, Canada, Cuba, China, Vietnam, Korea, Japan, Philippines, India...
- Specialised Research Institutions: INRA, ISRA, IESPI...;
- National Research Centres: CNRS, CIRA, which encompasses several specialities as:

IRRI, ILCA, CIMMYT, CIAT, ISNAR, IBPGR...; CIRAD, CRODI;

- International Research Networks as ICRAF, IBSRAM, CORAF. The relations with the international S and T institutions are governed by Protocols of Agreement whose functioning and follow-up are the subject of regular Consultation meeting. These Protocols cover different areas of research and concern several international Organisations: MRSTD/GTZ; MRSTD/ORSTOM; MRSTD/CIRAD; MRSTD/MNHN; MRSTD/CNRs; MRSTD/University of Rome/Italian Health Institute, MRSTD/Smithsonian (USA)... In each Protocol of Agreement, specific conventions are established according to the disciplines;
- in addition to the above-mentioned institutions, the MRSTD has permanent cooperation with some international Organisations: UNESCO, UNDP, FAO, UNICEF, UNIDO, WHO...

2.3.2 Relations with the Productive Sectors

There are many relations between the MRSTD and the productive sectors. There are many users of results, particularly:

- the public Ministries among which are: MPAEF, MINAGRI, MINSAN, MTP, MINCOM, MIEM...;
- Para-Statal and private Organisations;
- the different associations of small farmer and small-scale industrialist. Among the latter two categories of operator, the following may be noted: SIRAM, SIRANALA, CIMELTA, JEUMONT, CENAM, Savonnerie Tropicale, OFAFA, COROI, COFARMA, SOMCIA, SEVE, UAMA, NGOs and the external users of products from the MRSTD.

2.3.3 Analysis and Comments

(i) MRSTD Relations with the S and T Institutions

The role of the MRSTD is not only to establish relations in Science and Technology, but to make them dynamic when the activities fall within its competence. To this end, it plays the role of a catalyst in the fields requiring the action of several local or foreign institutions.

Like the development of present technologies, the relations established by the MRSTD encompass almost all the specialisation fields of Science and Technology.

These relations are functional or organisational or both at the same time. Among these relations, a slight predominance of external relations is noted although the internal relations are not neglected.

The exchange of information on Science and Technology at the different seminars, working meetings, symposia in which the MRSTD participates or organises intentionally, lead generally to all forms of relation. During these Consultations, the efforts made by the MRSTD begin to be significant, the exchange of Information and Scientific and Technological Documents are known in Madagascar for the CIDST, having a national inclination deals with it seriously.

(ii) MRSTD Relations with the Productive Sector

The relations aimed at the social and economic integration, under the circumstances, putting at the disposal of the field of national development of new technologies (technology in the service of development), are the most numerous. The awareness of the majority of Malagasy economic operators of the use of new products has been effective: immediate application has been noted. The dissemination of new technologies begins to yield results.

The functional relations are also noted. Several results achieved by the MRSTD are publicised by other Ministries (MPAEF, MINAGRI...), other private or semi-private economic partners and even to the level of small farmers. Some Ministries (example MIEM) work with the MRSTD in specific fields leading to the establishment of Small and Medium enterprises and Small and Medium Industries. It is the same for consultations on the Energy Policy (University Delegation to New Energy) or on the Environment Policy (PAE, UNEP). This type of relations is frequent and must be strengthened.

2.4 Powers

2.4.1 Statutory Powers

The Statutory Powers of the MRSTD are closely linked to its Organisational Structure (cf. U.11.1). Each organisational and hierarchical organ has specific sequential powers.

The central decision-making organ is the MRSTD, assisted by the meetings of the Cabinet and the Directors, Executive Boards and Scientific Orientation Council.

The power of the MRSTD is defined by its status:

"To encourage the multidisciplinary approach of Scientific and Technological Research for development,

the Ministry of RSTD is authorised to establish by Decision of the Sectoral consultative Commissions in which the Research Institutions, the Ministries concerned, the users of research results, the Ministry in charge of Finance and the General Directorate or Planning Participate".

These Commissions hold joint periodical meetings to exchange information and express their views on the general direction and evaluation of the RSTD.

Each Commission may call upon, whenever necessary, any person, any national or international Organisation whose opinion, based on particular knowledge, it deems useful.

The DPP shall be the Secretariat of these Consultative Commissions.

The Statutory powers regarding the planning, programming, coordination, follow-up and evaluation, promotion and protection of results have been assigned to three Technical Directorates. The DAAF has powers as regards the management of administrative and financial matters.

The CNRs are executing organs. To implement the Science and Technology Policy for Development, the statutory powers of the CNRs consist of:

- setting up of associated research teams working for it on pluridisciplinary programmes financed by public funds or convention funds;
- organising and financing travels and stays of members of these teams;
- contributing to the development of joint research work with associated services or laboratories falling under other Ministries, public or private, national or foreign Organisations;
- participating in the economic and commercial use of research results, particularly with the establishment of societies with the assistance of other state services, local communities or other public or private national or foreign Organisations;
- participating in the preparation and implementation of scientific cooperation agreements on a bilateral, regional or international basis;
- managing the research equipment acquired within the framework of these Agreements;

- evaluating the outcome of activities carried out and the quality of work accomplished by the associate teams and researchers;
- publishing the results of research activities in the form of reviews, atlas, guides, maps, bibliographies, audio-visual material and others;
- organising scientific meetings in the form of seminars, conferences, symposia, exhibitions and excursions in the fields falling within its competence;
- especially for the CIDST, it must promote the establishment of a document network in which the libraries and document units depending on public organisations, scholarly and professional societies and economic groupings would participate on a cooperative and voluntary basis.

2.4.2 Perceived Powers

The surveys carried out in each CNR made it possible to point out that the latter has the following powers:

it participates in the preparation of Science and Technology Policy in the fields falling within its competence;

- it has the power to define, plan, coordinate and control all the activities it deems necessary and adequate in the performance of its duties;
- it has all the internal management power: Personnel Management, Equipment and Financial Management.

Each CNR, in its capacity of establishment of EPIC nature, may have particular conventions and services with the economic partners. It has all the latitude of designing income generating projects, the objective to be attained is to achieve self-financing of each CNR, without minimising its statutory inclination.

- it has the possibility to draw-up scientific and technological cooperation Agreements with other partner institutions in the field of national senior staff training and technical assistance. It may also establish societies or pilot units with the assistance of other state services and that by the establishment of Study and Research Centres;
- it may establish and subsidize pluridisciplinary research teams. It behooves it to follow-up and

evaluate the programmes undertaken by the said teams.

- each CNR may establish or organise sensitisation mechanisms, new Technology demonstration sessions for potential users or economic operators.

2.4.3 Comments

On the whole, there is no incompatibility between perceived and statutory powers. Each level tries to carry out the tasks assigned to it. However, at the practical level, the harmony between the perceived and statutory power is not perfect, particularly when we consider the CNRs. Indeed, it seems that the application of powers

comes up against factors that block or reduce the execution of activities. These factors are of different type:

- material :obsolete nature of some equipment;
- financial:instability of financing (amount, allocation) and delay in release of funds;
- human :*lack of quantitative and qualitative staff;
- *lack of motivation.

To have a perfect harmony between the statutory and perceived powers, measures must be taken to mitigate the effects of these blockades and enable an affirmation of the statutory and perceived powers.

CHAPTER 3

ACTIVITIES AND RELATIONS

3.1 Activities

3.1.1 Planning and Programming

3.1.1.1 Planning

The Science and Technology Policy for Development at the national level is drawn up by the Council of Ministers. The MRSTD, the support Ministry in charge of the implementation of that policy, works out the strategies making it possible to attain the objectives set. It is in this perspective that the Ministry set up the Directorate of Planning and Programming.

Considering the major options adopted by the Government and the research strategy the Ministry should know very well the different components which will enable it carry out a coherent and effective action:

- financing of the research work;
- status of the Researchers;
- relations with external STI;
- material resources, laboratory equipment, logistics;
- centralisation of programmes with the definition of the major aspects at the level of institutions;
- reorientation and readjustment of the activities of the Centres;
- strengthening of Centres through training and recruitment of technicians and researchers;
- acquisition of laboratories and scientific equipment;
- an evolutive programme of activities for the repetition of ongoing activities;
- the programming of new projects deemed priority nes;
- strengthening of the follow up and evaluation system;
- local and external financing prospection;
- approval of all projects to be submitted to the superior organs (MEF-MFB) and to donors;
- for everything concerning the formulation of training policy and national and international relations, the function has been entrusted to the General Secretariat.

3.1.1.2 Programming

In this field, the activities of DPP consist particularly of:

- prioritising the research programmes according to criteria established beforehand by the MRSTD considering the local context (accounting with the PIRDs);
- prospect local and external financing necessary for the implementation of programmes;
- study the feasibility and profitability of the programme and the appropriateness of its cost with the expected results.

At the level of the CNR, the activities relating to programming consist of:

- identifying the possible inputs;
- prioritise the medium and long-term programmes and projects;
- study the short term programmes and projects (conventions...) to meet the immediate local needs;
- prepare annual work plans taking into account the means available per programmes;
- draw up execution programmes by considering the directives of the CSO, the EB and the *ad-hoc* research project management Committees;
- draw up the training programmes of its staff;
- identify some national research programmes for its effective participation.

As regards the STI programmes, the CIDST works out a strategy through the combination of the following activities:

- mobilisation of all the human resources;
- adapted STI establishment and research;
- progress in the restructuring of the information supply;
- attempt at mastering technology for a better probability;
- improvement of product quality.

3.1.2 Coordination

3.1.2.1 Between Science and Technology Institutions

The Coordination activities fall within the competence of the MRSTD at national and sectoral levels.

At the level of the IPST itself, there are two sets of Coordination activities particularly: the Coordination activities of the DPP and those existing in each CNR.

The Coordination activities relating to the functions of the DPP consist of:

- making dynamic the relations with the other technical Directorates and all the CNRs to establish and maintain a cohesion and coherence in the Scientific and Technological Activities;
- establish permanent working relations with and between the target units in charge of research in order to avoid unnecessary duplication and identify the drawbacks at the level of drawing up of the policy and the execution of research activities;
- incite the effective participation of users of research results in the financing of programmes (search for easy and adequate procedures of financing);
- ensure, as regards Research and Development, the pre-dissemination with the potential users through the organisation of demonstration and consultation Sessions with the Malagasy farmers and Craftsmen;
- intensify the MRSTD relations with the national and foreign Science and Technology partners in order to use the complementarity of respective activities in each institution (LNRT-CNRT; CIRAD-FOFINA...)

The Coordination activities of the CNR consist of executing the following activities:

- supervision of research activities by the Science Directorate or through an *ad-hoc* Coordinating Committee;
- establishment of CSOs in charge of considering the coherence of research programmes;
- adoption, intensification of the principle of complementarity of activities in Centres;
- targeting of a channel of complementary activities to master the basic technologies at the national level;

- consultation between all the partners (users and services) involved in the same field of research;
- multisectoral and pluridisciplinary cooperation with the different CNRs and STIs;
- sectoral activity (example: 1 - Case of fishery research CNRO-LIFSH-Fishery and Aquaculture Directorate - Marine Station; 2 - Case of CIDST with the establishment of documentary network).

3.1.2.2. Reconciliation and harmonisation of ASTs with the National Policy

At the level of the MRST, the follow up and evaluation of activities are ensured by DASE which intervenes at the different stages of programmes. All the services under that Directorate (Scientific infrastructure service, follow up and evaluation service, implementation service) contribute to supervise the compliance of activities with the MRSTD policy. To that end, the DASE cooperates closely with the DPP for the follow up of the major aspects adopted by the CSOs and the EB and for the submission of the various results and new orientations to the Cabinet Council.

In the CNR, the activities affected by this field relate to the following actions:

- establishment of *ad-hoc* Committees in charge of the reconciliation and harmonisation of activities with the policy of the CNR concerned, under the circumstances the MRSTD general policy (example: Committee to consider programmes for FOFIFA, technical Committee for documentary network for CIDST);
- follow up - evaluation of programmes and activities under the aegis of the CSOs;
- simultaneous actions of the EB and CSO to see if the ASTs comply with the MRST policy.

3.1.3 Execution of Scientific and Technological Activities

3.1.3.1 Implementation Programme

The broad outlines of the implementation programmes are the following:

- material and financial strengthening;
- strengthening of the human potential;
- development of a close cooperation with the training and research work carried out at the level of the regional University Centres and

other institutions and the development actors, normal users of research results;

- -give priority to the establishment of small pilot teams of Research-Development in a certain number of polyvalent basic technologies considering the present development priorities and activities already existing in various sectors;
- systematic Science and Technology data collection for the establishment of documentary networks and data banks on Sciences linked to the use and development of natural resources available in general and in particular the environmental sciences (food, flora, Malagasy pharmacopoeia products and toxic products...);
- valorisation of research results through technical briefs, annual Reports, bibliographic and scientific publications, consultation reports for the users and economic operators and large scale use;
- dissemination of research results by different processes linked to the transfer of technology to the user partners;
- training, guidance, assistance to mobilise national Science and Technology human resources;
- execution of all the programmes, projects and particular activities laid down in the PDRs;
- meet the cooperation and urgent activities, potential remunerative sources to attain the self-financing policy;
- execution of work linked to the maintenance of available scientific and technological equipment.

3.1.3.2 Control and Evaluation

The DASE and DVPPR, in cooperation with the DPP and the CNRs, supervise the control and evaluation of Science and Technology activities particularly in the field of execution. The various data collected during the surveys carried out in the form of questionnaires of follow up and evaluation constitute the basic elements making it possible to grasp the progress in research programmes and projects.

In the CNRs the control and evaluation of ASTs and the duties of the CSOs in general, the EB and some *ad-hoc* Committees "Programme considering Committees" particularly. The surveys carried out in the CNRs within the framework of the study on performances

(CEA) revealed that the latter integrated into their structure the establishment of a follow up and evaluation system in permanent relation with the DASE, DVPPR and DPP.

In the MRSTD, each functional organ, including the technical Directorates and the CNRs, prepare an Annual Activity Report for its field of competence. It is through these said annual reports that the MRSTD evaluates the operations carried out.

The other activities affected by this field relate to the following operations:

- authorisation for marketing (AMM) some products of the CNRP;
- functioning of observation and monitoring networks on environment (CNRE);
- establishment of standards for the quality of products (FOFIFA);
- regular contributions by different members of the documentary networks through the technical Committees per network and inventory operations by regular questionnaires on documentary organisations of Madagascar for programme evaluation (CIDST);
- systematic control of pilot installations (CNRIT);
- control and evaluation of operations on marine natural resources and activities carried out for their rationalisation and management with the partners concerned (CNRO).

Each CNR has all the Science and Technology activity control and evaluation in its field.

3.1.4 Advice

As the objective is to put Scientific and Technological Research for Development in the service of national development, the activities thus carried out should generate advice on the use of new technologies by possible users.

- ensure the improvement and adaptation of imported technologies for the local context;
- contribute to the implementation of the National Research Policy on rural development. In order to achieve it, sensitisation sessions must be held to introduce the new technologies and results to the farmers (high yielding varieties, agricultural technology, fertiliser...)

On the other hand, technical assistance should be established to ensure the application of results and the

transfer of technology. Publications and technical briefs on the new acquisitions must be put at the disposal of economic operators, users and decision-makers. These publications will be made in cooperation with the CIDST while the results will be produced through the DVPPR.

3.1.5 Recommendations

The MRSTD assisted by the Technical Directorates (DVPPR, DPP and DASE) organise and participates in several Scientific and Technological events during which it identifies and rationalises the local Science and Technology potential. It must be pointed out that all the Economic partners and potential users also participate in these events. Activities are carried out within the framework of development and the use of endogenous Science and Technology in the new technologies.

The MRSTD organises commented visits, campaign meetings, science days, seminars, exhibitions and also participates in fairs (SALAMA 89, SAINA...) at the regional and national levels to promote and publicize the results.

In the same order of promotion and dissemination of results, the press section of the Ministry, in cooperation with the researchers, carries out radio programmes and drafts scientific articles for the press.

These different events assist in popularising the activities and results of the CNRs and make it possible to sensitize the donors, the promoters for a possible strengthening of financial resources and reach the economic operators for profit making from and export of results of activities.

3.2 Attainment of Objectives

3.2.1 Planning and Programming

3.2.1.1 Planning

Almost all basic structures are at present operational. The National Science and Technology Policy for Development was drawn up since the inception of the IPST by Decree No 83-353 of 21 October 1983.

In the MRSTD, the Research Master Plan (PDR) has been drawn up. Several PDRs have been prepared by the CNRs, among others: the Agricultural Research Master Plan (PDRA) in force for FOFIFA, the Oceanographic Research Plan (PDRO), under officialisation, by the CNRO. The other PDRs for other CNRs are being worked out including the Environment Research Master Plan (PDRE) by the CNRE, the Science and Technology Information Research Master

Plan (PDRIST) by the CIDST; finally those of the CNRP and the CNRIT are being designed.

The idea aimed at the successful issue and self-financing of each CNR begins to occupy a priority place in the general policy of the CNRs; some related achievements have been pointed out, namely:

- participation of some CNRs as shareholders of production or exploitation companies;
- on-going establishment of a production and marketing Company or unit for the CNRP. The efforts made by the CNR orientate further towards production in particular and development in general;
- establishment of particular convention agreements and remunerative cooperation. Strategies concerning the drawing up of adequate plans in the field or services directed towards local and external marketing of research products are being designed. The establishment of pilot research and development is increasing;
- as regards cooperation in Science and Technology Policy, the working out of a general strategy with the Universities and the CNRs (cooperation before) and with the development operators (cooperation after) has been done as a whole;
- the policy for the national utilisation and development of the natural resources of the country is being drawn up, to mention only the case of the CNRP which uses completely local resources in its area of research;
- the establishment of small effective National research teams is regularly done and according to the needs.

In the STI field, documentary networks have been established and are functional.

3.2.1.2 Programming

Research programmes in all the sectors have been prepared; those on development of local natural resources and those relating to the transfer to technology in the different Research and Development Sectors are priorities.

Programmes leading in the long run to self-financing of CNRs have been designed.

Research Financing Programmes have been established. *Ad-hoc* Financing Committees work in close cooperation with the DPP. This aspect concerns both local and external financing resulting from different

bilateral or multilateral cooperation agreements. To avoid precariousness of financing, estimated programmes have been prepared.

Annual work programmes are submitted and adopted at regular meetings of the EB and the COSs. Each CNR prepared, in conformity with the PIRD, its short, medium and long-term programmes.

3.2.2 Coordination

3.2.2.1 Between Science and Technology Institutions

There has been following achievements in the field of coordination:

- exchange of Science and Technology between all the institutions concerned are constantly carried out.

Indeed, various consultative Commissions have been established and organised by the MRSTD;

- National consultation between the partners involved in the field of Science and Technology and development is at present increasing: for example, consultation within the framework of Environment, that in the field of marine resources;
- the supervision activities carried out by the DPP resulted in the fact that no duplication has been noted between the various CNRs of the MRSTD or the different institutions. On the other hand, it is noted that there is complementarity of action on preconceived programmes. However, some cases of duplication are noted when private institutions are considered (example: case of IMRA and CNRP);
- *ad-hoc* coordinating committees have been set up within the CIDST to coordinate the establishment of documentary networks.

3.2.2.2 Reconciliation and Harmonisation of Science and Technology Activities

The reconciliation and harmonisation activities entrusted to the MRSTD have been carried out on the whole. The PIRDs are in harmony with the National Policy and, to this end, still remain valid and adapted to the national context to date. The CSOs, the EBs, the meetings of Directors and of the Cabinet of the MRSTD are operationally adequate: Follow-up and evaluation actions, mid-term review of programmes have been regularly carried out.

Within the CNRs, *ad-hoc* Committees on programme consideration have been set up for an internal follow-up and evaluation of achievements.

3.2.3 Execution of Envisaged Science and Technology Activities

In general, considering the present economic situation, most of the programmes set have been implemented (40 to 60%). The maximum achievement was not possible because of many constraints which would be stated in Chapter 4.

As for the execution of activities, several results have been obtained by the CNRs. A large number of these remained in the laboratories. On the other hand, some have been disseminated and others patented (e.g.: FANAFEROL for the CNRP).

The training aspect occupied an important place in the MRSTD activities. Most of the researchers involved in the ASTs were given additional training locally or in foreign institutions. To some of them, Universities degrees were awarded at the end of training,

thus guaranteeing their promotion. On the other hand, most of the CNRs are involved in the training and guidance of University students for the preparation of dissertation or Ph.D. thesis.

In the socio-economic field, the execution of CNR activities enabled the development of a certain number of technologies and the adaptation of new technologies having a positive impact on the improvement of the living conditions: improved stove, equipment using local inputs, medicines prepared from local plants...

3.2.4 Execution of Scientific and Technological Activities

CNP

Through the organisation of its different Departments, the CNRP succeeded in preparing a large number of medicines. Some like FANAFEROL have already been patented and obtained authorisation to be marketed (AMM). Others are being patented. To support these pharmaceutical research activities, the CNRP also made an inventory of Malagasy medicinal plants and set up a reference herbarium.

Through the assistance of UNIDO, the CNRP could master the aromatic and medicinal plant development technology. This project executed to about 90% will now be extended thanks to a policy of transfer of technology that will be carried out in pilot companies.

In addition to these scientific activities, the CNRP has been able to raise the level of competence of its

officers following a continuous training policy (all its researchers have been trained in specialised Centres outside the country).

Furthermore, the CNRP is the appointed reference centre of WHO for traditional medicine. It also plays the role of medicine quality control laboratory and of assistance to partner enterprises.

Although, still modest, the achievements of the CNRP seem already to have an important impact on the socio-economic development of the country:

- improvement of living and social conditions;
- development of the plant products of the country;
- and indirectly increase in turnover with the work of some enterprises having obtained its technical assistance.

Correlatively to these results, the establishment of a pilot unit will have positive repercussions on the society with the creation of new jobs.

CNRIT

According to the general direction of the Ministry, the CNRIT is a research Centre for industrial and technological development. On that score, its activities are not limited only to obtaining scientific and technological results but also the effective application of results.

It is thus called upon to strengthen the whole scientific and local potential (contribution to training, contribution to scientific and technological information and documentation, contribution to the strengthening of Scientific and Technological infrastructure and equipment).

Since its inception, the CNRIT has witnessed the execution of a certain number of projects:

- study of biogas with the development of various inputs leading to the establishment of the biodigester and improvement of existing devices;
- development of solar collector system: manufacturing of water solar collector and installation of solar light;
- the other Departments succeeded in devising new building materials and new equipment (improved stove...) whose sale contributes greatly to improve the living conditions and develop some local technologies.

To sum up, the CNRIT contributed to the establishment and improvement of local productions but also the improvement of transfer of technology from outside.

In the field of training, the CNRIT counted on training by research through its open policy before its activities: close cooperation with the University and the other institutions and after with the operators.

This training policy culminated with the establishment of small competent and operational specialists.

CNRO

The point of departure of any programme of action is that of the National Development Plan which has been summed up in the form of PIRD. As regards the CNRO, the objectives have been clearly set out in the PDRO (being officialised) or the Oceanographic Research Master Plan and they fell in the line with the following aspects: Food self-sufficiency - Development of Export Products - Improvement of Living Conditions. A certain number of priorities must have been adapted considering the human and financial potential of the Centre. These priorities are the synthesis of knowledge in the fishery area:

- evaluation of stocks, dynamics of population;
- obtaining of socio-economic data or small-scale and traditional fishing;
- improvement of knowledge about deep water crustaceans: Shrimps, Crabs...
- knowledge of coastal traffic and improvement of knowledge on marine hydrology and primary productivity;
- knowledge of problems of tunny fishing: availability of living baits, biology of reproduction and migration of the tunny fish...

The Scientific achievements of the CNRO go together with a staff training policy of the Centre. Most of the Scientific officers could thus accede to higher degrees through their scientific activities and the different courses they followed in the partner laboratories within the framework of regional programmes:

COI (IOC)--- Tunny Fish Project

COMARAF----- African Programme on Coastal, Mangrove,

Lagoon Ecosystems

UNEP-- Programme on sea mammals

Furthermore, thanks to the cooperation with the Maritime Science Training Institutions, Universities,

UFSH, marine station, the CNRO contributed to the training of young researchers by guidance for the DEA dissertation or Ph.D. thesis.

FOFIFA

In the field of research activities, FOFIFA has obtained several results of which:

- some are for the improvement of present scientific knowledge;
- some are developed through technical briefs for the users;
- some are used on a large scale.

With regard to the implementation of PIRD "Food Self-Sufficiency", the achievements contribute to the improvement of productivity in the National Agricultural and Animal Production in conformity with the directives of the *ad-hoc* Committees (CSO, EB), which are:

- acquisition of new high yielding, adapted varieties of rice, corn and food crops;
- development of a biological fertiliser or green fertiliser and chemical fertiliser formula for a better yield;
- farming technologies adapted to the Malagasy rural area;
- production of improved seeds available for the farmers;
- development of an adequate integrated plant pest and destroyer control system;
- acquisition in the field of improvement of zootechnology and animal health, several high milk and meat yielding cattle breeds which issue from genetic research carried out;
- development of many vaccines and serum for different cattle, sheep, goat and chicken diseases.

Concerning the PIRD "Development of Export Crops", pepper, cotton, sugar cane, coffee, vanilla, tobacco... FOFIFA has made several achievements regarding varietal research, integrated control system, farming and post-harvest technologies.

As regards the PIRD "Development of Natural Resources", the achievements of FOFIFA are particularly:

- development of high yielding forestry species for reafforestation (pine, eucalyptus...) and wood technology;

- development of fruit resources leading to processed products: fruit juice, liquor, etc...

At present FOFIFA has many scientific results most of which have not been used on a large scale. For the disseminable results, FOFIFA organises regularly commented activities, campaign meetings aimed at not only to show to the possible operators the achievements of different operations but also to sensitize them about the adoption of new technologies.

In the field of training, FOFIFA also applied the policy laid down by MRSTD for its human potential. The majority of technicians

and researchers were given training courses in different international training institutions according to their speciality.

Finally, in the fields of relations and financing, considering the EPIC nature of the establishment, FOFIFA has already executed several contracts with particular conventions. Income generating conventions were implemented to achieve self-financing.

CIDST

The achievements of CIDST are:

regular inventory of existing documents in partner Organisations. At present, CIDST has 6000 volumes of document;

computerisation of CIDST for the establishment of a data bank;

establishment of four specialised documentary networks, namely:

*MIREMBY Network :Scientific and Technological Research

*BETAFITA Network :Industrial and Technological Research

*MAMPITA Network :Agricultural Science

*JACCARANDA Network:Economy

-Various Publications;

-Research for Development (3 series);

-Archives of the different CNRs;

-Journal of the Researcher;

-Bibliography Bulletin;

-Directory;

-Monography;

-Symposium Records;

-Different Reports;

-Newsletter.

All the achievements of CIDST contribute to the gradual integration and the distribution of Scientific and Technological products. In the field of training,

CIDST gives training courses and assistance in computerisation and computer science. These are meant for its own staff, those of other CNRs and other services. Furthermore, CIDST sends regularly its technicians to specialised institutions for further training.

CNRE

Since its recent establishment, the achievements of the CNRE are still modest, however, some partial achievements deserve to be noted particularly:

- knowledge and development of biological resources;
- study of the different factors of natural ecosystems for a better management of the environment;
- analysis of the interaction between man and his environment;
- improvement of the living conditions of the people: tropical disease control and quality control of foodstuffs. The researchers training aspect deserves a special mention. Indeed, since the launching of the Centre, most of the researchers have received additional training.

3.2.5 Advice

Some results have been obtained in the execution of the CNR activities. These results are recorded in the archives and Activity Reports submitted to the responsible authorities at the end of each budgetary year. The scientific results and unprecedented discoveries made at the CNRs or other research Organisations are published in Scientific reviews entitled: "Research for Development", published regularly by the MRST. This publication has three (3) series:

- "Biological Sciences" Series;
- "Man and Society" Series;
- "Technological Sciences" Series.

Following the obtaining of new technologies and patentable results, the wish is expressed that a decree on industrial protection and property may be prepared so as to safeguard the interest of the CNRs and the Government. The Directorate of Results Dissemination, Promotion and Protection work in the same direction and the texts are being prepared. In the field of Agricultural Research, the wish is that legislative texts be enforced for the phytosanitary control and newly imported products be quarantined. Sensitization actions are carried out regularly for potential users and economic operators either by advertisement boards or by participating in scientific and trade events.

3.2.6 Recommendations

- Activities for financial resource mobilisation for the implementation of the Science and Technology Policy were carried out. Requests for local and external financing are made forthwith;
- Scientific events have been organised (commented visits, campaign, meetings, exhibitions) by MRSTD which continued to participate in Seminars, Scientific Days, national or international Symposia;
- As regards endogenous capacity building and in conformity with the multidisciplinary approach chosen by the MRSTD, associated teams in specific fields were set up and are at present operational;
- Concerning the popularisation of Science and Technology, continued efforts were made by the DVPPR with the assistance of the DVA/MINAGRI in the agricultural field or of other services in the other fields;
- In the sensitization field, activities should be carried out to affirm the national scope of CIDST.

3.2.7 Analysis and Comments

Concerning Planning and Programming

Each CNR worked out policy strategies according to its respective field: the PDRA in Force the PDRO being officialised, the PDRE and PDRIST being drawn up, the Pharmaceutical Research Master Plan (PDRP) and the Industrial and Technological Research Plan (PRDIT) are being designed. Along with these achievements, each CNR drew up operation plans, annual work plans and long-term plans.

Concerning Coordination

The achievements made it possible to note that at present the general coherence between the Science and Technology Institutes and the activities they carry out is established gradually. Efforts have been made by each STI to avoid duplication and encourage complementarity.

Concerning the envisaged Scientific and Technological Activities

Our analysis made it possible to note that some programmes had been implemented in complete conformity with the schedules or the PTAs drawn up beforehand. However, other programmes faced delay

problems in execution because of various factors (material and financial resources).

Concerning Advice

The sensitization activities about the achievements of IPST are carried out forthwith. Advice about transfer and application of new technologies gave encouraging results: the number of related publications increases considerably.

Concerning Recommendations

The endogenous Science and Technology resources are used rationally by increasing the Science and Technology associated units or teams.

Dissemination activities increase gradually. The Scientific and Technological sources including the collection and dissemination of data are very varied.

To sum up, the achievements by IPST are encouraging but they are, nevertheless, modest considering the scope of the mission entrusted to it.

CHAPTER 4

STRENGTH AND WEAKNESSES

4.1 Objectives and Functions

All the objectives and functions set up the MRSTD and the Science and Technology Institutions under its responsibility are adequate as a whole. This situation constitutes one of the strong points of the IPST considered. The objectives set by the National Science and Technology Policy have not been amended substantially and they still constitute a long term plan.

Each CNR confined to its objectives and specific functions is at most "limited" in its mission compared with other CNRs. There is a lack of concerted actions which could strengthen the complementarity of CNR activities to attain the same objectives.

4.2 Organisation

4.2.1 Structure

The sectoral articulation of the IPST within the Government gives it a preponderant place in the National Science and Technology Policy. As the MRSTD is a support Ministry, it is called upon to work before with the ministries in charge of socio-cultural fields, particularly the MINESUP and after with the production Ministries such as MPAEF, MINAGRI and MIEM...

As regards the upstream relations and, as it is in the world, higher education should constitute the fundamental research base. The MRSTD has requested a cooperation with the University to attain the following:

- strengthen the National Research Centres in the execution of some necessary research activities for Development;
- contribute to the Researcher Training by orientating further the Ph.D. training towards the search for solutions to the problems of this development.

The relations have not always been easy following a certain trend to keep the University Research free and autonomous. On the one hand, it has not always been possible to have a formal agreement as regards the orientation of the work of the Ph.D. students towards the study and search for solutions to problems of our development. That constitutes, in our opinion, a major handicap in the appropriateness between training and employment and in the search for solution for the mitigation of unemployment problems.

Furthermore, this upstream organisational separation prevents a better knowledge of the present scientific and technological potential and ensures better the role of coordinator of research work assigned to MRSTD.

The downstream sectoral articulation does not seem to pose major problems to the potential users and the economic operators although there is still hesitation in some areas following a wrong dissemination of information and a lack of exchange between the two entities. The present awareness about different components constitutes, however, a major asset for the operation of the structure set up. Indeed, given the present economic situation, the use of well adapted technology and the development of local products is beneficial for the development of the nation.

4.2.2 Composition

The composition of the IPST as presented under the Chapter "Organisation" does not call for any particular remark. As the establishment was completed very recently, its force seems to lie in a greater cohesion of different organs and in a better coordination of their activities (establishment of a rapid information system which informs the different links about the current events and activities taking place at each level).

This recent organisation, however, reveals a certain number of weaknesses particularly in the collection of finalised reports and their transmission to the possible operators.

4.2.3 Relations

As pointed out by mentioning the strength and weaknesses of the structure, the relations established by the MRSTD constitute a certain number of assets and have drawbacks.

They are assets as regards:

- the utilisation, afterwards, of the achievements of Science and Technology to improve the living conditions;
- the involvement of economic operators in the promotion of RST by suggesting new research directions and by participating in the financial support to these activities.

The drawbacks lie mainly in:

- relations between dissemination and research;

- lack of information between possible partners, hence the risk of duplication of projects;
- the non-conformity of the degree of importance given to ST data by the different partners, the users and the decision-makers;
- the holding back of information for various reasons which often leads to ignorance of results obtained and an important volume which only awaits use remains in the drawers.

4.2.4 Powers

The weaknesses noted are linked to several factors, particularly:

- too long a delay decision-making and implementation of the latter;
- lack of regulations governing the functions and powers of ad-hoc Committees which leads to a demotivation and lack of devotion by the Members;
- at the level of decisions, it is noted that there is inappropriateness of some decisions for allotment of research means with the importance given to R and D activities;
- administrative slowness to release research funds leading to hesitation in terms of power and delay in execution of activities. Everything that is linked to this slowness, among others, the complication of the invitation to tender procedures, the slowness in signing of conventions or approval of contracts, constitutes one of the weaknesses hindering the materialisation of powers;
- the inexistence of regulations governing the researchers and the technicians trained in each CNR.

4.3 Resources and their Utilisation

4.3.1. Human Resources

The IPST has all the categories of Officer required at different levels of decision-making and actions: central level and in the CNRs. If the strength and the qualification seem relatively satisfactory in the Ministerial Cabinet and in the support Directorates, it is not the same in the CNRs. The staff strength is far from adequate and needs substantial qualitative and quantitative strengthening to expect a high level of performance.

This strengthening is desired in all categories of staff and more particularly among senior researchers (Chief of researcher and Directors of research). This shortage

of skilled staff is a direct consequence of lack of budgetary codes due to a difficult economic situation. One could also mention the lack of an inciting status which makes it difficult to get the researchers interested and encourage them to devote themselves further to research work. Indeed, at present, the only existing status for the researchers is that of teaching researchers which stipulates that only degree holders of universities may accede to it. The problem that poses, therefore, is the integration of engineers trained on the spot or in foreign colleges and already working in the CNR. This leaves a certain ambiguity concerning their situation.

Furthermore, this lack of status is worsened by the frequent departure of the researchers from the CNRs to the Universities or more remunerative private firms. We have already pointed this out in Paragraph 2.4.3.

4.3.2 Material Resources

The present infrastructure is very inadequate to take care appropriately of all the CNR activities. Some CNRs are compelled to rent Offices.

The premises available are, in general, decrepit requiring urgent restoration work.

As regards consumable materials and products, there is a general shortage, particularly:

- lack of documentary work tools for the CIDST
- lack of research boat for the CNRO, etc...

It has also been noted that there is a lack of equipment maintenance infrastructure and that the existing machines are decrepit.

4.3.3 Financial Resources

As regards this aspect, the weaknesses prevail over the assets. At the national level, the volume of financing allotted to research work is clearly below the international standards. Indeed, only 0.5% of the GDP is earmarked for this sector.

At the level of CNRs, shortage of financing is a major weakness. It is noted that every CNR is facing shortage of financing. This embarrassing situation has negative repercussions

on the implementation of programmes laid down. Some activities had to be suspended and some research stations had to reduce work to a minimum pending the inflow of new resources.

As for external financing, the contribution is substantial. However, access to these funds and their release is often very complicated following the very exigency of donors (very lengthy procedures, very huge

counterpart funds beyond the reach of the Government). On the other hand, the initiation of a long term research based on external financing is always very risky for the related activities may be compromised if the funding runs out. This dependency situation makes the future of research work precarious if no remedy is found.

4.4 Analysis and Comments

Concerning the objectives and functions.

The Science and Technology activities of the CNR constitute a rather complete coverage of all the vital sectors: human health, food, energy, building materials, export products, import substitute products... The objectives set by the PIRD are complied with though the attainment is far from being perfect.

Concerning the Organisation.

The structures adopted for the attainment of objectives are, in general, solid and coherent. However, it should be stressed that the consultative Committees do not play their role at the operational level. As a matter of fact, in spite of their vocation, they never convened formal meetings.

On the other hand, the relations established by the MRSTD, particularly with the external STIs are beneficial. They translate an open door policy of the Malagasy IPST towards its foreign counterparts and particularly an attitude to familiarise itself with the imported tech-

nologies so as to adapt them to the local realities. These relations are related to the different activities carried out by the CNRs.

Another form of relations, however, deserves to be pursued and developed which is that with the economic operator otherwise the results and the technologies designed at the level of the CNR may be ignored and not developed.

Concerning the Resources and their Utilisation.

The human resources management may sometimes be delicate. As a matter of fact, as stressed many times, the lack of motivation and interest in the researchers leads to departures and defections which are detrimental to the CNR activities: delay in the publication of results, leakage of results, activities in abeyance. A fair and equitable policy of promotion and motivation should be considered quickly enough.

The problem of equipment also represents one of the weaknesses of the IPST. It is important: shortage, decrepit, lack of spare parts, maintenance problem. This constitutes one of the factors hindering the research activities.

The lack of communication between the different actors working on the same subject destroys furthermore any spirit of competition which leads to a stagnation of skills.

CHAPTER 5

RECOMMENDATIONS

At present Madagascar has a functional and effective IPST capable of implementing a National Science and Technology Policy. This IPST has executing institutes or CNRs and an organisational structure which supports these institutes. The recent restructuring of this IPST bears out the political will to make Science and Technology an instrument of development of this IPST, as we have pointed out in Chapter 4. This leads us to make some recommendations.

5.1 Objectives and Functions

The objectives formulated by the MRSTD agree in general with the development policy laid down by the Government. They also constitute a long term plan. However, as all the means used are not always equal to the objectives to be attained and that all the problems are linked, some recommendations deserve to be accepted. To avoid all forms of powdering at the level of the CNRs, a reduction of subjects dealt with should be considered on the basis of the financial and human potential of each Centre, as this will ensure the concentration of resources on one or a few priority subjects.

On the other hand, the CNRs should contribute to the establishment of pilot units and production systems thus encouraging the development of achievements and particularly the movement towards a greater financial autonomy.

5.2 Organisation

By its orientation, the IPST occupies a preponderant place in the economic development of the country. Thus, it would be advisable if a broadening of participation of various structures (universities, industries, operators...) in the research activities could be accepted.

At the level of the CNRs themselves, no particular recommendation was mentioned except the wish expressed by CNRIT for the establishment of support Departments concerning the electro-mechanical workshops, the manufacturing workshops, the studies and methods Departments and the raw materials store.

This recommendation takes care of the concern of operationalisation of the structures established and the mastery of the technologies used.

The relations with other national and foreign IPST deserve to be intensified: bilateral and multilateral

cooperation encompassing the different Science and Technology activities, the Science and Technology data should furthermore be constantly exchanged and information networks should be established between the different national and international organisations.

As regards the powers, some recommendations must be accepted:

- activation of decision-making and their application;
- promulgation of legislative text regulating the functions and powers of *ad-hoc* Committees so as to motivate the members and avoid absenteeism;
- wish for a simplification of administrative formalities;
- finalisation of legislative texts governing all the researchers and technicians who underwent internal training in order to avoid skill drain.

5.3 Resources

5.3.1 Human Resources

Human resources constitute one of the weak points of the CNRs from the qualitative and quantitative view point. A remedy can be found through:

- a better integration of the scientific potential of Universities where more than 70% of the human potential likely to carry out research work is found;
- a better promotion of researchers of the CNRs through the preparation of an adequate status for all the researchers;
- a restructuring and protection of the prestige of research practice and art of the researcher by giving him the possibility to defend his results and enjoy the fruits of his activities of researcher;
- reduction of number of issues dealt with by IPST;
- production of pilot factories and production companies by strengthening the strategies leading to the financial autonomy of each CNR.

5.3.2 Material Resources

They are another negative factor of the IPST. All the executing institutes or CNR, with a few difference, face the same problem. In spite of the efforts made by the

Government, the situation remains critical. The recommendations of the CNRs are summed up as follows:

- extension of existing premises;
- acquisition of laboratory equipment;
- strengthening of the logistic support: rolling stock, research boat, etc...
- establishment of a maintenance structure.

5.3.3. Financial Resources

The stability of financial resources is a serious concern of a long term policy for the perennialization of the IPST. The public powers make an appreciable effort for the financing of the research work but it is far from being adequate.

The state subvention is, mostly, absorbed by the Staff and recurrent expenses. The research activities are thus

largely dependent on external assistance. We think that a financing prospecting should be intensified so as to raise its level:

- increased participation of economic operators in the financing or development of research work;
- participation of decentralised communities in the financing of research work or the establishment of Regional Research Centres;
- allotment of well determined quota from the Commissions on the product marketing;
- self-financing by valorisation and promotion of results;
- striking of a balance between investments, salaries and science and technology activities.

CHAPTER 6

CONCLUSION

In Madagascar, we consider that the performance of Science and Technology Policy Institutions is a reality owing to its wealth and diversity. Wealth for it dates as far back as the colonisation period and it has afterwards been strengthened with the establishment, since 1983, of a Ministry of Scientific and Technological Research for Development which is stable and operational. Diversity, for it covers several fields which particularly concern the various aspects of a sustainable development.

The analysis of the needs in IPST for a better management of resources and for a rational use of its potentialities is in line with our Science and Technology Policy.

If the objectives and present functions are clearly defined and the structure and organisation adequately built, nonetheless their implementation and success depend on a certain number of limiting factors linked to material, financial and human resources which are necessary to obtain tangible and lasting results for development.

These resources themselves depend on the national political will: the will to make Science and Technology as determining factors of development but also of a well-thought out policy on external resource mobilisation through judicious bilateral and multilateral cooperation.

The success of this cooperation depends on a credible IPST having a solid and reliable management capacity. This credibility needs, for our case, the establishment of a certain number of accompanying measures based on a better human resource development. The following measures are thus recommended:

- training of researchers;
- an adequately developed documentation and information exchange;
- a wide opening towards the outside world to make up for our insularity;
- a well-established and well-followed up publication policy
- without forgetting the inciting considerations and the permanent search for the aspects of staff motivation: promotion, adequate status, indeed even the honorary distinctions...

Our constant concern is the strengthening of achievements and the search for a lasting mechanism, characteristics of a viable and well-built IPST. The various weaknesses which we now know must be pointed out and the search for adequate solutions and corresponding improvement are the greatest challenges for our IPST.

Finally, the choice of our structure issues from everything that has been said: THE STRUCTURE OF OUR IPST is hybrid for it is both horizontally and vertically integrated. Its horizontal nature is related to its privileged position of being responsible for the National Research Policy for Development. The mission of our IPST is, therefore, the reply of the Government in the field of Scientific and Technological Research in general in Madagascar.

Finally, to succeed our IPST depends on:

- well defined vertical structures to face the different development sectors;
- and structural working relations within the purview of Associated Teams in the fields which are not directly covered by our National Research Centres.

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PERFORMANCE REVIEW OF SCIENCE AND TECHNOLOGY POLICY INSTITUTION IN MALAWI

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EXECUTIVE SUMMARY

In Malawi there is an explicit commitment to science and technology as important strategic variables at the highest level of political leadership. This commitment has manifested itself in several Presidential decrees principal amongst which are those which resulted in establishments of the National Research Council of Malawi as an apex advisory body; the Department of Research and Environmental Affairs as a ministerial apex body entrusted with, inter alia, the responsibility of formulating and facilitating the implementation of S&T policies, identifying and promoting front line areas of research in different S&T by different sectors of society and industry, and international S&T affairs; the Committee on Scientific and Industrial Research and Development; the Malawi Award for Scientific and Technological Achievement; the Committee on Secondary School Science Competitions; and the annual celebration of the Scientific Revival Day of Africa on 30th June.

The paper shows that following a Presidential decree in 1974 that the National Research Council of Malawi (NRCM) be established, it was recognized at national seminars for policy-makers that were held in 1986 and then in 1987 that the complement of the NRCM Secretariat staff was far inadequate to service the demands of both the scientific community and the private sector, and that the grades of the posts created for the Secretariat were not commensurate with the duties and responsibilities placed upon the Secretariat personnel. After this weakness was observed the Malawi Government directed that the Secretariat be re-organized and re-structured and that the Secretariat staff be strengthened in terms of its compliment and grades.

Additional posts for the NRCM were created in early 1988 and in a press release quoted by the local media on 20 February 1991 the Government announced that Malawi's Head of State and Government had directed that a Department of Research and Environmental Affairs be created in the Office of the President and Cabinet and that "as a result of the new set up, all matters pertaining and relating to research and environment, which were previously handled and dealt with by

the National Research Council of Malawi would come under the new Department". As this paper shows, the mission of the Department of Research and Environmental Affairs (DREA) is to promote an effective contribution of research, science and technology to the quality of life and prosperity of the people of Malawi. In carrying out this mission DREA and its predecessor have pursued several goals principal amongst which are those detailed below.

National S&T Policy

Cognizance of the fact that in the absence of clear policy guidelines, institutions involved in R&D tend to make their own inferences about national needs and act accordingly led the Department to formulate a National S&T policy which has now been approved by the Government after taking into account inputs from the scientific community and other interested individuals.

National Inventory of S&T Capability in Malawi

Cognizance of the fact that in the absence of clear pKnowledge of the available human resources for science and technology must be one of the factors to be used as a basis for any decision to develop the scientists and technologist for the required calibre. It was in this context that the Department of Research and Environmental Affairs has conducted a survey aimed at obtaining data on Malawi's current S&T capability.

National Inventory of Technological Needs in the Private Sector

One of the functions of DREA is to ensure that the scientists and engineers in the country are relevant to industry. Indeed the scientists' innovations and inventions can be expected to be useful to industry only if the R&D activities from which they emerge are demand oriented. To identify the private sector's technological needs, DREA has conducted a survey on the type of technologies needed by the industrialists/entrepreneurs. In the survey an attempt was made to establish whether or not industry in the country was

willing to support R&D activities geared towards providing solutions to production constraints.

The information obtained from this survey will soon be published together with some data from another survey which was conducted to establish the availability of technologies that have endogenously been developed in the country. It is hoped that the publication will serve to show to the scientists the type of problems the private sector wishes to see solutions provided for, and to the private sector the type of technologies that are locally available. The survey conducted on the availability of locally developed technologies has pointed to an urgent need for the establishment of mechanism and policies for the commercialization of inventions. The Department will in the near future submit proposals, for Government consideration, aimed at addressing this issue.

National Inventory of Approved Research Projects and Priority Areas of Research

One of the functions of the Department of Research and Environmental Affairs is to take an inventory of all research activities conducted in this country. In a survey conducted recently an attempt has been made to give a summary of research projects and priority areas of research identified by various research organizations in the country. The presentation of the data is so designed that a reader is able to review the research projects summarized herein in relation not only to the priority areas of research but also to policy objectives.

It is the wish of the Department of Research and Environmental Affairs (DREA) that research activities conducted in the country are consistent with the socio-economic realities that prevail locally and that their execution is in support of the country's developmental needs. The Department would like to see also the establishment of an adequate system for planning, allocating, and monitoring research resources which can be used to avoid not only the fragmentation and overlapping of research activities between different ministries and institutions but also a misallocation of resources. The data summarized in the 1991 publication indicate areas where collaborative research activities could be encouraged in order that resources, be

they human or financial, allocated for the purpose are effectively utilized to the benefit of the country.

A National Inventory of Items of Laboratory Equipment

It is now generally accepted that in most developing countries one of the factors which constrain the effectiveness in R&D is inadequacy of research facilities. It is observed in many developing countries that equipment, instrumentation and materials that are essential for the effective execution of R&D activities are either non-existent, in a poor state of maintenance, or insufficient or regular supply.

In this country many items of scientific equipment have been procured. To obtain information regarding:

- (i) the type and quality of the items of scientific equipment that have been procured and brought into the country,
- (ii) how many of them are currently functional, and
- (iii) whether or not at an institution where equipment is, there is an Instrumentation Officer/Technician who is responsible for repairing and/or servicing the equipment.

DREA has conducted a survey the findings of which have been compiled and recently published.

Survey on Library and Documentation Services

The effective utilization of science and technology for development essentially involves the collection and processing of scientific and technological data from various sources and combining them to produce the desired technological input for the implementation of national, industrial and economic development projects. An efficient information and documentation service that enables timely access to any kind of scientific and documentation information available either locally or through an international network of information systems and services is regarded to be prerequisite to the fulfillment of the numerous tasks assigned to the Department of Research and Environmental Affairs. It was in recognition of this fact that the Malawi Government decided to establish a national information and documentation centre.

Much of the information generated in the country is in the form of cyclostyled and mimeographed documents that are not easily made available for the general public to read. It is also known that each of the library and documentation units established at various organizations in the country tends to act only within its constituency of clients and normally within its own institution. The Department of Research and Environmental Affairs believes, however, that, with the country's resources, a comprehensive information and documentation service can be achieved only by resource sharing at national level and extensive use of external sources and services.

It was within this context that the Department decided to conduct a survey aimed at taking stock of S&T information and documentation services that are currently rendered in the country. The libraries of information and documentation centres covered in the present survey were R&D government and parastatal institutions; private R&D institutions; and service rendering and manufacturing organizations. The information obtained is being processed for publication.

Five-Year S&T Plan

A Five-Year S&T Plan has been proposed by the Department of Research and Environmental Affairs. It has been observed in the Five-Year Plan that competing demands for limited resources require that careful attention be paid to planning and the development of appropriate infrastructure at an affordable cost, and that important concerns that should be addressed are:

- (i) ensuring that S&T are intimately integrated into the national macro-economic planning process;
- (ii) establishing the most appropriate infrastructure for invention, innovation and the application of S&T;
- (iii) determining, from time to time, S&T priorities for action;
- (iv) acquiring or transferring technology;
- (v) organizing the appropriate infrastructure for coordinating, monitoring, evaluating and forecasting, and for advising on S&T activities;
- (vi) providing appropriate S&T support services such as testing, quality control, stand-

ards and an adequate indigenous base for design, development and maintenance of scientific equipment.

The details of the proposed Five-Year Plan have been summarized in this paper.

Science Popularization

In order to generate, encourage, catalyses and give a fillip to science popularization programmes, the projects, schemes and activities initiated by the Department are science fairs and exhibitions, science competitions, an annual celebration of Scientific Revival Day of Africa, the use of the audio and audio-visual media like radio and films for popularization of science, the presentation of the Malawi Awards for Scientific and Technological Achievement, and science quiz and interviews on scientific topics.

A review of the functions of the Department in relation to what has been so far achieved clearly shows that the degree of congruence between the stated functions and those hitherto pursued is very great. What has so far been pursued and achieved also bears testimony to the fact that the Department enjoys the cooperation of the other S&T institutions in the country. It has been pointed out in the paper, however, that with the creation of the Department of Research and Environmental Affairs, there is need for more posts to be created, more buildings and equipment to be made available for the Department, and more financial resources to be allocated to the Department. In a conclusion it has been implicitly observed that the type of S&T institutions per se cannot achieve the stated missions if they are not supported by policy instruments. It is in this context that it has been reported in the paper that in pursuance of the Malawi Government's desire to create an effective interface between the scientists and industry, and in order to encourage the private sector to fund, or to involve itself in, R&D activities, the Department of Research and Environmental Affairs has proposed that a system of incentives that is supported by the necessary policy instruments be considered. The proposals are currently being considered by an appropriate committee before they are submitted to the Government for consideration and guidance.

1.0 PREFACE

1.1 Introduction

No pronouncement can match the seriousness of purpose and direction as the Lagos Plan of Action for the Economic Development of Africa, 1980-2000, which was adopted by the African Heads of State and Government at their Second Extraordinary Session that was held in Lagos, Nigeria, from 28 to 29 April 1980. In adopting the Lagos Plan of Action for the Economic Development of Africa, the Heads of States and Government showed their determination to take the necessary measures that would ensure the development of an adequate science and technology base and the appropriate application of S&T in spearheading development in various productive sectors.

Preceding this pronouncement was the Vienna Programme of Action on Science and Technology for Development that was adopted in 1979 at the United Nations Conference on Science and Technology for Development, and which was an important step in bringing into sharp focus the attention of the world community to the need for fostering and sustaining the development of S&T in the developing countries. The Vienna Programme of Action on Science and Technology for Development was adopted after almost two decades had elapsed during which African countries had tried to encourage the development and utilization of S&T as tools for development. One of the ways in which they decided to achieve this objective was through the creation of national institutions that were responsible for science and technology policy. The functions of the institutions for S&T policy (ISTPs) entailed and still entail:

- (a) Planning; including development of S&T policy and programming of S&T activities;
- (b) co-ordination; that is, seeking coherence and consistency among S&T activities, as well as compliance of those activities with S&T policy, where such policy exists;
- (c) execution; that is, management of S&T activities in general and implementation of specific S&T programmes, alone or in collaboration with other S&T institutions;

- (d) advice; that is, providing information to government and the general public on S&T issues; and,
- (e) advocacy; including popularizing S&T, and mobilizing support for S&T activities.

1.2 Objectives of review

Since its inception, the United Nations Economic Commission for Africa (ECA) has championed the need to have viable S&T policy-making bodies. It was, therefore, in this context that the Natural Resources Division of ECA decided to assess the past and present programmes of the ISTPs created by African countries, by initiating a project the main objectives of which were to identify past strengths and weaknesses, indicate present and potential obstacles, and then search for viable future reforms and improvements. Its specific objectives were:

- (a) to examine the statutory characteristics of selected institutions for S&T policy, including their stated aims and functions, prescribed organizations' structures, compositions of their Councils or Boards, links with other institutions, promised legal powers and resource allocations.
- (b) to review the institutions' past and present activities, highlighting their ways and means for attaining their stated objectives, in order to establish their actual characteristics, to compare these with those indicated by local needs and by the institutions' statutes, to account for disparities, if any, and to relate these disparities to the institutions' past and present performance;
- (c) to compare the institutions' statutory and actual aims and functions with those of other relevant national institutions, including government departments, in order to determine the extent to which similarities in statutory and actual aims and functions spawned rivalries or encouraged cooperation between those and other institutions;
- (d) to study the nature and working of the local power structure, now and in the past, espe-

- cially with regard to authority for allocating resources, to institutions for S&T policy;
- (e) to review performance of the institutions by estimating the extent to which actual achievements represent attainment of stated goals, or elimination of obstacles against the attainment of those goals; and
 - (f) from the emerging conclusions and from comparison with successful institutions for S&T policy in other parts of the world, to suggest ways in which African institutions for S&T policy could be strengthened and/or to propose new arrangements, alternative to those institutions, that would be more effective than they are in promoting and utilizing S&T for development.

1.3 Acknowledgements

Malawi has been honored to be one of the African countries selected for the ECA's review of the perfor-

mances of institutions responsible for science and technology policy.

The author wishes to express his sincere thanks to the Malawi Government for nominating him to take part in the study; Mr. C.W.S Chinthu Phiri for the assistance rendered during the study; Mrs R. Msaka for graciously and splendidly putting the manuscript on a word processor and for patiently and unremittingly coping up with what seemed a never-ending number of revisions that had been occasioned by the creation of the new Department of Research and Environmental Affairs; and Mrs. J. Maida for sparing her valuable time to proofread this paper. In acknowledging his debt to the above-mentioned, the author does not impute to any of them any share of responsibility for any errors which may have escaped notice, *homonym est errare*, and for the views expressed in this paper.

2.0 Background

2.1 Rationale for the Establishment of the Department of Research and Environmental Affairs

Research and experimental development (R&D) for the agricultural industry has been a priority area for research in Malawi since the country gained political independence in 1964. Prior to 1974, however, science and technology (S&T) had been operating in Malawi through implicit, rather than explicit, policy measures. It was observed that in the absence of explicit policy guidelines, institutions then involved in R&D tended to make their own inferences about national needs and goals and acted accordingly.

Because of the Government's desire to consciously orient the use of science and technology towards the socioeconomic and political objectives of the society, need arose for the establishment of a national apex body that could be entrusted with the responsibility of formulating and implementing science and technology policies, identification and promotion of strategic areas of research in different sectors of S&T, coordination of all S&T for different sectors of society and industry, and ensuring an R&D industry that is dynamic, responsive to national needs, and efficient. This was the rationale for the establishment of the National Research Council of Malawi in 1974 by a Presidential decree as the country's principal advisory organ of Government on all matters relating to scientific and technological development. To translate the Council's mission into action, the Government decided to establish a Secretariat which has now been elevated to the status of a ministerial apex body, the Department of Research and Environmental Affairs, and placed under the Office of the President and Cabinet with a mandate, *inter alia*, to be responsible for S&T policy.

2.2 History of the Department of Research and Environmental Affairs

With the advent of independence in 1964, the Malawi government declared its intention to develop a prosperous Malawi, with much better economic performance, improved standards of living, and enhanced quality of life. It was realized then that such human progress could only come from the expansion and more efficient use of the country's capacity; that is, the

country's human skills, capital, technology and human resources. It was mainly because of the Government's desire to expedite the process of human resources development that, barely three months after the country became independent, Malawi's premier institution of learning, the University of Malawi, was established under an Act of Parliament, and more primary and secondary schools were established.

To propel the endogenous development of science and technology for national development, the Government encouraged lecturers in the science faculties at each of the constituent colleges of the University of Malawi to conduct R&D activities. Because of the economic importance of the agricultural industry to the Malawi nation, R&D for this primary industry has since independence been a priority area for research in the country. This has as its basis the recognition that an improved and sustained agricultural production is dependent upon the establishment of an active research organization that is mandated to investigate and develop methods of increasing and sustaining the yield and quality of plant and animal products required on the internal and external markets. It was in recognition of this fact that the Agricultural Research Council of Malawi was established by an Act of Parliament in July 1964 with the main objective of reinforcing the existing government research and technical services.

It was observed later, however, that with an increase in R&D activities in the fields of agriculture and natural resources there was a fragmentation and duplication of research effort. The government, therefore, instituted the National Resources Research Committee (NRRC) in 1969 and charged it with the responsibility of coordinating the research activities and giving advice on priorities for research to research organizations and to the then National Development Council (NDC). The NRRC was chaired by the Secretary for Agriculture and Natural Resources. Its members were the Dean of the Faculty of Agriculture in the University of Malawi and representatives of the Ministry of Finance and the Economic Planning Division of the Office of the President and Cabinet.

While a particular emphasis has been on production research in the primary industries R&D programmes, and while the need for this research will continue, there has increasingly been a requirement for additional R&D into post-production issues such as improved market access and better ways of storing, handling and distributing products, as well as those areas that will promote and sustain industrial activities and facilitate the adaptation of imported technology for local use. To achieve this objective and to ensure that the R&D activities conducted in the country were in consonance with national goals and aspirations, a need was felt during the early 1970s of the establishment of a national apex body that could be entrusted with, inter alia, the responsibility of formulating national S&T policies and facilitating their implementation. It was, therefore, in 1974 that the National Research Council of Malawi (NRCM) was established by a Presidential decree as a national apex S&T body, charged with the responsibility of charting out national direction and priorities in S&T, fostering the integration of S&T activities within the broader framework of national socioeconomic development objectives, and coordinating all R&D activities in order to ensure that maximum dividend was obtained from the national investment in science.

The NRCM was placed in the Office of the President and Cabinet where it was under the chairmanship of the Secretary to the President and Cabinet, and has its members drawn from the Ministries of Agriculture, Education, Finance, Forestry and Natural Resources, and Trade, Industry and Tourism; the Department of Economic Planning and Development; the Tea Research Foundation of Central Africa; and the University of Malawi. It had a Secretariat comprising only one scientist at the rank of Principal Scientific Officer and one copy typist. When the first ever national seminar for policy-makers on the "Role of Scientific Research and Technology in Malawi's Development" was held in the country from 29 to 30 August 1986, the complement and gradings of the NRCM Secretariat staff were as follows:

- 1 x Principal Scientific Officer (P7)
- 1 x Administrative Officer (AO)
- 1 x Copy Typist and
- 1 x Messenger

It was at this seminar when, after reviewing the functions of the NRCM, it was appreciated that the complement of the NRCM Secretariat staff was far

inadequate to service the demands of both the scientific community and the private sector and that the grades of the posts created for the Secretariat were not commensurate with the duties and responsibilities placed upon the Secretariat personnel. After these weaknesses had been identified, the Government instructed the Secretary for Personnel Management and Training to review the complement and gradings of the Secretariat relative to the duties and responsibilities the personnel of the NRCM Secretariat were charged with.

A review team formed by the Department of Personnel Management and Training (DPM&T Review Team) produced a report on the performance of the National Research Council of Malawi in 1986 in which it was observed, among other things, that Malawi was "at a stage of industrial development take off" and that the process of "industrialization must proceed according to well defined national science and technology policies, plans and strategies in order to ensure maximum benefit".

It was recognized that there was need to have a body that was effective enough to foster the integration of science and technology in economic and social development through linkages with development goals. It was felt that this integration was more important and fundamental than the mere consideration of mechanisms to be employed to promote the development of science and technology, and that it was through this integration, both conceptually and in practical terms, that the application of science and technology could make the most effective contribution to industrial and economic development.

The DPM&T Review Team observed that for the National Research Council of Malawi Secretariat to improve its performance there was an urgent need for it to be restructured and re-organized and for it to have its staff strength improved. The recommended numbers and grades of the Secretariat's staff which were regarded by the DPM&T Review Team as a bare minimum consisted of the Secretary to the Council at the rank of Deputy Secretary, Chief Scientific Officer at the rank of Under Secretary, four posts of Principal Scientific Officer, a Senior Administrative Officer, an Executive Officer, one Senior Clerical Officer, one Senior Copy Typist, and three Copy Typists.

On receiving the report, the Malawi Government not only approved the proposal to restructure the NRCM Secretariat but also decided to improve the

Secretariat's staff strength by letting it be headed by a Principal Secretary and creating more posts at senior grades. This underscores the Government's recognition of the fact that science and technology are the primary vehicle for development and that maximizing the potentially beneficial impacts of scientific and technological developments within the national economy requires focussed and specific effort to integrate scientific and technological considerations into national development planning.

Recognizing the cross-sectoral dimension of the environmental issues, the Government later directed that environmental programmes and activities designed to ensure the protection and conservation of the environment should be placed under the charge of the NRCM Secretariat. It was after the NRCM Secretariat had

been restructured and re-organized, and its staff strength improved, that a directive was made by the country's leadership at the highest level that the NRCM Secretariat be elevated to the status of a ministerial apex body for S&T concerns and placed in the Office of the President and Cabinet. The body thus created is the Department of Research and Environmental Affairs. It became functional on 1 April 1991.

The directive by the country's leadership that the Department of Research and Environmental Affairs be created underlines a desire that the research which is conducted and managed in the country is guided by an effective policy framework that ensures the R&D activities to be relevant to the needs of sustainable physical environment and to the needs of users.

3.0 Goals and Functions

3.1 Mission of the National Research Council of Malawi

As enunciated in the Constitution of the National Research Council of Malawi, the Council comprises twelve (12) appointed members who are specialists in main scientific disciplines including social science or persons involved in technology-related activities plus the Secretary to the President and Cabinet and Principal Secretaries of the Government Ministries with significant functions related to science and technology and to economic planning and development. The Council is the principal advisory organ of Government on all matters relating to scientific research and technological development. Its basic mission is to contribute to Malawi's quest for enhanced sustainable economic performance, living standards, environmental quality and community understanding of science and technology, through excellence, leadership and teamwork in research.

3.1.1 Statutory Goals and Functions

It has been pointed out in the Constitution of the NRCM that "without prejudice to the generality" of subsection 3.1, the functions of the Council shall be:

- (a) to facilitate the formulation of the national science and technology policy and the assessment of the requisite financial resources;
- (b) to chart out national direction and priorities in science and technological development in relation to economic and social policies of the Government and its international commitments;
- (c) to foster scientific activity in all its widest possible scope and to maintain a vigorous drive towards self-reliance in national scientific and technological capability;
- (d) to help cultivate among Malawians an appreciation for the value of science and technology as an integral part of the development strategy of the country and corollarily to promote and sustain national support for the application of science and technology in the developmental process as well as the management of the environment;
- (e) to identify research and experimental development activities that are consonant with the national development objectives;
- (f) to serve as a national consultant and advisory body to the Government on all scientific and technological matters that impinge upon Malawi's socioeconomic development;
- (g) to encourage the development and use of local consultancies in the design of development projects with technological inputs;
- (h) to advise the Government on the scientific and technological requirements for the conservation of the national and social environment of Malawi;
- (i) to encourage both the public and private sectors to participate more in research activities, particularly by identifying and utilizing a wider range of local natural resources for development;
- (j) to initiate and monitor R&D activities of the nation and ensure maximum utilization of resources on a sustainable basis;
- (k) to coordinate and consolidate (through information, acquisition, storage, retrieval and dissemination) all relevant technical information on research and development and environmental issues for national needs;
- (l) to promote the dissemination and commercial exploitation of the results of scientific and technological research to farmers, industrialists and other entrepreneurs through appropriate institutional arrangements for the commercialization of research results;
- (m) to ensure cooperation and coordination between the various agencies involved in the machinery for making the national science policy;
- (n) to advise generally on all scientific activities including:
 - (i) the application of research results for development;
 - (ii) the scientific and technical manpower requirements of Malawi;
 - (iii) scientific research and technology;

- (iv) science education, not only at the advanced level in respect of quality and quantity of potential manpower training, but also at lower levels in respect of general science education for the public; and
- (v) scientific documentation, statistics, surveys and general information.
- (o) to advise the Government on suitable organizational arrangements for planning, managing and coordinating scientific activities at various levels including the creation of new research establishment and technical services, but excluding the indiscriminate creation of R&D institutions, which leads to proliferation of small unattached units that compete for scarce human and financial resources;
- (p) to advise the Government on the overall financial requirements for an effective implementation of the national science policy and on disbursements to the agencies concerned;
- (q) to review generally and advise on the programmes and budgets for the promotion of the research and related scientific activities proposed by Ministers concerned and ensure that they are in consonance with the national science policy;
- (r) to carry out independently or in collaboration with any appropriate person, body of persons, agency or institution such surveys and investigations as the Council may consider necessary for its tasks; to be responsible for the maintenance of a national register of scientific and research projects and human resources;
- (s) to sponsor such national and international scientific conferences as it may consider appropriate;
- (t) to act as a channel for liaison with the outside world for the routing of information and resources of aid to assist the country's research effort;
- (u) to be the authority through which requests for external aid for scientific and technological activities shall be channelled to the Treasury;

- (v) to promote and ensure the maximum coordination of, and cooperation in, all research and development activities in order to benefit from the concentration of efforts, and to minimize undesired duplications in order to achieve maximum efficiency from, and throughout, the entire socioeconomic system;
- (w) to promote and maintain cooperation in science and technology with similar bodies in other countries and with international bodies connected with science and technology; and
- (x) to undertake all other actions or measures as will promote speedy and effective scientific research and development in Malawi.

3.1.2 Composition of the Council

The Council comprises twelve (12) Appointed Members who are specialists in main scientific disciplines including social science or persons involved in technology-related activities plus the Secretary to the President and Cabinet and Principal Secretaries of the Government Ministries with significant functions related to (i) science and technology; and (ii) economic planning and development. The Chairman of the Council is the Secretary to the President and Cabinet. One of the appointed members is elected Vice Chairman by the Council from amongst the members initially for a period of three years and is eligible for re-election.

3.1.3 Analysis and Commentary

By placing the National Research Council of Malawi (NRCM) in the Office of the President and Cabinet under the chairmanship of the Secretary to the President and Cabinet, the Malawi Government has been able to make it possible for the NRCM Secretariat to discharge the cross-sectoral functions indicated above. It was, however, mainly because the Secretariat has, since the NRCM's inception, hitherto been understaffed that most of the functions have not been effectively pursued.

3.2 Operationalisation of Mission

3.2.1 Perceived Goals and Functions

Following the decision by the Malawi Government to improve the complement and grades of the NRCM Secretariat, particularly after the creation of the Department of Research and Environmental Affairs (DREA) as a ministerial apex body for environment, science and technology concerns, the heads and

management of the departments of the newly created DREA have been made to understand the mission and functions of the Department as indicated below.

The Department of Research and Environmental Affairs

As a Secretariat of the NRCM of Research and Environmental Affairs (DREA) has been entrusted with functions which include:

- (a) formulation, and facilitating the effective implementation of, the national science and technology (S&T) policy;
- (b) fostering, promoting, sustaining the nurturance and development of focussed scientific research and technologies that are adaptive and relevant to the needs of the Malawian economy;
- (c) preparation of Research and Development Priorities Plan;

As a Secretariat of the NRCM, the Department o

- (d) ensuring that local scientists endowed with creative and innovative talents are encouraged to develop and express their talents through relevant scientific and technological activities;
- (e) institution of Technology Assessment mechanisms;
- (f) recommendation for introduction of Policy Instruments governing the import and endogenous generation of technology;
- (g) preparation of Guidelines for Import of Technology for enterprise in the public as well as private sectors;
- (h) undertaking Technology Forecasting activities in priority sectors and making the results widely known to all interested parties;
- (i) institution of an S&T Information Bank which will facilitate knowledge of the technology shelf, act as a vital link to world technology sources, and foster-in-country diffusion and extension of technology;
- (j) plan for adoption, adaptation and digestion of carefully identified imported technologies; ensuring that R&D plans include those intended for absorption of imported technology as well as those for endogenous generation of new technologies in areas

where the country can make the best use of late starter advantage;

- (k) development of design engineering capability and in-house research;
- (l) provision of a central fund for augmenting the research, development and application of the new and emerging sciences and technologies with high potentials for medium to long term benefits to Malawi;
- (m) fostering the nationwide acquisition and development of appropriate and relevant scientific and technological attitudes, behavioral patterns and culture in ways consistent with technology development and use;
- (n) ensuring that economic and social development in the country is sustainable by promoting developmental activities the execution of which is guided by the desire to conserve and protect environmental assets;
- (o) playing a nodal role in the coordination of S&T activities conducted in the country, and in which a number of Institutions/Departments/Ministries have interest and capabilities;
- (p) providing secretarial coordination to the apex subject specialist committees of the NRCM; and
- (q) serving as a focal point for international scientific, technological and environmental affairs.

As an apex nodal S&T institution and a ministerial apex body in Malawi, the Department of Research and Environmental Affairs (DREA) has the following as its major objectives:

- (a) to carry out strategic research that can be applied by the Malawian industry or Government for community benefit;
- (b) to collaborate with other institutions and industry to strengthen the research effort and ensure its transfer and application;
- (c) to lead and promote an expanded science and technology effort in Malawi; and
- (d) to provide the scientific knowledge required for the effective management and conservation of Malawi's natural resources and environment, particularly in relation to the conservation and protection of natural

heritage and sustainable use by dependent industries.

To facilitate achievement of its mandate, DREA operates through specialized Divisions that are indicated below:

Division of the NRCM Affairs

The Division has been entrusted with the responsibility of:

- (a) the formulation of national S&T policy and its implementation;
- (b) preparation of a Research and Development Priorities Plan (RDA);
- (c) organic linking of S&T infrastructure through active intermediaries between users of technology and the sources of technology;
- (d) organizing meetings of the National Research Council of Malawi (NRCM);
- (e) facilitating the implementation of the recommendations of the NRCM;
- (f) providing secretarial coordination to the apex Subject Specialist Committees and other Committees of the NRCM;
- (g) ensuring that the cultivation and application of S&T proceed in a coordinated manner;
- (h) reviewing all existing policy instruments relating to import and generation of technology in the country and making recommendations for the introduction of new policy instruments related to such activities;
- (i) initiating Technology Assessment (TA) mechanism in every Ministry, providing technical assistance for TA units and formulating uniform appropriate methodologies and guidelines for the functioning of such units in different agencies;
- (j) undertaking technology forecasting activities in priority sectors and making the results widely known to relevant agencies;
- (k) the preparation of Guidelines for Import of Technology for enterprises in the public as well as private sectors;
- (l) promoting the adoption of National Codes and Standards for industrial plants, equipment and accessories;

- (m) establishing and maintaining an "S&T Information Bank" which will facilitate knowledge of the "technology shelf" to the users and act as the vital link to world technology sources, as well as endogenously developed technologies;
- (n) facilitating the establishment of in-house R&D and design engineering units in the public sector, as well as encouraging the formation of design engineering firms in the private sector;
- (o) administration of a Research Fund for augmenting research in specific areas where technology generation opportunities exist;
- (p) providing support to scientific associations, foundations and societies engaged in scientific and social-sciences research and development;
- (q) formulation of policy guidelines for the promotion and popularization of science and technology in general and at all levels;
- (r) promotion of science culture in general and especially in rural areas and among women and children.

Division of Administration and Support Services

The Division of Administration and Support Services operates through two sections; viz, the Administration Section and Support Services Section.

The Administration Section is mandated to carry out several functions which include:

- (i) provision of administrative services to all the Divisions of DREA;
- (ii) assisting the Controlling Officer in processing the Department's scientific, technical and other human resources requirements;
- (iii) processing applications and papers for all appointments and promotions of staff;
- (iv) to be responsible for housing and office accommodation issues;
- (v) ensuring that staff discipline is maintained in accordance with the Malawi Public Service Regulations;
- (vi) ensuring that all personnel in the Department and their resources are employed efficiently and effectively, and that their work load is well coordinated;

- (vii) ensuring the efficient working of the Registry, including expeditious despatch of incoming and outgoing mail;
- (viii) ensuring that the Department's personnel comply with matters of national policy that may be formulated from time to time;
- (ix) processing the training requirements of the Department's staff;
- (x) supervision of supporting staff in respect of punctuality, observance of official minimum working hours and in the efficient discharge of their duties;
- (xi) processing travel documents for the staff of the Department and making necessary arrangements for both local and overseas travels for staff as well as arranging airport receptions and departures for the Department staff and guests of the Department;
- (xii) coordination and the efficient use of the Department's transport facilities;
- (xiii) provision of secretarial services for conferences, meetings, seminars or workshops organized or coordinated by the Department; and
- (xix) initiating the process of pension and gratuity papers.

Finance and Supplies Section

The responsibilities of the Finance and Supplies Section include:

- (i) to advise Division Heads on proper administration and on financial implications of their decisions both at the planning and at the operational stages;
- (ii) to compile annual estimates of revenue and expenditure for the Department;
- (iii) to ensure that expenditure on funds allocated to each of the Department's Divisions is within the limits of allocations, that the funds are spent effectively, and that all disbursements are charged promptly in his accounts under their proper allocations;
- (iv) to assist the Controlling Officer in finance and expenditure matters of DREA;
- (v) to ensure the efficient requisition, purchase, control and proper use of expendable office supplies;

- (vi) to be responsible for the requisition, purchase, control and proper use of non-expendable office equipment;
- (vii) to be responsible for the processing of all claims and payment vouchers for the DREA staff and all procurement orders;
- (viii) to produce regular returns of revenue and expenditure of the Department; and
- (ix) to ensure that an up-to-date inventory of all expendable and non-expendable office equipment brought on charge on the Stores Ledger of each of the Department's Divisions is punctiliously maintained.

Division of Science and Technology

The Division of Science and Technology operates through five Sections which are: Agricultural Sciences Section, Industrial Research and Development Section, Energy Research and Natural Sciences Section, Medical and Pharmaceutical Sciences Section, and Technology Transfer Section.

The Division of Science and Technology operates through five Sections which are: Agricultural Sciences Section, Industrial Research and Development Section, Energy Research and Natural Sciences Section, Medical and Pharmaceutical Sciences Section, and Technology Transfer Section.

Agricultural Sciences Section

The responsibilities of the Agricultural Sciences Section include:

- (i) fostering formulation of agricultural research policies which cover crops, livestock, forestry, fisheries and related subjects;
- (ii) identification of priorities in all fields of agricultural sciences research comprising crop and animal husbandry, forestry, fisheries, etc., and including them in the Research and Development Priorities Plan (RDPP);
- (iii) identification of problems and constraints in agricultural sciences research and determining both their significance and the resources for their solution;
- (iv) promotion of research for improving agricultural development consistent with the socio-economic conditions in the country;

- (v) promotion of development of special services in support of agricultural production such as soil, plant and water resources, agro-meteorology, agro-forestry, etc.;
- (vi) monitoring and evaluation of research in the agricultural sector; and
- (vii) serving as a nodal agency for the coordination of agricultural R&D activities.

Industrial Research and Development Section

The Section has been mandated to carry out the following functions:

- (i) initiation and formulation of policies for industrial research;
- (ii) development of priorities in industrial research;
- (iii) identification and promotion of front line areas of research in different sectors of S&T;
- (iv) fostering and promoting the enhancement and development of indigenous capabilities, particularly engineering and consultancy services, in the selection, acquisition, adaptation, absorption or development of technologies;
- (v) promoting the formulation of appropriate legal, fiscal, and financial instruments for selection, importation, absorption and adaptation of foreign technology;
- (vi) ensuring that the development of technological infrastructure is contingent upon the industrial and economic development goals;
- (vii) compiling industrial patents that have been filed in the country and disseminating them to end-users;
- (viii) promotion of local inventions and innovations as well as indigenous technology in Malawi's industrial sector;
- (ix) promotion of small-scale industries through the provision on appropriate incentives;
- (x) providing support to genetic technologies like biotechnology, genetic engineering, micro-electronics, etc.; and
- (xi) serving as a nodal agency for coordinating industrial R&D activities.

Energy Research and Natural Sciences Section

The Energy Research and Natural Sciences Section is charged with functions which include:

- (i) policy formulation in energy research and in natural sciences;
 - (ii) identification and determination of research priorities in energy and natural sciences, and including them in the Research and Development Priorities Plan (RDPP);
 - (iii) promotion of research in all forms of energy and areas of the natural sciences;
 - (iv) serving as a nodal agency for coordination of R&D in energy and natural sciences;
 - (v) encouraging and promoting energy conservation and efficiency in all sectors;
 - (vi) promoting the establishment and enforcement of strict energy use standards (e.g. W m-2) for all new facilities (residential, commercial, industrial and institutional);
 - (vii) liaising with international and local organizations on energy and the natural sciences;
 - (viii) encouraging and promoting the development of indigenous expertise in the application of new and renewable energy technologies;
- Medical and Pharmaceutical Sciences Section**

The Medical and Pharmaceutical Sciences Section is mandated to carry out functions which include:

- (a) performing a catalytic and coordinative role in the formulation of medical and pharmaceutical sciences research policies;
- (b) identification of priority for R&D in medical and pharmaceutical sciences research;
- (c) promoting the growth and development of traditional medicine and its practice throughout Malawi with a view to giving it a scientific basis that will lead to its eventual integration into the health care system of the country;
- (d) promotion and encouragement of R&D in the relevant university colleges and other tertiary institutions in the fields of medical and pharmaceutical sciences;

- (e) fostering and encouragement of R&D activities in the medical and pharmaceutical sciences in the private sector;
- (f) fostering and encouraging basic research in human vaccine development;
- (g) promotion of local production of drugs and biological;
- (h) monitoring and evaluating the progress made in the research into medical and pharmaceutical problems in the various sectors in the country; and
- (i) serving as an apex nodal agency for coordination of R&D in medical and pharmaceutical sciences.

Technology Transfer Section

The primary responsibility of the Section shall be to stimulate reverse engineering and the functions of the Section are:

- (a) to achieve the maximum possible autonomy in the acquisition of technology with the purpose of orienting it towards the needs of economic and social development of Malawi;
- (b) to identify the problems that require acquisition of foreign technology, individualizing the appropriate technological alternatives, negotiating favorably the acquisition of technology, and absorbing technology;
- (c) to assist the productive system in the identification, search evaluation, application and improvement of the necessary technology;
- (d) to promote the acquisition of technology based on definite priorities as contained in the Development Plan, or at least oriented to the satisfaction of the most urgent socio-economic needs, taking into account the natural conditions and resource endowments of the country;
- (e) to authorize the acquisition of technology only when it is not available in the country, when it is appropriate to the requirements of the productive process, when it is negotiated in reasonable competitive terms, when its sale and use is not subject to restrictive business practices, when it complies with the socio-economic needs of the country, and

when it is not acquired exclusively in packaged form;

- (f) to collect and sift research results from the different centres, institutes, faculties doing research, particularly those results that have the potential of commercial exploitation;
- (g) to put pilot projects aimed at verifying R&D results;
- (h) to demonstrate new technologies to users and gauge their acceptability and intrinsic worth;
- (i) to contact local entrepreneurs and offer them incentives to start manufacturing enterprises that will exploit the new technologies; and
- (j) to promote the commercialization of any technologies that have been transferred, adapted, and/or developed endogenously;

Division of Information Science and Engineering

The functions of the Division of Information Science and Engineering include:

- (a) to promote, and be a leader in, strategic research on information and communications technologies and the integration of systems based on these technologies for the benefit of Malawi;
- (b) to promote and encourage special training courses in software development and computer-aided design for scientists at research institutions and the university colleges;
- (c) to establish a Computer Advisory Committee to advise on the specifications required for a versatile, cheap, portable and standard computer;
- (d) to promote and encourage the application of software engineering to develop expert systems (innovated or adapted), or intelligent knowledge-based systems (IKBS), for fabrication in areas deficient in human expertise (e.g. medicine, agriculture, environmental studies);
- (e) robotics, involving design or construction of software for remote control, special tools for computer architecture and hardware for sensing designs; and

- (f) to encourage industry sectors to improve their competitiveness through the use of advanced computer, communications and space systems.

Division of Natural Resources and Environment

The Division of Natural Resources and Environment serves as the focal point in the administrative structure of the Government of the Republic of Malawi for:

- (a) performing a catalytic role;
- (i) in initiation, formulation and development of policies and administrative devices related to conservation, protection and management of the natural and man-made environment, and
- (ii) in harmonization of those policies and other activities of Government ministries, departments and other institutions as they relate to the environment so that functional conflicts and wasteful duplications of effort and resources are avoided;
- (b) fostering and promoting inter-disciplinarity and integration of environmental policies, plans, programmes and projects with a view to ensuring proper management and rational utilization of resources on a sustainable yield basis;
- (c) encouraging the development of strategies and methodologies for the achievement of accepted environmental and human settlements policies, goals and objectives and the integration of such policies, goals and objectives in development planning and decision-making at all levels;
- (d) coordination and follow-up of all matters related to the activities of the United Nations Environment Programme (UNEP) and the United Nations Centre for Human Settlements (UNCHS - (HABITAT)) and other international, inter-governmental and non-governmental organizations dealing with environmental issues;

- (e) coordination of joint environmental projects between Malawi Government and international, inter-governmental and non-governmental bodies;
- (f) providing the scientific knowledge required for the effective management and conservation of Malawi's natural resources and environment, particularly in relation to the conservation and protection of natural heritage and sustainable use by dependent industries;
- (g) promotion and coordination of R&D in all environmental matters of interested individuals and institutions;
- (h) collection, collation and coordination of available research findings on the environment; encouraging further research in identified critical areas, and conducting research and surveys in the field of environment;
- (i) monitoring and assessment of the current state and the foreseeable trends in the quantity and quality of the natural resource base in the country and the preparation of periodic reports on the state of the environment;
- (j) promotion and encouragement of afforestation and regeneration of degraded areas;
- (k) encouraging environmental impact assessment studies;
- (l) dissemination of environmental information to Government ministries and departments, other institutions and individuals;
- (m) organization of conferences, meetings, seminars, workshops, courses and training programmes on issues related to the environment; and
- (n) creating environmental awareness at national level.

To discharge its functions effectively, the Division of Natural Resources and Environment operates through the Sections indicated below.

Population Control and Environmental Health Section

This Section is charged with the following functions:

- (a) Identification and monitoring of pollution in air, water (surface and ground water), land and the soil, biota, and their sources and their impacts on the receiving media to en-

sure that critical thresholds are not exceeded.

- (b) Identification of air, water, land, biotic, noise and thermal pollution sources by industry and human settlements and proposing and implementing appropriate industry/domestic/pollutant-specific control measures.
- (c) Development and promotion of appropriate, ambient discharge, technological and treatment standards and other regulatory proposals for the minimization of air pollution, water pollution, land pollution, biotic pollution, noise pollution and thermal pollution.
- (d) Responsible for the promotion of research and surveillance programmes geared toward the control of food contamination by mycotoxin and other contaminants, during the growth, harvesting, storage, processing, distribution and handling of food substances and animal feeds and related products.
- (e) Promotion of efforts geared toward the identification, survey, monitoring and control of the importation, manufacture, distribution, sale and use of dangerous and potentially dangerous drugs and substances.
- (f) Promotion of environmentally sound and appropriate energy alternatives, including the development of renewable energy sources and catalyzing the development of energy saving mechanisms and devices.
- (g) Promotion of the development and use of renewable and non-renewable, conventional and non-conventional energy resources.
- (i) Responsible for liaison with the Ministry of Health, Malawi Bureau of Standards, Traffic Police Department, the Factory Inspectorate, Government Chemist, Ministry of Transport and Communications and other institutions with respect of the matters mentioned above.
- (j) Promotion of suitable environmental planning, design, maintenance and standards for service control in respect of sewerage and sewage disposal projects and programmes.
- (k) Responsible for the development of National Register of Potentially Toxic Chemicals

and the maintenance of the IRPTC National Correspondence.

- (l) Responsible for the development of National Code of Conduct for multinational and national companies with respect to the manufacture, distribution, sale and use of drugs and other chemical substances.
- (m) Facilitating the development, promotion and application of standards and other measures (including quality control standards) for the control of pollutants in the soil, biota and food substances and allied products.
- (n) Assisting the Director in the promotion and enhancement of inter-disciplinary and integration of all NES programmes and activities.
- (o) Responsible for the preparation and subsequent follow-up for Malawi's participation in UNEP Governing Council and Habitat Commission meetings and other international, inter-governmental and non-governmental forums.
- (p) Responsible for the organization of meetings, conferences, seminars, workshops, symposia and courses on matters related to pollution control and environmental health and in the preparation of appropriate materials in conjunction with the relevant ministries/departments and other local institutions and donor agencies.

Environmental Education and Information Section

The functions of this Section are the following:

Environmental Education:

- (a) Planning and developing environmental education programmes aimed at inculcating and promoting environmental awareness and knowledge among the Malawian public, including:
 - (i) the school population at basic level;
 - (ii) the school population at the higher institutions of learning. These include secondary schools, teacher training colleges

- and the university colleges;
 - (iii) out-of-school population which includes the general public, adult education and other institutions including non-governmental organizations.
- (b) Responsible for liaison with the Ministry of Education and Culture to ensure the inclusion of environmental education component in the school curricula at all levels.
- (c) Responsible for organizing the dissemination of information on environmental education to schools at all levels through media such as radio, lectures, and film shows.
- (d) Responsible for organizing national seminar, workshops and conferences for DDCs and those educators and administrators charged with the responsibility of making people understand environmental issues.
- (e) Responsible for co-ordination with UNEP, UNESCO, HABITAT and other international and inter-governmental and non-governmental organizations in all matters related to environmental education.

- (f) Responsible for the promotion and enhancement of inter-disciplinary and integration of the Section's programmes and activities.
- (g) Responsible for the preparation of the relevant subject matter of the UNEP Governing Council and the HABITAT Commission meetings and the meetings of other relevant organizations and in subsequent follow-up action.

3.2.2 Commentary

The Department of Research and Environmental Affairs is functioning directly under the Head of State and Government. Since the Department has recently been created, not much can be said regarding its performance. It is, however, pertinent to point out that by having the Head of State and Government as its Minister, the Department is recognized not only by the other development and regulatory Ministries but also by the private sector as a ministerial apex body for environment, science and technology concerns and enjoys full cooperation from them. It is this arrangement which facilitates coordination between and among the other S&T institutions and makes it easier for the Department to discharge its duties, inter alia, as an apex body for the management and integration of technological considerations into the national social and economic development planning process.

4.0 Organization

4.1 Structure

4.1.1 The Position of DREA in Government Structure

It has been pointed out above that the Department of Research and Environmental Affairs functions directly under the Head of State and Government and is in the Office of the President and Cabinet. It is headed by a Principal Secretary who is directly answerable to the Secretary to the President and Cabinet.

The Department is structured to respond to Malawi's needs and to ensure that the research and experimental development (R&D) activities conducted in the country are targeted to national priorities. Strong links with industry and community are fostered and maintained in order for the Department to have a better understanding of future directions in Malawian industry and foster an improved community understanding and appreciation of both old and new technologies.

The Department is so structured that collaboration with industry is facilitated and close and mutually profitable relationships with the University and other tertiary education bodies are maintained. These arrangements facilitate the process of S&T policy formulation and implementation.

4.1.2 Sectoral Articulation

The Department has established several subject specialist committees that are entrusted with principal functions among which are:

- (a) to advise, within its ambit of scientific responsibility, on:
 - (i) the details of research programmes and projects required to implement stated research priorities that are consonant with the national science and technology policy, and
 - (ii) the promotion and effective coordination of research activities in its sector of scientific responsibility;
- (b) to consider all research proposals, pertaining to its sector of scientific responsibility, submitted to the Department with requests

for funding, and to advise on the relevance of the proposed research projects to the national S&T policy;

- (c) to register human resources and facilities (governmental and otherwise) available in Malawi for the execution of scientific research programmes;
- (d) to advise on the sectoral scientific and technical human resources requirements and to promote the development of the human resources, through education and training, for research in its sector of scientific responsibility in order to ensure that the sectoral minimum critical mass of research scientists is attained;
- (e) to promote cooperation in science and technology with similar organizations, both public and private, indigenous and foreign, connected with sectoral science and technology;
- (f) to record information on scientific and technological development, to evaluate technologies used in, or to be imported into, Malawi and to facilitate the dissemination and application of new technologies;
- (g) to advise on the publishing of research data and on the popularization of the results where their application will contribute towards the realization of national socio-economic development objectives;
- (h) to advise on such organizational changes, including the establishment of new institutes, as are required to implement, or further the efficiency of, the research required by Malawi;
- (i) to review annually the progress made by those whose research projects are funded either by or through the Department and to ensure that research projects are not continued through inertia;
- (j) to advise on the most appropriate machinery required to monitor Government-funded research and development plans; and
- (k) to advise on sectoral S&T policies.

4.1.3 Commentary

The fact that members of the subject specialist committees are drawn from each of the relevant sectors facilitates the participation of interested parties from the various S&T sectors in the policy formulation policy. Because of this participation, they are expected to be able to respond effectively to the national science and technology policy. Time has yet to tell whether this will be the case.

4.2 Sections and Personnel

The Department of Research and Environmental Affairs is organized into functional Divisions the functions of which have been described above. Fig. 1 summarizes the organization and structure of the Department while the organizational chart (Fig. 2) indicates the Department's linkages with other S&T institutions. The figures appear at the end of the report.

The Government is currently considering a proposal that each of the Divisions of the Department of Research and Environmental Affairs should have the number of personnel indicated below as a bare minimum.

(a) Division of Administration and Support Services

(i) The Administration Section

In this Section the posts which have yet to be created are those of Under Secretary (one has already been sent to DREA), Senior Personal Secretary (one has already been sent to DREA), Principal Administrator, Principal Personnel Officer, Senior Personnel Officer, Personnel Officer, Chief Executive Officer (CEO) (GD), Senior Executive Officer (SEO) (GD), Shorthand Typist/Stenographer, Executive Officer (one post), Office Superintendent, Clerical Officer (one post), Head Messenger and PBX Operator (1 SCI and SC II). The complete complement and grading of the required staff is as follows:

- 1 x Principal Secretary (S2)
- 1 x Senior Personal Secretary (S8)
- 1 x Deputy Secretary (S4)
- 1 x Shorthand Typist/Stenographer (D4/3)
- 1 x Under Secretary (S5)
- 1 x Shorthand Typist/Stenographer (D4/3)
- 1 x Principal Administrative Officer (S7)
- 1 x Senior Administrative Officer (S8)
- 1 x Senior Personnel Officer (S8)
- 1 x Administrative Officer (AO)
- 1 x Personnel Officer
- 1 x Chief Executive Officer (SEO) (GD)

- 2 x Executive Officer (EO) (GD)
- 1 x Office Superintendent (EO)
- 2 x Senior Clerical Officer (SCO) (GD)
- 1 x Senior Copy Typist (D5)
- 4 x Clerical Officer (CO) (GD)
- 4 x Copy Typist (D8/7/6)
- 4 x Messenger (SCIV)
- 2 x Security Guard (SCIV)
- 1 x Head Messenger (SCI)
- 2 x PBX Operator (1 SCI and 1 SCII)

(ii) Finance and Supplies Section

The additional posts proposed for Government consideration are those of Principal Accountant, Senior Accountant, Assistant Accountant, Senior Accounts Assistant (SCO) (one post), and Accounts Assistant (CO) (2 posts). The complete complement and grading of the required staff is as follows:

- 1 x Principal Accountant (S7)
- 1 x Senior Accountant (S8)
- 1 x Accountant (PO/CEO)
- 1 x Senior Assistant Accountant (SEO)
- 2 x Assistant Accountant (EO)
- 1 x Senior Assistant Accountant (SEO)
- 2 x Assistant Accountant (EO)
- 2 x Senior Accounts Assistant (SCO)
- 4 x Accounts Assistant (CO)

(b) Division of Science and Technology

The Division of Science and Technology is expected to operate through five Sections which are: Agricultural Sciences Section, Industrial Research and Development Section, Energy Research and

Natural Sciences Section, Medical and Pharmaceutical Sciences Section, and Technology Transfer Section.

(i) Agricultural Sciences Section

The additional posts are those of Technical Officers. The complete complement and grading of the required staff is as follows:

- 1 x Principal Scientific Officer (P7)
- 1 x Senior Scientific Officer (P8)
- 2 x Scientific Officer (PO)
- 2 x Technical Officer (TO)

(ii) Industrial Research and Development Section

The additional posts are those of Shorthand Typist/Stenographer, Senior Technical Officer, Technical Officers and Technical Assistants. The complete

complement and grading of the required staff is as follows:

- 1 x Chief Scientific Officer (P5)
- 1 x Shorthand Typist/Stenographer (D4/3)
- 1 x Principal Scientific Officer (P7)
- 2 x Senior Scientific Officer (P8)
- 2 x Scientific Officer (PO)
- 2 x Senior Technical Officer (STO)
- 2 x Technical Officer (TO)
- 4 x Technical Assistant (TA)

(iii) Energy Research and Natural Sciences Section

The additional posts are those of Principal Scientific Officer, Scientific Officer (one post), and Technical Assistants. The complete complement and grading of the required staff is as follows:

- 1 x Principal Scientific Officer (P7)
- 1 x Senior Scientific Officer (P8)
- 2 x Scientific Officer (PO)
- 2 x Technical Officer (TO)
- 2 x Technical Assistant (TA)

(iv) The additional posts are those of Principal Scientific Officer and Technical Assistants. The complete complement and grading of the required staff is as follows:

- 1 x Principal Scientific Officer
- 1 x Scientific Officer (PO)
- 2 x Technical Assistant (TA)

(v) Technology Transfer Section

The additional posts are those of Assistant Chief Scientific Officer, Senior Scientific Officer, Scientific Officers, Senior Technical Officer, Technical Officers, Senior Technical Assistants and Technical Assistants. The complete complement and grading of the required staff is as follows:

- 1 x Assistant Chief Scientific Officer (P6)
- 1 x Principal Scientific Officer (P7)
- 1 x Senior Scientific Officer (P8)
- 2 x Scientific Officer (PO)
- 1 x Senior Technical Officer (STO)
- 2 x Technical Officer (TO)
- 2 x Senior Technical Assistant (STA)
- 2 x Technical Assistant (TA)

(c) Division of Information Science and Engineering

The additional posts are those of Assistant Chief Scientific Officer, Principal Scientific Officer, Senior Scientific Officers (3 posts), Senior Technical Officer,

Technical Officers, Senior Technical Assistant and Technical Assistants. The complete complement and grading of the required staff is as follows:

- 1 x Assistant Chief Scientific Officer (P6)
- 1 x Principal Scientific Officer (P7)
- 2 x Senior Scientific Officer (P8)
- 4 x Scientific Officer (PO)
- 1 x Senior Technical Officer (STO)
- 4 x Technical Officer (TO)
- 1 x Senior Technical Assistant (STA)
- 4 x Technical Assistant (TA)

(d) National Documentation Centre

The following posts, except that of Senior Librarian (P8), have already been created for the Centre and for the Department's library. All but one (i.e. that of Assistant Librarian) have not been filled.

- 1 x Chief Documentation Officer (P5)
- 1 x Principal Documentation Officer (P7)
- 2 x Senior Documentation Officer (P8)
- 1 x Senior Librarian (P8)
- 4 x Librarian (PO)
- 1 x Documentation Officer (PO)
- 1 x Assistant Librarian (TO)
- 1 x Shorthand Typist/Stenographer (D4/3)
- 4 x Senior Library Assistant (STA/SCO)
- 4 x Library Assistant (TA/CO)

Government has been requested to consider the possibility of creating the post of Senior Librarian (P8). The Public Service Commission has been asked to expedite the recruitment process.

(e) Division of Natural Resources and Environment

(i) Pollution Control and Environmental Health Section

The following posts, except that of Deputy Environmental Coordinator (which has not yet been filled), are to be created:

- 1 x Deputy Environmental Coordinator (P5)
- 2 x Principal Chemist/Principal Environmental Engineer (P7)
- 1 x Senior Chemist/Senior Environmental Engineer (P8)
- 1 x Senior Biologist
- 1 x Senior Physicist
- 4 x Scientific Officer (PO)
- 2 x Chief Technical Officer (CTO)
- 2 x Senior Technical Officer (STO)
- 2 x Technical Officer Laboratory (TO)
- (2 x Senior Technical Assistants (STA)

4 x Laboratory Assistants (TA)

(ii) Environmental Education and Information Section

The complete complement and grading of the required staff is as indicated below; none of the posts have been created but their creation has been recommended as follows:

1 x Assistant Chief Environmental Education Officer (P6)

1 x Principal Environmental Education Officer (P7)

2 x Senior Environmental Education Officer (P8)

2 x Environmental Education Officer (PO)

1 x Senior Technical Assistant (STA)

2 x Technical Assistants (TA)

(iii) Human Settlements Section

The complete complement and grading of the required staff are as indicated below; none of the posts have been created but their creation has been recommended as follows:

1 x Principal Environmental Officer (P7)

2 x Senior Environmental Officer (P8)

2 x Environmental Officer (PO)

2 x Senior Technical Officer (STO)

2 x Technical Officer (TO)

1 x Senior Technical Assistant (STA)

2 x Technical Assistant (TA)

(v) Planning and Environmental Impact Assessment Section

The additional posts are those of Principal Environmental Officer, Senior Environmental Officer, Environmental Officer, Technical Officer and Technical Assistant (2 posts)

1 x Principal Environmental Officer (P7)

1 x Senior Environmental Officer (P8)

3 x Environmental Officer (PO)

3 x Technical Officer (TO)

3 x Technical Assistants (TA)

(vi) Environmental Law Section

The complete complement and grading of the required staff is as indicated below; the posts have not yet been created but recommendations have been made for their creation.

1 x Senior Environmental Officer (P8)

2 x Environmental Officer (PO)

(f) Publications Unit

Currently the Unit has two Reprographic Assistants (DP3/2) and one post of Duplicating Machine Operator. Indicated below, however, are the minimum

staff requirements, and the creation of the additional posts has been recommended:

3 x Typesetter (D4/3)

2 x Graphic Artists (CO)

2 x Paste Up Assistants (CO)

2 x Reprographic Assistants (CO)

2 x Photographer (1 for Camera and 1 for Repro-camera)

3 x Collators/Binders (CO0)

(g) National Research Council of Malawi (NRCM) Affairs Division

The following posts have been created and all but that of Scientific Officer have been filled:

1 x Principal Scientific Officer (P7)

1 x Senior Scientific Officer (P8)

1 x Senior Administrative Officer (S8)

2 x Scientific Officer (PO)

4.3 Committees

The National Research Council of Malawi (NRCM) has established the following standing committees:

(a) Fund Allocation Committee

(b) Agricultural R&D Committee

(c) Committee on Scientific and Industrial Research and Development

(d) Health Development Sciences Research Committee

(e) Energy R&D Policies Committee

(f) Environmental and Resources Committee

(g) Documentation and Information Committee

(h) Legal and Patenting Policies Committee

(i) Committee on Secondary School Science Competitions

(j) Malawi Award for Scientific and Technological Achievement (MASTA) Selection Committee

The constitution of the NRCM provides for the establishment of any other standing committees and ad-hoc committees to deal with specific issues.

4.4 Linkages

Figure 2 shows how both the Department of Research and Environmental Affairs and the NRCM link with other S&T institutions all of which are members of the NRCM. Since it is the Malawi Government's desire that there must be an effective interface between scientists and industry, the latter is involved in the activities of the NRCM through its membership of not only the

Council Board but also several of the committees reported above.

4.5 Powers

What is widely recognized in Malawi by both the public and private sectors is an explicit commitment of the political leadership at the highest level to science and technology as important strategic variables. This commitment has manifested itself through Presidential promulgations such as those which have resulted in the establishments of the National Research Council of Malawi as an apex advisory S&T body; the Department of Research and Environmental Affairs as a ministerial apex body entrusted with, *inter alia*, the responsibility of formulating, and facilitating the implementation of S&T policies, identifying and promoting front line areas of research in different S&T sectors, coordinating S&T activities in the country, promoting the utilization of S&T by different sectors of society and industry, and international S&T affairs; the Committee on Scientific and Industrial Research and Development; the Malawi Award for Scientific and Technological Achievement (MASTA 1991); the Committee on Secondary School Science Competitions; and the annual celebration of Scientific Revival Day of Africa.

This commitment has been underscored in the constitution of the National Research Council of Malawi (NRCM). It is therefore from this commitment and from the national S&T policy in which the role of the

Department of Research and Environmental Affairs (DREA) in S&T endeavors has been promulgated that DREA derives its powers to carry out the duties it is mandated with. The fact that DREA is in the Office of the President and Cabinet where it is directly accountable to the Secretary to the President and Cabinet and has the Head of State and Government as its responsible Minister and a Principal Secretary as its Head facilitates coordination with other development and regulatory S&T Ministries (Fig. 2). Whereas DREA is headed by a Principal Secretary all the other S&T government departments are headed by officers who are junior by two ranks. The other factor that encourages cooperation between DREA and other S&T institutions is the inclusion of senior scientific researchers from the institutions in the Department's subject specialist and other committees.

For the duties hitherto conducted, the Department has not lacked the required financial resources. To ensure that the endogenous development of S&T is effectively encouraged, however, the Department has submitted a draft Science and Technology paper and is currently preparing a Science and Technology Budget Statement whose approval by the Government will serve to underscore the deep government commitment to support scientific and technological endeavors in the country.

5.0 Activities and Goal Attainment

5.1 Policy Development

The Department of Research and Environmental Affairs considers it very important that with the explicit commitment of Malawi's leadership at the highest level to science and technology as tools for socio-economic development, the process of national S&T policy must involve not only the scientific community but also the Government's Department of Economic Planning and Development.

It is believed that these bodies, headed by the Secretary to the President and Cabinet, should work in tandem in order to ensure that the desired integration of scientific and technological considerations is achieved. It is in this context that the Department of Research and Environmental Affairs intends to establish an ad-hoc multi-disciplinary committee which will be charged with the function of giving guidance to the Department on how best to articulate a truly cohesive and embracing national S&T policy that is in consonance with national development goals and aspirations, and which takes into account the need, inter alia, for local private sector R&D, and improved science, mathematics and technology education. In articulating such a policy, inputs from the Department of Economic Planning and Development will be sought at meetings of a committee that will be established for the purpose and chaired by the Secretary to the President and Cabinet.

In formulating the national S&T policy which has now been approved by the Malawi Government (National S&T Policy, 1991), the Principal Secretary in the recently created Department of Research and Environmental Affairs prepared a comprehensive draft policy and circulated it widely to obtain comments from local scientists, technologists and engineers, and also from those sectors where S&T are utilized. All inputs thus received were compiled and presented to a committee. Members of the committee were drawn from both the public and private sectors who were entrusted with the responsibility of examining critically the draft policy and proposing how best the input could be crystallized and incorporated into the draft policy.

The amended draft S&T policy was later considered at a national conference on S&T for national development and adopted after amending it. Attending the

conference were delegates from the scientific community, senior policy-makers from the public sector, and senior executives and managers from the private sector. Several of the conference's sessions were chaired by the Secretary to the President and Cabinet. It can, therefore, be said that what was adopted at the conference in 1990 and later approved by Government was a national S&T policy that reflected a high level of consensus.

5.2 Planning and Infrastructure

What has not hitherto been explicitly stated but is implicit enough from what has been observed above is the fact that since its inception in 1974 the National Research Council of Malawi (NRCM) has not until 1988 been effective in discharging its functions. There are two main factors which have contributed to this. The first one was the membership of the NRCM. Heads of S&T institutions were members of the NRCM and yet many of them, particularly the Principal Secretaries several of whom were not scientists, failed to attend most of the Council meetings. Their representatives kept changing and those who attended were rarely briefed on what was discussed at the previous meetings. The meetings, therefore, were not as productive as one would have expected them to be.

The second factor was the strength of the NRCM Secretariat. As already pointed out above, the Secretariat was headed by an officer who was relatively junior in rank and was supported by an administrative officer. None of them had experience in R&D activities and could not, therefore, appreciate the importance of having a national S&T policy. This will perhaps explain why Malawi's national S&T policy was formulated sixteen years after NRCM was established and why it is only recently that the Department of Research and Environmental Affairs has taken some

steps to invite inputs from the scientific community aimed at improving a five-year S&T plan proposed by the Department (DREA, 1991).

Under a Section titled Planning and Infrastructure it has been observed in the proposed five-year S&T plan that competing demands for limited resources require that careful attention be paid to planning and the development of appropriate infrastructure at affordable cost, and that important concerns that will be addressed are:

- (i) ensuring that S&T are intimately integrated into the national macro-economic planning process;
- (ii) establishing the most appropriate infrastructure for invention, innovation and the application of S&T;
- (iii) determining, from time to time, S&T priorities for action;
- (iv) acquiring or transferring technology;
- (v) organizing the appropriate infrastructure for coordinating, monitoring, evaluating and forecasting, and for advising on S&T activities;
- (vi) providing appropriate S&T support services such as testing, quality control, standards and an adequate indigenous base for design, development and maintenance of scientific equipment.

Proposals for an institutional infrastructure required to support industrial development in Malawi have been made (Maida, 1990).

5.3 Programming

Since the inception of the NRCM no effort has until recently been made to ensure that investment plans should have a built-in mechanism for progressive development of scientific and technological capability in terms of research, engineering design and local manufacture of the various elements of plant, equipment or infrastructure. It was against this background that the Department of Research and Environmental Affairs has proposed that with effect from 1 April 1991 the five-year schedule of activities should be as indicated below:

Year One

1. Introduction of a National S&T Policy.
2. Manpower Development
 - (i) Assessment and regarding of present staff in public sector S&T institutions;
 - (ii) Recruitment of highly trained, technical/professional S&T staff locally and overseas as necessary;
 - (iii) Training of staff technicians on use and maintenance of specialized equipment;
 - (iv) Acquiring or transferring technology;
 - (v) Organizing the appropriate infrastructure for coordinating, monitoring, evaluating and

forecasting, and for advising on S&T activities;

- (vi) Providing appropriate S&T support services such as testing, quality control, standards and an adequate indigenous base for design, development and maintenance of scientific equipment.

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 - (iii) Training of staff technicians on use and maintenance of specialized equipment.
3. Improvement of the Scientific & Technological Environment
 - (i) Introduction of honors, medals, prizes and other schemes which will provide due recognition, prestige and status to scientists.
 - (ii) Introduction of a scientific stream in the civil service with improved salaries and career paths.
 - (iii) Improvement of the Science and Technology Information System.
 - (iv) Provision of fellowships.
 - (v) Support for conferences, seminars and workshops.
4. A review of public sector R&D institutions towards improving their organizational structure,

redefining their functions in terms of the Five Year Plan and improving their efficiency and accountability.

5. Provision of Support for Research Activities.

- (i) Support for new and continuing programmes/projects.
- (ii) Increased support for appropriate scientific institutions.
- (iii) Introduction of research projects and grants programmes.

6. Placement of science attaches in some of the overseas embassies.

7. Carrying out a series of studies on the establishment of a science park, venture and risk capital entities and an appropriate technology development organization.

8. Review of the operation of Patent and Copyright Legislation and of the Patent System.

9 Identification of areas where research and development or adaptation may be required for progressive indigenization of technologies.

10. Upgrading, and establishing where appropriate, mission-oriented industrial and agricultural extension services.

11. Development of Physical Infrastructure

- (i) Survey of S&T facilities and equipment.
- (ii) Upgrading laboratories and facilities, including equipment.

12 Increased promotion of S&T awareness in the society.

13. Provision of resources to priority S&T programmes.

14. Strengthening and development of new international S&T linkages.

15. Establishment of joint committees to develop closer linkages between R&D institutions and industry.

16. Action for increasing the ratio of scientific staff to technical support staff in public sector R&D institutions.

17. Action to reduce the salary component of the recurrent budget of public sector S&T institutions to no more than 50% of the total.

Year Two

Continue:

1. Training and upgrading of skills of local S&T manpower.

2. Recruitment of highly skilled professional S&T staff.

3. Improvement of scientific environment.

4. Introduction, where appropriate, of new institutional framework required for national S&T policy implementation.

5. Provision of support for selected research activities.

6. Programme of placement of science attaches in some of the overseas embassies.

7. Programme to identify areas where R&D or adaptation may be required for progressive indigenisation of technologies.

8. Build-up of mission-oriented industrial and agricultural extension services.

9. Survey of S&T facilities and equipment.

10. Promotion of international S&T linkages.

11. Establishment of joint committees to develop closer linkages between R&D institutions and industry.

12. Action to increase the ratio of scientific to support staff and the reduction of the salary component of the recurrent budget towards 50% of the total budget.

13. Commerce rationalization of R&D facilities and institutions in Malawi on the basis of data gathered in year one.

14. Implement results of feasibility studies carried out in year one and undertake new feasibility studies in priority areas.

15. Introduce new, or strengthen old, Copyright and Patent Legislation as required.

16. Develop pilot plant facilities to serve research institutions and industry.

17. Increase bilateral and multilateral agreements for co-operation in S&T fields and expand collaborative R&D programmes.

18. Carry out a comprehensive review of the various units in the country for testing quality control and standards to further improve their facilities for carrying out the tasks assigned to them.

19. Launch a programme of advanced training in various S&T fields at doctoral and post-doctoral levels for talented young scientists and engineers from the University, private or Government sectors.

20. Further improve S&T information facilities and resources.

21. Formulate national code of conduct for the transfer of technology to regulate the process.

22. Introduce a programme to enable research students to work for specified periods with selected specialist groups at relevant R&D institutions of both public and private sectors in the country.

23. Develop a programme which will allow a regular exchange of personnel between the University and Government R&D institutions.

Year Three

1. Continue programmes for year two.

2. Establish a national museum of S&T.

3. Develop an adequate indigenous base for design development, manufacture and maintenance of scientific equipment.

Year Four

Continue programmes from year three.

Year Five

Continue programmes from year four.

5.4 Execution of Programmed S&T Activities

This is the first year of the programmed S&T activities. Already the national S&T policy has been introduced as programmed. The activities described below have also been conducted.

5.5 National Inventory of Technological Needs in the Private Sector

One of the functions of DREA is to ensure that the scientists and engineers in the country are relevant to industry. Indeed the scientists' innovations and inventions can be expected to be useful to industry only if the R&D activities from which they emerge are demand oriented. To identify the private sector's technological needs, DREA has conducted a survey on the type of technologies needed by the industrialists/entrepreneurs. In the survey an attempt was made to establish whether or not industry in the country was willing to support R&D activities geared towards providing solutions to production constraints.

The information obtained from this survey will soon be published together with some data obtained from another survey which was conducted to establish the availability of technologies that have endogenously been developed in the country. It is hoped that the publication will serve to show to the scientists the type of problems the private sector wishes to see solutions provided for, and to the private sector the type of technologies that are locally available.

The survey conducted on the availability of locally developed technologies has pointed to an urgent need for the establishment of mechanisms and policies for the

commercialization of inventions. Because DREA believes that the effectiveness of a structure for the registration of patents and industrial property is a *sine qua non* for commercialization of local inventions, it has recently established a national Committee on Scientific and Industrial Research and Development with a mandate, among other things, to propose for Government consideration policies that will strengthen the existing structure and propel industrial and technological development in the country.

5.6 National Inventory of Approved Research Projects

One of the functions of the Department of Research and Environmental Affairs is to take an inventory of all research activities conducted in this country. In a survey conducted recently an attempt has been made to give a summary of approved research projects and priority areas of research identified by various research organizations in the country. The presentation of the data is so designed that a reader is able to review the research projects summarized herein in relation not only to the priority areas of research but also to policy objectives.

It is the wish of the Department of Research and Environmental Affairs (DREA) that research activities conducted in the country are consistent with the socio-economic realities that prevail locally and that their execution is in support of this country's developmental needs. The Department would like to see also the establishment of an adequate system for planning, allocating, and monitoring research resources which can be used to avoid not only the fragmentation and overlapping of research activities between different ministries and institutions but also a misallocation of resources. The data summarized in the 1991 publication indicate areas where collaborative research activities could be encouraged in order that resources, be they human or financial, allocated for the purpose are effectively utilized to the benefit of the country.

5.7 A National Inventory of Items of Laboratory Equipment

It is generally accepted that in most developing countries one of the factors which constrain the effectiveness in R&D is inadequacy of research facilities. It is observed in many developing countries that equipment, instrumentation and materials that are essential for the effective execution of R&D activities are either

non-existent, in a poor state of maintenance, or insufficient of regular supply.

In this country many items of the scientific equipment have been procured. To obtain information regarding:

- (i) the type and quality of the items of scientific equipment that have been procured and brought into this country,
- (ii) how many of them are currently functional, and
- (iii) whether or not at an institution where equipment is, there is an Instrumentation Officer/Technician who is responsible for repairing and/or servicing the equipment,

DREA has conducted a survey the findings of which have been compiled and published recently.

5.8 Survey on Library and Documentation Services

The effective utilization of science and technology for development essentially involves the collection and processing of scientific and technological data from various sources and combining them to produce the desired technological input for the implementation of national, industrial and economic development projects. An efficient information and documentation service that enables timely access to any kind of scientific and documentation information available either locally or through an international network of information systems and services is indeed regarded to be prerequisite to the fulfillment of the numerous tasks assigned to the Department of Research and Environmental Affairs. It was in recognition of this fact that the Malawi Government decided to establish a national information and documentation centre.

It is widely known that much of the information generated in this country is in the form of cyclostyled and mimeographed documents that are not easily made available for the general public to read. It is also known that each of the library and documentation units established at various organizations in this country tends to act only within its constituency of clients and normally within its own institution. The Department of Research and Environmental Affairs believes, however, that, with the country's resources, a comprehensive information and documentation service can be achieved only by resource sharing at national level and extensive use of external sources and services.

It was within this context that the Department decided to conduct a survey aimed at taking stock of S&T information and documentation services that are currently rendered in the country. The libraries or information and documentation centres covered in the present survey were R&D government and parastatal institutions; private R&D institutions; and service rendering and manufacturing organizations. The information obtained is being processed for publication.

5.9 Advice

The Department of Research and Environmental Affairs strongly believes that a close relationship between the scientists and industry must be forged. It was in this context that the Department, then known simply as the National Research Council of Malawi (NRCM) Secretariat, advised the Malawi Government in late 1988 on the need for evolving mechanisms for the creation of an interface between science and industry.

This advice later resulted in the inclusion of the Chamber of Commerce and Industries of Malawi as a member of the Council and representatives of the private sector as members of the various committees of the NRCM. Senior executives from several companies in the country also were accorded an opportunity to have interactive discussions with scientists and government policy-makers at a national conference on S&T for development that was held in early March 1990. These are some of the measures which have sown the seed of cooperation and which, it is hoped, will germinate into an inseparable linkage between industry and the generators of new ideas and innovations.

It was also on the basis of an advice given by the Department that the Government has taken major steps towards stimulating the scientific consciousness of the populace. Among the projects, schemes and activities initiated by the Department after obtaining the sanction of the Government with a view to generating, encouraging, catalyzing and giving a fillip to science popularization programmes are science fairs and exhibitions, science competitions, the annual celebration of Scientific Revival Day of Africa, the use of the audio and audio-visual media like radio and films for popularization of science, the presentation of the Malawi Awards for Scientific and Technological Achievement, and science quiz and interviews on scientific topics.

Odhiambo (1988) has pointed out that "Africa cannot afford to settle in the development philosophy of the latter half of the twentieth-century which merely invited

us to accept the products of technology transfer" and recommended that we "must ourselves reach for the frontiers of those sciences which are at the heart of our

problems so that we can be enabled to fashion out the relevant technological innovations that would provide effective, competitive, appropriate solutions".

It is the intention of the Malawi Government to encourage scientists in the country to "reach for the frontiers of those sciences which are at the heart" of the nation's problems. For the scientists to do this, however,

an enabling environment has to be created. An appreciation of this fact has recently prompted the Department of Research and Environmental Affairs to invite inputs from the scientific community and from other interested parties to improve a proposal on a system of incentives designed to help the scientists in Malawi to accept their calling as full time career scientists. After taking into account the inputs, the Department intends to submit the proposal for Government's consideration.

6.0 Strengths and Weaknesses

6.1 Goals and Functions

The goals and functions of both the National Research Council of Malawi and the Department of Research and Environmental Affairs have been well articulated.

6.2 Organization

It is evident from Figures 1 and 2 that the organizational structure of the Department of Research and Environmental Affairs does have the relevant Divisions required for it to carry out the functions it is charged with, and provides the required linkages.

As a ministerial body, the Department of Research and Environmental Affairs does not have any statutes in which its functions, structure and composition have been stipulated. As already pointed out above, however, by having the Head of State and Government as its Responsible Minister and a Principal Secretary as its Head, the Department which is placed in the Office of the President and Cabinet is in hierarchy above the of the S&T institutions in the country. This arrangement affords the Department to have the powers necessary for it to discharge its functions effectively and to have a role that is dynamic and readily responsive to changing circumstances.

6.3 Resources and their Utilization

6.3.1 Human

The decision by the Malawi Government to have a secretariat that is self-contained had as its basis the

observation that the failure of the NRCM to make an impact since its inception in 1974 was ascribable to the fact that its secretariat was understaffed. As indicated above, the Government addressed this weakness by creating more posts in 1988.

With the Presidential directive that the secretariat be elevated to the status of a ministerial apex body for S&T endeavors, proposals for the creation of additional posts have been submitted to the Government for consideration. Judging from what has so far been achieved, however, following the Government's decision was a right one and should be applauded.

6.3.2 Material

Prior to the creation of the Department of Research and Environmental Affairs, the NRCM Secretariat had the required material relative to the strength of its staff. Need for more buildings and equipment has, however, arisen following the recent creation of the Department. The government is currently considering proposals for more material.

6.3.3 Financial

Available data show that the level of funding drastically increased in 1988 with an improvement in the complement and grades of the Department's staff. The increase took into account the funds required to meet not only overhead but also operational costs. This is expected to be the case after Government sanction has been obtained for the creation of the posts.

7.0 RECOMMENDATIONS AND CONCLUSIONS

7.1 Goals, Functions and Organization

Since what has been summarized in Figures 1 and 2 are the organizational structure and linkages which the Government wishes to be instituted following the recent creation of the Department of Research and Environmental Affairs, it is recommended here that time should be allowed to be the judge of the extent to which what are now clearly well articulated goals and functions will achieve their aim.

7.2 Policy Instruments

Malawi has now a national S&T policy and is planning to integrate it in the national development process. The Government has taken positive steps aimed at, inter alia, creating an interface between local scientists and industry. These commendable measures will, however, lead to the promotion of an effective contribution of research, science and technology to the quality of life and prosperity of the people of Malawi only if they are substantiated by means of implementing them. Ex-

perience in the newly industrialized countries clearly shows that this is not achieved through the type of S&T institutions per se but by the type of policy instruments instituted.

In the absence of policy instruments a science and technology policy statement is liable to remain a mere piece of rhetoric (Raman, 1989). In Malawi like in many other developing countries, the private sector, which is composed of the ultimate consumers of the products of S&T research, does not play any significant role in the funding of R&D activities. The steps taken by the Malawi Government to create an effective interface between the scientists and industry will be able to encourage the private sector to fund or to involve itself in, R&D activities only if a system of incentives supported by the necessary policy instruments is instituted. The Department of Research and Environmental Affairs has submitted proposals to this effect for Government consideration.

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PERFORMANCE OF SCIENCE AND TECHNOLOGY POLICY INSTITUTIONS OF SENEGAL

B. Drame

A.T. Sylla

SEPTEMBER 1991

1. PREFACE

1.1. Objectives of the Evaluation Exercise

Over the last two decades there has been a growing interest in the development of Science and Technology in Africa. At the multilateral level, several Conferences have been held including the conference for the in Application of Science and Technology in Africa (CASTAFRICA) convened in 1974 and 1987 and the congress of Scientists (1987) which led to the establishment of the Pan-african Union of Science and Technology.

Alongside these meetings, the donors continued to support the African countries in the formulation of policies, programmes and activities regarding Science and Technology.

For its part the Senegalese Government, since the Second Economic and Social Development Plan, assigned a significant role to Science and Technology. The establishment of a Policy-making Organ in charge of the Science and Technology Policy and Research Institutions covering all fields and the efforts to define research programmes better adapted to the economic and social development needs bear out this concern.

In spite of this awareness of the role of Science and Technology in development and despite the numerous recommendations made for the development of Science and Technology, it should be admitted that the results are not commensurate with the efforts made.

Why?

It is within the purview of the reply to this question that this study was commissioned by the Economic Commission for Africa (ECA) thanks to the assistance of the Carnegie Foundation of New York.

It is to measure, through this study, the degree of effectiveness of our institutional research system through its Policy-making Organ of Science and Technology Policy and the Research Institutes and to make recommendations for its improvement, identify the institutional, material, psychological and financial constraints for the dissemination of Science and Technology.

This study could not attain all the expected objectives because of the almost inexistence of resource planning structure in the institutes likely to provide precise information on the existing scientific and technological potential.

For a better understanding of the concepts, it should be specified that Science and Technology encompass scientific and technological research.

1.2 Gratitude

This study has been carried out by Mr. Boubacar Drame and Mrs. Arlette Tairou Sylla thanks to the assistance of all the actors in the field of Scientific and Technological research, who are the National Directors of Institute, Research, Patrons, etc...

This is an opportunity to thank them all, and particularly:

- Mr. Modou Mboup, Director of Scientific and Technological Matters and his Staff;
- Mr. Mohammed El Habib Ly, Director General of the Senegalese Agricultural Research Institute (I.S.R.A) and his team;
- Mr. Jacques Diouf, Special Adviser to the Governor of the Central Bank of the West African States (B.C.E.A.O), former Minister of Scientific and Technological research;
- Mr. Djibril Sene M.P., and former Delegate to the Scientific and Technological research field;
- Mr. Armand Faye, Scientific Journalist;
- Mr. Alban Defondeville, Technical adviser to the Director of Science and Technology Matters.

2. BACKGROUND

2.1. Reason for the Establishment of O.D.P.S.T.

The economic context having led to the establishment of a structure in charge of the Science and Technology Policy is marked by:

- * An inadequately productive rural system

The cereal production covers only half the demand of the domestic market (it is estimated that the cereal production meets only 52% of the national requirements). This situation is due to a low yield and the dependence of our agriculture on climate risks.

- * Food dependence on the outside world reflected by increased

import of food grains (particularly rice) and plant or animal products.

- * An increased technological dependence on the outside world translated into huge imports of hard goods.

- * A low economic growth rate (an average of 2%) and lower than the population growth rate at 3%) showing the efforts that we have to make to meet all types of need (food, health, education) of a population that doubles every twenty five years.

Such a situation, if it were to persist, would result in a worsening of the trade balance deficit and a future loss of sovereignty, because we may depend on the outside world for supplies of the most essential food and hard goods.

The only way to reverse this trend is through scientific and technological research which may enable the production of precocious high yielding varieties, improvement of animal production and encouragement of mastery of appropriate technology.

This was understood by the Senegalese State which, from its independence, set up a structure in charge of the Science and Technology policy with the main mission of coordinating and giving impulsion to scientific and technological research.

2.2. Historical Background of O.D.P.S.T.

Since 1960, Senegal has gradually established and perfected the policy organ in charge of drawing up and implementing the Government policy on scientific and technological research.

The major stages of growth of this organ are:

1960: establishment of a coordination office for scientific and technological research. That Office was attached to the Office of the Chairman of the Council;

1966: establishment of an Office of Science and Technology Matters, attached to the Office of the President of the Republic;

1970: establishment of a Directorate of Science and Technology Matters at the level of the Office of the Secretary of State to the Prime Minister in charge of Planning;

1973: establishment of a General delegation for scientific and technological research at the level of the Office of the Prime Minister;

1979: establishment of an Office of a Secretary of State for scientific and technological research;

1981: establishment of a Ministry of Higher Education and Scientific research;

1983: establishment of a Ministry of Scientific and Technological research;

1986: establishment of a Directorate of Science and Technology Matters attached to the Ministry of Planning and Cooperation;

1990: transfer of the Directorate of Scientific and Technological Matters to the Ministry of National Education.

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The institutional development of the Policy-making Organ in charge of the Science and Technology Policy reflects two major phases: a growing phase from 1960 to 1983:

It progressed gradually from an Office to a Directorate, from a Directorate to a Delegation, from a Delegation to an Office of the Secretary of State and an Office of a Secretary of State to a full-fledged Ministry.

This phase coincided with the establishment of institutes covering almost all the research fields.

a decreasing phase as from 1986:

The Ministry of Scientific and Technological Research was scaled down to a Directorate.

This phase corresponded to the gradual restructuring of the Senegalese administration with the discontinuance and merger of several ministries.

From 27 March 1990 the Policy-making Organ in charge of the Science and Technology Policy is located in the Ministry of Education.

3. OBJECTIVES AND FUNCTIONS

3.1. Mission of the O.D.P.S.T.

3.1.1. Objectives and Statutory Functions

The Senegalese State, through the Eight Economic and Social Development Plan (1989-1995), set the following objectives for scientific and technological research.

- * Intensification of research in the various sectors of activity and application of results through:
- an intensification of research work for the production of precocious varieties adapted to the conditions of water shortage according to the agro-ecological zones;
- an intensification of research work for the production of highly productive breeds capable of increasing yields in the area of animal production and constitution of a test and ameliorative herd per animal species;
- an improvement in the management and utilisation of water and multi-functional resources.
- * Succeed in the technological adaptations by:
- strengthening contacts between Senegalese and foreign researchers;
- increasing the vaccine production;
- increasing the production of selected plant seeds;
- strengthening the links between Research-Development and extension work.
- * Develop innovation Centres by:
- establishment of technopolis in Dakar;
- preparing professional circles for the utilisation of data bank services.
- * Improvement of the institutional framework of research through a selection and strengthening research structures per field of research.

On the basis of the objectives defined above, the Directorate of Science and Technology Matters (DAST) was requested to:

- propose for the approval of the Inter-Ministerial Council for Scientific and Technological research;

- the definition of the major features and objectives of research policy;
- the establishment, strengthening or discontinuance of research institutes or organisations;
- determinations of the annual research budget and its sectoral allotment;
- ensure the implementation of the decisions of the Inter-ministerial Council for Scientific and Technological Research;
- plan and coordinate, follow and impel all the research activities carried out on the national territory in cooperation with the Ministerial Departments and Organisations concerned;
- make, in liaison with the services and organisations concerned, the inventory of the scientific and technological potential and the diagnosis of programmes and research potentialities;
- ensure, in close liaison with the research services and Organisations, the technical and financial planning evaluation and programming as well as the constant follow-up research projects and actions;
- formulate and develop a regional and international cooperation policy;
- identify the research staff training needs and ensure their integration in the national research structures;
- follow-up the utilisation of research results in economic and social development particularly to encourage the establishment of small and medium enterprises using technological innovations;
- collect and process data on research programmes and actions.

3.1.2. Analysis and Comments

It emerges from the consideration of the objectives and statutory functions that there is a willingness of the authorities to bind research work to the development concerns of the country.

However, one cannot help raising some questions linked to the importance of the mission of the Directorate of Science and Technology Matters (DAFT):

- does DAFT have the means to carry out its mission?
- does its installation in a Ministry more concerned about school and university problems enable it play fully its role?
- can the objectives set for research be attained when we know that the "research budget" is spread over several ministries?

The place of DAFT within the Government machinery particularly in the Ministry of Education is partly justified by the concern of being closer to the preoccupations of basic research by encouraging a coordination of research work carried out in the University and in the training institutes.

The magnitude of the education and training problems at the elementary, secondary and higher levels relegate scientific and technological research to the background.

This is borne out by the fact that there are almost no seminars or conferences on Science and Technology chaired by the Ministry itself.

From that viewpoint, it could be thought that by splitting the Ministry of Education into two separate Ministries (one dealing with elementary and secondary education and the other with Higher Education and Scientific Research) Science and Technology would assert itself better.

Unfortunately no. For that would continue to give to scientific and technological research the character of a basic research still making research work but finding no results.

What is, therefore, to be done at the institutional level to move to a higher stage which favour the development of Science and Technology?

Attach the structure for the promotion of scientific and technological activities to the Ministry of Agriculture or the Ministry of Industry?

Such an idea would guide scientific and technological research towards meeting the needs of agriculture and industry which are our development priorities.

In spite of that undeniable advantage we continue to think that Science and Technology will be better off within the framework of a light structure (e.g. Council) attached to the highest level of the State particularly the Office of the President of the Republic or the Prime Minister.

This will give a margin for manoeuvre to the National Directors in the exercise of their functions and will avert the administrative worries linked to the exercise of the responsibility.

3.2. Operationality of the Mission

This part is the outcome of meetings and interviews making it possible to know how the objectives defined for the research development are perceived by the National Directors and the Directors of institutes dealing with research management.

3.2.1. Perception of Objectives

In general, the National Directors and the Directors of institutes agree to say that research in Senegal has lost its lustre of the past and that is necessary to give it a new start. This take off should be translated in the objectives by:

- a greater research - action orientation which encourages a better responsibility of the establishments by themselves for it will allow the institutes to sell their scientific and technological services.
- an increased popularisation of the scientific and technological activities for "a scientific and technological spirit" to take roots in the people capable of generating scientific and technological progress.
- the need to define an endogenous scientific and technological research which takes into account the local development priorities.

3.2.2. Analysis and Comments

If the objectives assigned to research work are very ambitions, questions on the possibility of attaining them should be asked.

It should be noted that with its disengagements of the State, the contribution of the public authorities to the research institutes has greatly fallen. This leaves a big gap to be filled for the execution of research programmes.

This fact was not appreciated in all the dimension because in wanting to execute at all costs their programmes, the institutes turned towards donors which while financing them imposed a research work more in line with their concerns.

The most enlightening example is the market-gardening and horticultural research where at a given time 10 to 12 programmes corresponded to the needs of the donors.

There is, therefore, need to redefine the objectives (on the basis of this new fact) and also to direct them towards research-action which will enable the research institutes sell their scientific and technological services.

Efforts are being made in that direction but they are affected by bad promotion.

The institutes, in concert with the productive structures, must guide their research towards meeting the needs of the structure without totally losing sight of their future vision.

It is only at that price that the bases may be laid for a national scientific and technological research, the driving force of a self-sustained development.

But if we want to make research work everybody's concern, its pluridisciplinary nature must be greater. At the level of the formulation of objectives itself, the socio-economists, sociologists, statisticians, demographers, marketing officers, planners and researchers of all type must be associated. Better perceived objectives are a source of motivation.

Furthermore, owing to the preponderant role that Science and Technology will play in the future decades, a strategy for the dissemination of appropriate technologies which are less expensive and accessible to all must be laid down.

4. ORGANISATION

4.1 Structure

4.1.1. The Place of ODPST in the Government Structure

Since March 1990, the Policy-making Organ in charge of the Science and Technology Policy which is the Directorate of Science and Technology Matters has been attached to the Ministry of Education. From July 1991 the Policy-making Organ is attached to the new Ministry of Modernisation of State and Technology.

4.1.2. Sectoral Articulation

The Policy-making Organ of the Science and Technology Policy interacts first with the Inter-ministerial Council for Scientific and Technological research which is attached to the Office of the

President of the Republic. The Organ influences indirectly the research Units which depend upon the Ministries responsible for them or Universities.

4.1.3. Analysis and Comments

Research work is at present carried out in Senegal in a large number of generally quite specialized organisations. As regards their management, these Organisations depend upon the various Ministries which run them or the University. These institutes have a variable number of laboratories.

For example, agricultural research is under the supervision of the Senegalese Agricultural Research Institute (ISRA) which falls under the Ministry of Rural Development and Water Resources.

Research in Food Technology is under the Food Technology Institute (ITA) which is under responsibility of the Ministry of Industry and Handicraft.

These research Units are in touch with the users of the results (industries, developers) for the valorisation of the result and also with the Senegalese Researchers Association which contributes to the resolution of problems linked to research.

This contribution is made through advice, recommendations and reflections.

The research institutes do not have hierarchical but rather functions relations with DAFT.

The foreign donors are rarely mentioned as being part of the Organs which participate in the formulation of the Scientific and Technological Research Policy and yet these donors finance an average of 80% of the

research activities. This gives them the power to guide and influence the research policy and programmes.

Beyond this presentation of the different actors, several questions of substance arise:

- can DAFT impose an overall line to follow and strike effectively the balance between objectives and resources devoted to Scientific and Technological Research?
- can DAFT counterbalance the power of the Sectorial Ministries which now have the overall means for research?
- can DAFT avoid the duplication caused by sectorisation?
- can we prevent the foreign donors from guiding the research work according to their exigencies without taking into account those of the beneficiary country?

The effectiveness of the coordination of Scientific and Technological Research will depend partly on the replies to these questions.

To coordinate presupposes the working out of a priority plan or programme of action by the Policy-making Organ in charge of Scientific and Technological Research.

The importance of such a plan would be to serve as a reference framework for the donors, present the priorities, the ways and means to be explored in the five coming years, define the specific objectives to be attained and identify the necessary means for the execution of this programme.

In the absence of such a plan (as is the case at present) each institute of Organisation may study the subjects or themes already exhausted.

Thus very often, one sees for example, in the field of solar energy, four projects dealing with the testing and popularisation of photovoltaic cells. the huge amounts mobilised for these

projects could be used to finance research work in the field of biotechnology (still virgin sector).

In the event this plan existed, the present place of the Policy-making Organ would make the plan unoperational. In the absence of any weight at the institutional level, every directive will be unimplemented.

In our view, the hierarchical rank of the Policy-making Organ must be raised so as to give it all its means.

The Policy-making Organ will assume the form of a council or Delegation linked to the highest level of the State (Office of the Prime Minister or the President).

4.2. Composition

4.2.1. Organisational Chart

The organisation of the Directorate of Science and Technology Matters is as follows:

The Directorate of Science and Technology Matters (DAFT) has four (4) Technical divisions and two (2) related Services:

- Scientific Programming and Follow-up Division (DPSS);
- Studies and Planning Division (DEP);
- New Technologies Division (DNT);
- Research Valorisation and Heritage Division (DVPR);
- Scientific and Technological Documentation and Information Unit (CDIST);
- Management Office.

The DPSS is composed for the energy and Industrial Research Sector, the Agricultural and Agro-Industrial Research Section, the Medical and Pharmaceutical Research Section and the Social Sciences and Humanities Research Section.

The DEP groups the International cooperation Section, the Project Studies and Planning Section, the Project documentation, Statistics and Follow-up Section.

The DTN comprises the Valorisation section and the National Heritage Section.

4.2.2. Science and Technology Policy Conception Organ

With the support and at the recommendation of UNESCO, an Inter-ministerial Scientific and Technological Research Council was established in 1966.

It is a more political than scientific institution of horizontal type which groups the ministries concerned about research work or the utilisation of the results.

The "Policy" is defined by this Inter-ministerial Council which is the supreme decision-making Organ (deliberating organ) placed under the authority of the President of the Republic.

It usually meets once every year and considers the proposals made by the Ministry in charge of research particularly as regards:

- the determination of the major lines and priorities of national research;
- the establishment or discontinuance of research institutions;
- the determination and allotment of the annual research budget.

4.2.3. Consultative Commissions

The Commissions are purely consultative and scientific organs composed of scientists and representatives of users of research results.

Their role is to assist the Policy Organ with opinions and recommendations on the situation of the structures and the status of the implementation of research activities. They are six in number:

- Consultative commission on Agricultural and Industrial Research;
- Consultative Commission on Technological and Industrial Research;
- Consultative Commission on Medical and Pharmaceutical research;
- Consultative Commission on Social Sciences and Humanities Research;
- Basic consultative Commission which makes the synthesis of scientific and technological activities concerning several other commissions;
- Consultative Commission on Scientific and Technological Documentation and Standardisation.

The commissions express their views and make recommendations on:

- the on-going research activities, the results obtained and their utilisation for development;
- the changes proposed;
- the classification of these activities by order of priority on the basis of all appropriate criteria;
- the necessary means for their implementation;
- training, further training, retraining and employment of research staff.

4.2.4. Special Regional Development Committees

These committees, devoted to scientific and technological research, are a sort of "relay-structures"

which deal, at the level of the administrative regions of Senegal, with the same problems as the consultative Commissions.

4.2.5. Personnel of DAFT

The DAFT personnel comprises some thirty persons, three quarters of whom are scientists carrying out research administration functions.

In general, at the level of research institutes, the administrative staff remain relatively important while the support staff for research (maintenance technicians) remain small. It is in this field that efforts for training and recruitment of staff should be made to preserve the laboratory equipment which very often is expensive.

4.2.6. Analysis and Comments

In comparison with the countries of the sub-region, it is noted that in Senegal there are real efforts for the formulation of a national scientific and technological research policy which is integrated and which encompasses the development of research as a whole.

However, it should be stressed that for the CIRST and the consultative organs there is a serious discrepancy between what the regulations provide for and the reality of what is noted at the level of the application.

The Research Commission, Committees and Councils are not very operational, hence the increase in decisions and recommendations not followed by action.

This non-operationality is explained by:

- the irregularity of meetings,
- weariness.

Too many meetings have been held without any great result. Consequently, the researchers think that action must be taken.

The lack of craze for research activities among the people and the economic actors.

These commission, committees and councils must be reactivated so as to give further impulsion to scientific and technological research.

As regards the research staff in general, they lack motivation due to the absence of adequately attractive career profile and not very encouraging salaries.

The outcome is that many researchers at the end of a few years of practice, go abroad or work for foreign firms installed in Dakar. Hence the almost constant renewal of efforts for training in order to have high level and quality researchers.

At that level, everything must be done to accelerate the promulgation of the "Status of the Researcher" which guarantees better remuneration and improves the career profile of the researcher.

4.3 Relations

4.3.1. Relations with other Science and Technology Institutions

There are no direct relations between OPDST and other science and technology institutions. The relations are purely informal.

4.3.2. Relations with the Productive Sectors

The major problem of research work in Senegal is that it remained for long closed in an ivory tower with practically little relation with the productive sector.

Thus many achievements have been made in agricultural, agro-industrial and technological research but whose popularisation in the productive sectors remains one of the concerns of the authorities.

4.3.3 Analysis and Comments

Great efforts have been made to encourage the utilisation of the results by the productive sectors. Fiscal measures have been taken within the investment code to encourage enterprises which use the research results and technological innovation.

Nevertheless valorisation is still very timid. There are three major reasons for this:

- the lack of a sound liaison structure between the OPDST and the development sector. The existing valorisation lacks human and financial resources;
- the lack of a national valorisation structure like the ANVAR (National Valorisation Agency) in France;
- the lack of large scale publication of research results intended for the industrial and promoters world, likely to be interested in the utilisation of research results.

4.4 Powers

4.4.1 Statutory Powers

Statutorily, the DASST has the following powers:

* Promotion of Scientific and Technological research.

It is exercised in four directions:

- towards the researchers, with the aim, on the one hand, of creating and guiding research programmes and on the other of facilitating the integration of national researchers into the national structures;

- towards the state, to protect and use the national heritage for inventions and discoveries;
- towards the national and international funding sources to develop human and material resources placed at the disposal of National Research;
- towards the public through information and sensitization.

*** Coordination and Control.**

It is to coordinate all the research activities and studies on the national territory, to define the objectives and adopt the programmes, specify the role of each research institution or organisation, determine the stages of execution, distribute the means to control the execution of programmes accepted and ensure the implementation of the decision of the CIRST.

*** Participation in Development efforts.**

Being first of all in the service of development, scientific and technological research must lead to practical applications which encourage that development.

To exercise these powers, DAFT has the:

- Fund for Impulsion of Scientific and Technological Research (FIRST). The FIRST is provided annually with 100 million CFA Francs;

- Scientific and Technological Publications Fund. It is annually provided with 10 million CFA Francs;

Un operational budget.

This budget of 60 million CFA Francs is meant to pay the salary of the Officers and for maintenance purposes.

In addition to the operational budget, the Policy Organ has only 110 million CFA Francs to exercise the powers devoted upon it statutorily.

4.4.2 Powers Perceived

It is understood that for the exercise of these powers, the DAFT must be at a hierarchical rank above those of the institutes; this is not the case at present.

The consequence is the execution of some programmes by institutes without informing the Policy-making Organ or the other institutes for a possible cooperation but worse in that some directives are not followed by any action.

The most enlightening example is the obligation for the institutes to send their annual activity report to the DAFT. In practice, this directive has never been implemented by many research institutes.

4.4.3 Comments

It is accepted that the present organisation of research work does not allow the Policy Organ to carry out fully its functions. In the absence of any hierarchical link with the institutes, it is difficult to exercise its powers.

5. ACTIVITIES

5.1 Planning

5.1.1 Drawing up of Policy

The drawing up of the National Planning Policy depends on two instruments:

- * A future study for a new generation

A general reflection on the Senegalese Society and its natural and international past (1960-1988) their future (by the year 2015) environment with a view to submitting to the Government a range of scenarios proposing plausible images of the future and the ways to achieve it. The long term future choices are intended to enlighten and guide the strategic choices of medium term orientation plans.

- * A medium term Law-economic and Social Orientation Plan

It identifies a general strategy which fixes the orientation and priorities of the economy for a period of six (6) years, reviewable every three years. These instruments serve as reference framework for the National Planning Commission.

The National Research Planning Commission, on the basis of the Sectorial diagnosis and the directives outlined by the Inter-ministerial Scientific and Technological Research Council, defines the priorities and orientations of Scientific and Technological Research.

It should be stressed that this Commission is an Inter-ministerial structure which groups, apart from the representatives of technical ministries, the researchers, industrialists and the representatives of some Non-Governmental Organisations (NGOs).

The Commission draws inspiration from the proceedings of the Consultative Commission on Research, the indicative research plan prepared by the DAFT, available statistical data and official publication (speeches, seminars, etc...).

5.1.2 Programming

The Project Programming is, in general, made through the Triennial Public Investment Programme (PTIP) which selects the

Programmes of Action and Investment in conformity with the strategy chosen for their budgeting.

It should be added that an initial selection is made at the level of the Research institutes.

5.2 Coordination

Coordination aims at ensuring the harmonisation of the national policy on science and technology with the policies on other sectors such as Education, Industry, Environment, Agriculture and so on and a Research-Development link.

5.2.1 Between the Science and Technology Institutions

The means at the disposal of DAFT to carry out the coordination are:

- * Prior approval

for any study or research project it is necessary to obtain the prior approval of the Directorate of Science and Technology Matters before its submission for funding.

This approval should make it possible to have an overall view of projects to be funded, to see, according to the priorities identified by the Plan, which projects to execute in order to avoid duplication.

- * Submission of Annual Activity Reports

It is compulsory for the research institutes and organisations to send their Annual Activity Report to the DAFT. These reports evaluate the technical and financial execution of their research

projects and programmes and make it possible to take stock of the scientific and technological achievements.

- * Scientific and Technological Potential

An inventory of the scientific and technological potential must be taken periodically that is to know all the institutional

and extra-institutional resources of national scientific and technological research.

The purpose of this inventory is to identify the training priorities of researchers and research development, to know the extent of dissemination of research results.

5.2.2 Reconciliation and Harmonisation of Scientific and Technological Activities with the National Policy

The reconciliation and harmonisation of scientific and technological activities with the national policy is carried out through the Plan.

The Plan defines the priority action areas in all the sectors of economic and social development.

On the basis of the priority action areas, objectives are assigned to each development sector.

Thus the objectives assigned to research draw inspiration from the production needs expressed by the development sectors.

For example, in the agricultural field, the objective is food self-sufficiency. To do so, the Senegalese Agricultural Research Institute (ISRA) will be requested to intensify research work making it possible to have higher yields in all the sectors of farming.

A mid-term review of the execution of the planning carried out in order to better maintain the scientific and technological activities within the framework of the national policy.

5.3 Execution of Scientific and Technological Activities

Scientific and Technological activities are executed through Scientific and Technological Research Institutes.

5.3.1 Implementation Programme

In each institution, a programme for executing scientific and technological activities is worked out drawing inspiration from the research sectoral strategies identified in the Economic and Social Development Plan.

This programme takes into account for each project the human and financial resources available and to be

sought. The state of the equipment, the site, the objectives and the accompanying measures to be taken.

5.3.2 Control and Evaluation

The Scientific Committee of each institute has the powers to control and evaluate the research programme.

This committee groups all the necessary scientific disciplines for a good evaluation and technical follow-up of projects.

If the control in itself does not pose any problem, it is not the same for particularly the ex-post evaluation.

To evaluate presupposes the availability of order-nately precise indicators to measure often intangible objectives like, for example, the improvement of the living conditions of the people.

All the difficulties lie at that level. Our institutes do not have criteria to assess the effectiveness of research.

5.4 Recommendations

For a sound execution and follow-up of projects, various measures are necessary:

- control of the work of the researchers by the preparation, for each researcher or institution, of an annual report on future activities;
- preparation of scientific publications in each institute.

6. ATTAINMENT OF OBJECTIVES

6.1 Planning

6.1.1 Drawing up of Policy

The drawing up of the National Planning Policy is based on two instruments:

- the future study for a new generation;
- an economic and social orientation plan law.

These two instruments outline the future achievements in the field of research.

The degree of execution of these proposed actions is very rarely assessed because of the lack of information or the non-dissemination of information of research institutes or organisations to the ODPST.

6.1.2 Programming

Owing to the slippery nature of the Triennial Public Investment Programme, a review of the achievements is regularly carried out. This review gives ideas about the activities to be undertaken for the pursuit of the projects.

6.2 Coordination

6.2.1 Among Science and Technology Institutions

The coordination among science and technology institutions should be made through the ODPST.

The ODPST, thanks to the reports sent regularly to it, must play a major role in the orientation and pursuit of research activities. The instruments which make it possible to carry out fully this coordination (prior approval and supply of Activity Reports) are hardly used by the institutes because of the absence of all hierarchical links.

6.2.2 Reconciliation and Harmonisation of Science and Technology Activities with the National Policy

From this viewpoint, the science and technology activities fall perfectly in line with the objectives defined by the National Policy. This is what justifies the

predominance of agricultural and agro-food researches over the other sectors of research. The Government of Senegal gives priority to the development of agriculture which is the surest way of achieving socio-economic development.

6.3 Execution of Scientific and Technological Activities

The scientific and technological activities are in general executed rather correctly. The researchers are directly responsible for research activities. They conduct them and work associate researchers and assistants.

The problems they face are particularly administrative and are often upstream. They are the slowness in the mobilisation of funds and administrative slowness. These various factors contribute to delaying by about six months the take off of projects.

Furthermore, during the take off stage, the non-consideration of maintenance and recurrent expenses in the mobilisation of funds contribute to blocking the project mid way.

6.4 Counsel

The counselling activity at ODPST is not developed. It has an important function in the smooth execution of scientific and technological activities.

6.5 Recommendations

These recommendations comprise:

- the establishment of a counselling service in DAFT
- the establishment, at the level of the institutes, services in charge of relations with the ODPST and other institutes
- the inclusion of recurrent expenses (staff and maintenance) in project estimates.

7. STRENGTH AND WEAKNESSES

7.1 Objectives and Functions

Since independence, Senegal succeeded in establishing gradually a sector covering all research fields. Institutes have been set up in the agricultural, agro-industrial, energy, medical and other fields.

But this institutional growth has not enabled the establishment of an integrated research system enabling the

cooperation of institutes working upstream and downstream of a research field.

The result is an advanced specialisation of each institute in its sphere of activities.

- The objectives and functions defined by the Policy-making Organ for the development of research are too general and are not of a nature to fix performance and effectiveness constraints on the institutes.

- Lack of opening to Science and Technology. In Senegal, development of scientific and technological research has been particularly stressed while ignoring that the final aim of scientific and technological research is socio-economic development.

7.2 Organisation

7.2.1 Structure

The frequent changes in the Policy-making Organ bear evidence to the dynamism of an organisation in full development and the will of the political apparatus to put science in the service of

development and also of prudence to adapt this organisation to the socio-economic realities of the country.

It is probable that the work of this Policy-making Organ has appreciably contributed to:

- the development of the human scientific potential (828 researchers and technicians in 1982 to more than 1200 in 1990);
- the development of national human resources;
- the implementation of a science policy coherent and integrated enough in the general development strategy;
- the gradual reduction of scientific dependence on the outside world to focus on a gradually more endogenous national development.

However, in spite of these undeniable achievements, one cannot fail to stress that the present organisation of research with a lock of hierarchical links between the

Policy-making Organ and the research institutes do not militate for an effective research coordination. It generates duplication of activities and hardly encourages an integration of research.

7.2.3 Relations

It is in the field of relations between the research institutes and the development sectors that the problem lies.

The results of research available are not well known by the agricultural, industrial and agro-industrial sectors. And when they are known, they are affected by bad promotion. The lack of a

national valorisation structure partly justifies the lack of relations between the research institutes and the development sectors.

7.2.4 Powers

The present organisation of research is such that the management powers lie in the hands of the institutes while those of coordination and impulsion are in the hands of the Policy-making Organ.

It happens that the powers of coordination and impulsion cannot be effectively exercised without a higher hierarchical rank.

7.3 Resources and their Utilisation

7.3.1 Human Resources

It is indisputable that during the last three decades huge efforts have been made to train men and women.

However, it should, after all, be stressed that there is a shortage of research officers and technicians.

Many of the Scientists, after their training, remain in Europe or so to some african countries where remuneration is higher.

This constant brain drain results in the fact that Senegal is not self-sufficient in disciplines like Physics, Chemistry, Technology, Natural Science and Mathematics and appeals for technical assistance.

Women have a low representation in the Scientific and Technological areas (less than 10%).

Technical assistance is always present to the tune of 50%.

7.3.2. Material Resources

In general, the research institutes have capital equipment which are adequately functional.

For its part, DAFT has six (6) micro-computers used for the inventory of the scientific and technological potential and is equipped with modern typewriters.

This situation differs from that of the technical and vocational secondary schools where the equipment is obsolete and little functional. The root cause is lack of equipment and non-renewal of the latter.

7.3.3 Financial resources

The financial resources are characterised by:

- the fall in the contribution of the public authorities:

The contribution of the public authorities to the institutes represent an average of 20% of all the resources. It is generally translated into the allotment of an

annual subvention for recurrent expenses covering salaries and maintenance.

- strong dependence of research on bilateral or multilateral assistance.

The research programmes are financed by the donors in the form of multilateral loans and subventions to the tune of 80 to 90%. The Senegalese State provides only its share.

This situation establishes the future threats to research development.

- the almost total lack of resource generated by the institutes themselves.

The institutes generate little income to enable them bear the expenses of the execution of the research programme or projects.

8. RECOMMENDATIONS

- a) Reorganise the research work by raising the hierarchical rank of the Policy-making Organ by setting up new structures.

The Policy-making Organ (DAFT) will be attached to the National Science and Technology Council (CNST) which is directly attached to the Office of the President of the Republic.

The research Centres have a management autonomy and are placed under only one responsible organ: the CNST.

The innovation will be the establishment of a National Research Development Society whose inclination will be to work in relation with the industrialists, marketing officers, researchers at the valorisation of research results. The SRND will be a para-statal structure in which part of the capital will be from the private sector. The creation of "Technology" is an initial response to this concern.

The CNST will have the advantage of having a general view of the research work encompassing science and technology.

- b) Develop cross fertilisation between the University, Research work and Firms.

The development will have the advantage of guiding research work towards an action research which may enable research institutions and the University to sell their scientific and technological services.

In this connection, the recent establishment of a State-Firm-University Committee must be hailed (See Annex I).

- c) Continue to initiate encouragement actions for the promotion of Science and Technology.

These encouragement actions concern the establishment of prizes like those of the President of the Republic for Scientific

and Technological Innovation (See Annex 2) but also customs and tax exemptions for firms which use the research results.

- d) Work for the grouping of Institutions by branch.

There are many research institutions (See Annex 3). A wide dispersal does not favour an integration of research and encourages the dispersal of resources.

- e) Improvement of living and working conditions of researchers.

It means offering higher salaries so as to maintain the researchers in their structures and guarantee housing accommodation to the researchers.

Everything must be done now to speed up the promulgation of the "Status of the Researcher" which guarantees acceptable career conditions.

- f) Pursue the effort to guide research work to research-action.

The survival of institutions depends on it. It is only through this that they will be able to sell scientific and technological "services".

- g) Promote the appointment of entrepreneurs who proved themselves in the private sector to posts of director in research institutes and posts of adviser and guide of science and technology policy.

9. CONCLUSION

Most of the actors and observers of the scientific research world are aware that research work, at different degrees, in Senegal faces difficulties including some emanating from the policy itself and the organisation of structures.

This document wanted to draw the attention of the decision-makers and donors to the efforts that must be continued to be made for the development of science and technology in Senegal.

At the end of this work a measure was taken by the public powers: the attachment of DAFT to the Office of the Prime Minister within the purview of a new Ministry in charge of the modernisation of the state and technology. This, in itself, is an additional step towards a greater dissemination of the action of science and technology in our country.

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Days of reflexion on the Promotion of the results of the Food Technology Institute (FTI)

Lagos Plan of Action

Congress of Scientists from 25 to 30 June 1987 (CAS-TAFRICA 21)

ANNEXES

Annex 1: Status of the ODPST

Annex 2: State-Firm-University Committee

Annex 3: List of Research Institutes

**Annex 4: Decree Establishing the Ministry in Charge
of the Modernisation of the State and of Technology**

ANNEX 1

FUNCTIONS OF THE DIRECTORATE OF SCIENCE AND TECHNOLOGY MATTERS

The Directorate of Science and Technology Matters is in charge of:

planning, coordinating, monitoring, and impelling all the research activities being carried out on the national territory in cooperation with the ministerial departments concerned;

preparing, in liaison with the services and organisations concerned, the inventory of the scientific and technological potential and the diagnosis of research programmes and potentialities in Senegal;

ensuring, in liaison with the research services and organisations, the technical and financial planning, evaluation, programming, and the permanent follow-up of research projects and actions;

drawing up and developing a regional and international cooperation policy on scientific and technological research;

identifying research staff training needs and ensuring their inclusion in the National Research structures;

following-up the utilisation of the research results of the economic and social development and particularly encouraging the establishment of small and medium term enterprises using the technological innovations.

ANNEX 2

REPUBLIC OF SENEGAL

MINISTRY OF NATIONAL EDUCATION

DIRECTORATE OF HIGHER EDUCATION

No. 06 Dec. 90 MEN/DES

Dakar,

ORDER FOR THE APPOINTMENT OF A NATIONAL FOLLOW-UP COMMITTEE

ON COOPERATION BETWEEN THE DIRECTORATE OF HIGHER EDUCATION,

THE UNIVERSITIES OF DAKAR AND ST. LOUIS AND THE FIRMS

The Ministry of National Education,

Considering the Constitution,

Considering Law No. 87-19 of 3 August 1987 on the organisational and control of firms of the para-statal sector and the control of legal entities of private law benefiting from the financial assistance of the public powers,

Considering Decree No. 90-333 of 27 March 1990 on the allotment of the State Services,

Considering Decree No. 90-336 of 27 March amending the organisational structure of the Office of the President of the Republic,

Considering Decree No. 90-332 of 27 March 1990 on the appointment of Ministers,

Considering Decree No. 90-530 of MEN/DC/BS of 14 May 1990 of the appointment of the Director of Higher Education:

ORDERS

ARTICLE ONE: a national Follow-up Committee on cooperation between the Directorate of Higher Education, the Universities of Dakar and St. Louis and the Firms shall be established.

ARTICLE TWO: this Committee shall be composed of the following:

CHAIRMAN: Professor Djibril Fall, Director of Higher Education

RAPPORTEUR: Mr. Mahane Fall, Head of the Firms Unit within the Directorate of Higher Education

MEMBERS: -The Vice-Chancellors of the Universities of

Dakar and St. Louis.

Chairman of the National Employers' Council, A. Moctar Sow

Ferdinand Nkache, Technical Adviser in M.E.N

Mamadou Amadou Ly, Technical Adviser in M.E.N

Babacar Thiam, Technical Adviser in M.E.N

Chairman of the Chamber of Commerce, Industry and Agriculture of Dakar

Secretary General of C.C.I.A. of Dakar, Makhan Danfakha

Chairman of the Chamber of Trades of Dakar

Chairman of the National Phosphates Company of Taiba

Chairman of SONATEL

Chairman of SENELEC

Chairman of Junior firms

Chairman of Junior Entrepreneurs

Samir N. Bourgi et Frères F. Transit - Dakar

Chairman of the Sugar Company of Senegal

Chairman of SAED in St. Louis

Alasane Wade, Coordinator of Senegalo-German-Project

Chairman of SOTIBA SIMPAFRIC

D.G. of SN HLM

Chairman of AFRICAMER

Chairman of Autonomous Port of Dakar

Chairman of Dakar Marine

Chairman of SONACOS - Dakar

Chairman of SNCFS in Thies

Chairman of SODEFITEX

Chairman of Savonnerie Africaine FAKHRI

Chairman of LAGON II

D.G. of CICES

Chairman of the Consortium of firms

Chairman of the National Council of Young Firm Managers

Chairman of AGETIP

Chairman of SISMAR

Chairman of SOCOCIM

Chairman of EXPRESS TRANSIT

Chairman of TRANSCAP

Chairman of S.I.P.S

Chairman of the Bookshop Stationary "LE SENEGAL"

Chairman of Grands Moulins of Dakar

Chairman of SOBOA

Chairman of Comptoir Commercial du Senegal

Chairman of Savonnerie Ouest Africaine

Chairman of NESTLE SENEGAL

Chairman of SOCOPAO SENEGAL

Chairman of I.C.S

Chairman of Jean LEFEBVRE Company

Chairman of "la Compagnie Senegalaise d'Entreprises"

Chairman of Compagnie Générale d'Electricité

Femmes, Developpement et Entreprises en Afrique

The Chairperson of the Association of Women Company Managers

Chairman of FILFILI

Chairman of C.D.E

Amadou Diaw, Permanent Secretary of C.N.E.S

Bouna Gaye, University Cheick AntA Diop

Felix Sanchez, Member of CNES

Cherif Mbodj, CNES/CNP

Papa Ibrahim Beye, C.N.P

Amadou Lamine Diallo, Cabinet ABC

Tidiane Tall, ABC/CNP

Lamine Niang, Chairman EQUIP PLUS

Director of ENSPT

MIFERSO (Mr. Kande)

Madior Semou Niang, Chairman of a Company

Director of the Advanced Training College

ARTICLE THREE: the Director of Higher Education shall be in charge of the execution of the present order which shall be published in the official Gazette.

Ministry of National Education

Copies

PR/SG

SCM

MEN/DES

Those concerned

JORS

ANLES

ANNEX 3

ENERGY RESEARCH

1. Renewable Energy Studies and Research Centre (C.E.R.E.R)

2. Semi-conductors Laboratory - Faculty of Science

3. National Higher University College of Technology (ENUSUT)

4. Polytechnic College of Thies (E.P.T)

5. Faculty of Science (University of Dakar)

PLURIDISCIPLINARY RESEARCH

1. Overseas Scientific and Technical Research Department (O.R.S.T.O.M)

SOCIAL SCIENCES AND HUMANITIES RESEARCH

1. Faculty of Arts and Humanities

2. Fundamental Institute of Black Africa (I.F.A.N)

3. Applied Linguistics Centre of Dakar (C.L.A.D)

4. Applied Economics Research Centre (C.R.E.A)

5. Islamic Institute of Senegal

6. School of Architecture and Town Planning (E.A.U)

7. Centre for Civilisation Studies (C.E.C)

8. Housing, Town and National Development Research Centre (C.R.A.U.A.T)

9. Cultural Archives of Senegal (A.C.S)

10. Research and Studies Centre on Documentation, Institutions and African Legislation (C.R.D.I.L.A)

11. Centre for Higher Afro-Ibero-American Studies (C.H.E.A.I.A)

12. Environment Science Institute (I.S.E).

LIST OF RESEARCH INSTITUTIONS ACCORDING TO THEIR MAIN ACTIVITIES: AGRICULTURAL AND AGRO-INDUSTRIAL RESEARCH

1. Senegalese Agricultural Research Institute (ISRA) in charge:

MDR

● National Livestock and Veterinary Research Laboratory (L.N.E.R.V)

● Agronomic Research Centre of Bambey (C.R.A)

● Richard-Tall Agronomic Research Centre (Fanaye, Guede, Ndiol)

● Agronomic Research Centre of Kaolack - Nioro

● Agronomic Research Centre of Djibelor (C.R.A)

● Agronomic Research Centre of Tambacounda

● Agronomic Research Centre (C.N.R.F) Dakar-Hann

● Oceanographic Research Centre of Dakar-Thiaroye (C.R.O.D.T)

● Horticultural Development Centre (C.D.H)

● Zootechnology Research Centre of Kolda (C.R.Z)

● Zootechnology Research Centre of Dahra Djoloff (C.R.Z)

2. Food Technology Institute (I.T.A) in charge: **MDIA**

3. Common Organisation for Locust and Fowl Pest Control (O.C.L.A.L.A.V)

MEDICAL AND PHARMACEUTICAL RESEARCH

1. Joint Faculty of Medicine and Pharmacy

2. Centre for Biological Research on Leprosy (C.R.B.L)

3. Odontology Stomatology Institute (I.O.S)

4. Applied Tropical Diseases Institute (I.M.T.A)

5. Psycho-Pathological Research Centre (C.R.P.P)

6. Malta Pavilion

7. Abasse NDAO Teaching Hospital

8. Social Psychiatry Institute (I.P.S)

9. Inter-State School of Veterinary Medicine and Sciences (E.I.M.S.V)

10. Pasteur Institute

11. Regional Organisation for Food and Nutrition in African (O.R.A.N.A)

12. Applied Food and Nutrition Service in Senegal (S.A.N.A.S).

PUBLIC WORKS AND BUILDINGS RESEARCH

1. Experimental Research and Studies Centre for Equipment (C.E.R.E.E.Q)

DOCUMENTATION

1. Michel Adamson Research and Documentation Centre (C.R.D)

2. University Library (B.U)

SPORTS

1. National Advanced People's Education and Sports Institute (I.N.S.E.P.S)

OTHERS

1. Applied Mathematics Institute (I.M.A)

2. Research Institute for Teaching of Mathematics, Physics and Technology (I.M.E.M.P.T)

3. African Centre for Advanced Management Studies (C.E.S.A.G)

4. ENDA

5. Various NGOs

ANNEX 4

REPUBLIC OF SENEGAL

One-People One-Aim One-Faith

Prime Minister

**DECREE DEFINING THE FUNCTIONS OF
MR. MAGUED DIOUF, DEPUTY**

MINISTER IN THE OFFICE OF PRIME MINISTER IN CHARGE OF

MODERNISATION OF STATE AND TECHNOLOGY

THE PRESIDENT OF THE REPUBLIC

considering the Constitution and particularly its Articles 36, 37, 38, 43 and 65,

Considering the Order No. 85.1120 of 18 October 1985 on Organisation of the Ministry of Civil Service, Employment and Labour;

Considering Decree No. 87.1402 of 17 November 1987 on the Functions of the Delegation for Computer Science;

Considering Decree No. 91.427 of 7 April 1991 on the performance by the Prime Minister of some functions assigned by the texts in force to the Secretary General of the Office of the President of the Republic;

Considering Decree No. 91.430 of 8 April 1991 on the allotment of State services and the control of public establishments, national corporations and semi public corporations between the Office of the President of the Republic and the Ministries;

Considering Decree No. 91.696 of 17.1991 appointing the Deputy Minister in the Office of the Prime Minister in charge of Modernisation of State and Technology;

Upon the report of the Prime Minister:

DECREES

ARTICLE ONE: Mr. Magued Diouf, Deputy Minister in the Office of the Prime Minister in charge of the modernisation of the State and Technology shall exercise on behalf of the Prime Minister and under his authority the powers devolving upon the latter for the modernisation of the State and the development of technologies.

On this score, he shall be in charge of:

- the administration of Civil Servants falling within the general status of Civil Servants and the administration of non-Civil Servant employees;
- guidance and coordination of the policy defined by the Committee on modernisation of the State of which he is the Secretary General for the improvement of human resource management in administration, internal, and external communication of public services, the simplification and making the administrative process lighter, the increase in and evaluation of the administrative effectiveness;
- the implementation of the informatics policy defined by the National Informatics Committee;
- the implementation of the Scientific and Technological Research Policy and the Official Development Assistance Policy and the dissemination of technologies.

He shall represent the Government on Inter-State or International Technical Organisations competent in Civil Service and scientific research.

ARTICLE TWO: the Deputy Minister in the Office of the Prime Minister in charge of the Modernisation of the State and Technology shall have for the performance of his functions the services of the Office of the Prime Minister listed below:

- Delegation to Informatics
- Organisation and methods Office
- Directorate of Civil Service
- National School of Administration and Magistracy
- Administrative Staff Training Centre
- National Commission for Classification of Training Levels
- Establishment of total Wages Control Unit
- Directorate of Science and Technology Matters
- National Scientific and Technological Documentation Centre.

ARTICLE THREE: the provisions of Decree No. 91.441 of 8 April 1991 shall be rescinded.

ARTICLE FOUR: the Prime Minister and the Deputy Minister in the Office of the Prime Minister in charge of the Modernisation of the State and Technol-

ogy shall be in charge, each one in his field, of the execution of this Order, which shall be published in the official Gazette.

Done in Dakar on 17 July 1991
By the President of the Republic
The Prime Minister

PERFORMANCE REVIEW OF SCIENCE AND TECHNOLOGYPOLICY INSTITUTION IN SIERRA LEONE

N.C. Pratt

I.L.M Sesay

September 1991

EXECUTIVE SUMMARY

This report on the study of the Potential of Institution(s) for Science and Technology Policy in Sierra Leone, relates to the Ministry of National Development and Economic Planning (MONDEP). It deals specifically with the Central Planning Unit (CPU) and the Focal Unit established within the Central Planning Unit to promote and coordinate technology issues and the establishment of a National Council on Science and Technology for Development. MONDEP is the central governmental organ which coordinates national development planning in Sierra Leone. The study is undertaken by the United Nations Economic Commission for Africa (ECA) and was conducted by two local researchers nominated by the government of Sierra Leone. This study forms part of similar studies undertaken by the ECA with sponsorship from the Carnegie Corporation of New York in other African countries.

The report aims at giving an insight into the prevailing organizational arrangements and potential mechanisms for establishing policies in science and technology and for their integration into the broader framework of national socio-economic development objectives in Sierra Leone.

Thus, information is presented in chapters 2 to 7 on the development of the Focal Unit, the structure of the Central Planning Unit, its functions, science and technology activities of the Focal Unit, its resources and those available to certain S & T development activities, the links between the Central Planning Unit and other sectors of the national economy in so far as they pertain to science and technology. The information is drawn together by means of an analytical framework which allows an assessment of the performance and effectiveness of the Central Planning Unit and its Focal Unit for stimulating the development and application of science and technology in Sierra Leone.

In chapter 7 is highlighted the weaknesses and strengths of the science and technology conditions in Sierra Leone. Chapter 8 contains recommendations on the future prospects for the development of science and technology in the country.

Sierra Leone currently has no explicitly defined National Policy on Science and Technology. Also, it has no specific body with adequate statutory powers to promote the articulation of any coherent policy on science and technology, to identify and define its scientific and technological problems and requirements within the framework of the national development objectives and to forecast, plan and work out relevant S & T programme projects for development.

On the whole, there is no defined systematic mechanism for integrating science and technology into the formulation of the objectives of Development Plans and their execution.

The Development Plans do not include specific policy on science and technology which can be translated into a national scientific and technological budget, thus the resources available to science and technology activities are limited only to those which are available within the appropriations of relevant sectoral ministries. These resources have been insignificant by any standard and there is an urgent need for the specific allocation of adequate funds in the national budget for the development of science and technology.

In the context of models of organizational patterns of science and technology system; the network of science and technology system in Sierra Leone cannot be readily defined, since all the relevant factors are not discernible. However, based on its parliamentary type of political system and its indicative type of economic planning, the situation is best described as one of adhoc integration.

The country already has advanced mechanisms and institutional arrangements for economic development planning, so that it should not be difficult for it to deal adequately with the development and application of science and technology to the same extent either by evolving a coordinated or concerted interaction among the elements of S & T system. In order to reach this level, it has first to institute the relevant measures at the appropriate governmental level. So far, the impact on economic and social development of the prevailing adhoc arrangements of what S & T activities there have been in the country before the establishment of the Focal Unit and since its coming into being in 1985 has been insignificant. This is due largely to the various shortcomings highlighted in the text.

However, the prospects for the future could be bright since Sierra Leone has for a long time now been deliberating on and laying some aspects of the foundation necessary for the development and application of science and technology to socio-economic development.

PREFACE

Science and technology feature highly among the most precious tools for shaping economic growth and social development.

Developing countries worldwide and indeed in Africa have for a long time now appreciated the critical role that the utilization of science and technology can play in socio-economic development.

As a result of this awareness, in particular, since the United Nations Conference on Science and Technology for Development, UNCSTD, Vienna 1979, and the statements on science and technology issues in the OAU Lagos Plan of Action, most African countries have taken relevant measures for stimulating science and technology for development. Such measures include the development of science and technology resources through organizational planning and management of these resources.

Considering the efforts by most countries in Africa to ensure the effective use of science and technology through the formulation of specific science and technology policies and the institution of relevant measures at appropriate governmental level for the planning and implementation of such policies; and given the weak industrial base characteristic of the economies of most of these countries, it can be inferred that the strategic application of science and technology for development is still a major need.

Indeed, the urgent need for African countries to acquire and maximize their use of scientific and technological skills for development and thereby enhance their capacity to operate within the global economic and political system and attain the development aspirations of their peoples, is emphasized by the OAU in declaring the 1990's as the Industrial Development Decade in Africa.

Several obstacles continue to stand in the way of continent's take-off towards self-reliant science and technology development for the support of integrated and sustainable socio-economic development. Efforts to define and come to grips with the problems are continuing in several ways throughout the continent.

The objective of the present study is to review the performance and effectiveness of the main/central Science and Technology Policy Institution(s) in Sierra Leone and thereby assess its impact on the country's overall development.

Thus, the review involves an examination of the Science and Technology Policy Institution (ISTP) in terms of its organizational pattern, its resources, the links between it and other sectors of the national economy to determine the extent to which it is able to perform certain relevant functions required of any Science and Technology Policy Institution if it is to stimulate science and technology for development. Also, it involves an indication of how these functions are performed in terms of the goals of national development.

This study is limited to the Ministry of National Development and Economic Planning because of its key role as the body responsible for national development planning. Furthermore, it has established within its Central Planning Unit a focal point to deal with issues of technological development.

The information gathering tool was a structured questionnaire containing six parts and designed to elicit information on the general characteristics, functions, scope of coverage and resources of the ISTP. In addition, information was collected from primary and relevant secondary sources (e.g. Plan documents, National Papers on S & T policy issue.

ACKNOWLEDGEMENT

Information has been collected from two main sources: standard literature review, and interviews with relevant persons in the Ministry of National Development and Economic Planning and other institutions. A great debt is owed to these individuals for their cooperation and assistance and thanks go especially to Mr. E. Tuboku-Metzger, Director of Planning and to Mr. R. B. Johnson, erstwhile S & T Coordinator in the Focal Unit for giving up their valuable time to be interviewed and to complete the questionnaire.

Also, special mention must be made of Ms. K.L. Barlay, Senior Planning Officer, MONDEP and Dr. Ogunade Davidson, Director University Research and Development Services Bureau for their invaluable contributions of data and useful information.

Grateful thanks are due to Miss L. Thorpe and Mrs. Clarissa Wilson-Clarke for typing out manuscript and processing the typed script.

BACKGROUND

2.1 Rationale for establishment of the ISTP

2.1.1 Basic data of the country

Sierra Leone, a West African country shares borders with Guinea on the north-west and north-east parts, and on the south-east with Liberia.

Area: 71, 740 Sq. Km.

Population (1985): 3.7 million. Annual growth rate is estimated at 2.6%.

Population density (Sq. Km.) is about 48: 22% of the population are urban dwellers.

2.1.2 Natural resources

(a) **Agricultural Resources:** Sierra Leone's considerable agricultural and water resources provide a very strong potential base for economic growth. 80 - 85% of the active labour, is engaged in the sector. The main agricultural exports include coffee, cocoa and palm kernels, fishes and shrimps and these account for 30% of export earnings;

(b) **Mineral Resources:** According to its mineral assessment report, Sierra Leone has a very favourable resource endowment with deposits of diamond kimberlite, bauxite and rutile. The raw mineral sector accounts for over 65% of export earnings.

2.1.3 Development setting and its problems

The Sierra Leone economy is characterized, like that of most developing countries by an under-developed industrial base with manufacturing (mainly light industries) accounting for only about 5% of GDP in 1981. There is therefore a very high dependence on imports to satisfy most of the country's requirements for consumer, intermediate and capital goods, including inputs for agricultural production. Consequently, this dictates the urgent need for the establishment of a sound industrial base as proclaimed in the Lagos Plan of Action. Again, the urgency of lifting industrial development in Sierra Leone, beyond the very modest effort which is dependent on importation for most of the raw material needs and technological management can be emphasized in the context of the OAU declaration of the 1990s as the Industrial Development Decade for Africa.

One of the challenges to development in Sierra Leone has been the building of autonomous capacity in the field of science and

technology which is necessary for an endogenous and self sustaining development.

The major problems hindering the development process include the high rate of illiteracy and the accompanying shortage of skilled technical and managerial personnel, the weak and under-developed state of the infrastructure, the lack of capital resources, the decline in recorded production of major exports and the dependence of the manufacturing sector on imported raw materials.

The natural endowments of the country are however favourable for achieving a fast and eventually, self sustaining growth.

2.1.4 Science and technology policy issues

The first National Development Plan, 1974/75 - 1978/79 sought to address this challenge, through its emphasis on priorities such as the following:

- (a) Development of infrastructural facilities and social services with strong emphasis on the rural sector;
- (b) Emphasis on agricultural output, in particular food production;
- (c) Expansion of manufacturing in absolute terms and as a share of GDP with a strong concern for maximizing the use of local resources.

From the objectives of its National Plan, Sierra Leone demonstrates implicit recognition of the need to promote scientific and technological development. Increased sensitivity to the important role that science and technology can play in socio-economic development was manifested by the country's elaborate preparation in 1978 for participation in the United Nations Conference on Science and Technology for Development, (UNCSTD) Vienna, August 1979. It planned and organized a series of national seminars/workshops to prepare and collate its national contribution to the seminar. For this purpose, a non-statutory body, the Interim Committee on Science and Technology for Development was set up in the Ministry of National Development and Economic Planning. This ministry is

the central government organ responsible for the coordination of development planning in Sierra Leone.

The Development Plan deals with "Development Strategy, Objectives and Policies" which relate to problems of the development of agriculture and industry, of import structure and export potential. In general terms, the major development efforts pursued immediately after independence in April 1961, have been in industrialization through import substitution in mining, the expansion of institutional, and physical infrastructural facilities and the re-organization of educational curriculum and the development of new facilities. The emphasis placed on the priority sector, then mining, having been found to be inadequate in bringing about the desired growth rate in the economy, while at the same time satisfying the basic needs of the population has been shifted.

Policies are now re-orientated towards the development of agriculture and industries based on the utilization of locally available raw materials. The second National Development Plan 1981/82 - 1985/86 which takes the form of rolling plan and which will have to be made operational stressed the importance of promoting agriculture and allied industries that will have an impact on the rural population. Implicit emphasis has been placed on the development of appropriate technologies in the agricultural and small scale manufacturing sectors (formal and non-formal) and also on the promotion of renewable energy resources particularly for the benefit of the rural areas. In this connection, the development of Integrated Agricultural Programmes in the various districts has been accorded top priority by the government. This was reflected in the sector's share in the overall projected investment for the plan period 1983/8 to 1985/86 of 25.7 percent.

In the context of the current national philosophy of "Constructive Nationalism," this emphasis is being addressed in the concept of the "Green Revolution" which is the cornerstone of the various programmes being undertaken nowadays by the Ministry of Agriculture, Natural Resources and Forestry.

The manufacturing sector as a complement of the agriculture sector also received higher priority than in the first National Development Plan. With the realization that the industrial sector is being dominated by the formal sector which is controlled by foreigners, the need of developing the informal sector is receiving some attention.

2.2 History of the ISTP

There is no chapter specifically devoted to science and technology policy and no indication of policy instruments to determine and plan for science and technology implications of the various objectives under the chapters dealing with individual sectors in the first Development Plan 1974/75-1978/79. The need to evolve a national Science and Technology Policy appropriate to development priorities and plan the implementation of such policy, as part of the national planning process formed a major consideration in the drafting of the second plan - 1981/82 -

1985-86.

It is proposed in the drafting document that a "National Body on Science and Technology Development" be set up to assist in formulating integrated science and technology policies which are consonant with the national development priorities, to identify the demand for technological skills and recommend suitable training programmes and generally to promote the training of scientific and technological manpower and the advancement of national scientific and technological capacity.

The Council when formed would be of assistance to the government through the Ministry of National Development and Economic Planning in formulating national science and technology policies. It would also advise government on the education and training of skilled manpower in the science and technology field and in making suggestions as to how to create/strengthen national science and technology services. Pending its formal creation, the non-statutory body, the Interim Committee on Science and Technology for Development set up in 1979 to coordinate and organize Sierra Leone's contribution to UNCSTD is usually called upon by the ministry to fulfil some of the indicated functions as and when required. In the absence of a statutory body, a Focal Unit was set up in 1985 in the Ministry of National Development and Economic Planning and temporarily charged with the responsibility of coordinating science and technological activities in the country. In the execution of its duties, the Unit is sometimes assisted by the Interim Committee on Science and Technology for Development.

Several institutions in the country also undertake scientific and technological activities. In general S & T activities, though uncoordinated, have been conducted

in institutions concerned with scientific research and experimental development.

These institutions include the:

-University of Sierra Leone (Fourah Bay College and Njala University College where a great deal of research in agriculture is carried out, while at Fourah Bay College research is conducted in the basic and applied sciences):

-Technical ministries such as Agriculture, Natural Resources and Forestry, Mines, Lands, Housing and Environment, Health, Energy and Power, Trade and Industry and State Enterprises.

On the whole, not much research and development work is been done in the public and private sectors compared to the volume of work undertaken in the University, except for the Rice Research Centre at Rokupr, which has affiliation with WARDA.

3.GOALS AND FUNCTIONS

3.1 Mission of the ISTEP

3.1.1 Statutory goals and functions

There is no statutory body responsible to coordinate science and technology activities in the country. There are however, certain governmental institutional arrangements, which while not explicitly science and technology policy making bodies, can affect the management of science and technology systems in Sierra Leone and influence the transfer, utilization and development of technology. An example is the National Planning Council.

It is the highest policy-making body in the country. The President of the Republic is the Chairman of this Council. The members of the Council, include the principal economic and technical ministries as well as the Governor of the Bank of Sierra Leone. It is assisted by an Inter-ministerial Committee of Permanent Secretaries headed by the Development Secretary, Ministry of National Development and Economic Planning.

The main functions of the Council include:

- (i) indicate the basic goals and objectives of the national development plans;
- (ii) decide for each plan, such macro-economic variables as rate of economic growth, investment and sectoral priorities, domestic savings and foreign resource allocation among programmes and projects, etc;
- (iii) provide guidelines on economic and social policies in accordance with planned goals and objectives;
- (iv) decide on monetary, fiscal, foreign trade and other economic matters in accordance with planned goals and objectives.

The key sectors of the economy and their development projects and programmes entail decisions relating to applications of science and technology, so that the statutory goals and functions of the Planning Council implicitly encompass the spheres of science and technology.

3.1.2 Analysis and commentary

The need for a coordinated and coherent approach to promoting S & T activities has long been realized by the Government of Sierra Leone.

In March 1978, government instituted within the Central Planning Unit of the Ministry of National Development and Economic Planning and adhoc body, the Interim Committee on Science and Technology for Development. This Standing Committee was not only entrusted with the preparation of the country's national paper for the United Nations Conference on Science and Technology for Development, held in Vienna in 1979, but also was charged with advising the government on the best ways and means of laying a concrete course of action for S & T. The committee as part of government's S & T activities organized with technical assistance from UNCTAD, a National Seminar on Science and Technology Policies in April 1984.

An output of this seminar was a plan of action, the main elements of which is the setting up of an institutional arrangement/focal point temporarily under the Ministry of National Development and Economic Planning for the formulation and implementation of integrated S & T policies in Sierra Leone. The main purpose of this Focal Unit is the establishment of a National Council for Science and Technology for Development (NCSTD) which is to serve as an advisory intersectoral policy making body. The rough structure and functions of the council have been evolved from Elliott's Report, (Proposals for the establishment of Science and Technology Development Commission in Sierra Leone) - which took into consideration a number of other mission reports prepared by various UN Agencies including UNESCO and UNCTAD on science and technology policy for Sierra Leone.

As a result of the momentum generated by the National Seminar on Science and Technology Policy in 1984, and in the hope that the part funding of the seminar by government indicates conscious effort to implement recommendations emanating from the continuous discussions in the country on S & T development dating back as far as early 1970s, the Focal Unit has undertaken action in relation to a range of activities set out in the recommendation of the 1984 National Seminar.

Also, its activities relate to ensuring that the S & T activities undertaken by private and public sectors are in accordance with planned national objectives. Studies were initiated on sectors considered of critical impor-

tance to the country (i.e. agro-industries and food processing, metal works and capital goods, energy R & D, etc.). The spate of activities in the initial years of the establishment of the Focal Unit appeared to improve the coordination of science and technological activities undertaken by the private and public sectors and institutions.

The efforts of the Focal Unit is to get the Law Officers Department to draft the legitimizing Bill to bring into being the proposed National Council on S & T for Development.

3.2 Operationalization of Mission

3.2.1 The definition and selection of development objectives is based normally on a set of goals declared by government that reflect long-term national aspirations and performances and on the

other hand on an analysis of development potentialities and constraints.

The fact is that the statement of national goals which indicate the political and development philosophy of the government should normally precede the formulation of more specific and operational development objectives. Without goals, planners and heads of department would not have a clear guidance and criteria for selecting alternative sets of development objectives. These are instrumental values not sought for in itself, but for the contribution it can make to achieving a goal, which is ultimately a value judgement reflecting basic political, social and economic preferences of the society.

On the basis of various policy documents and announcements and in particular on the basis of the All People's Congress Party (APC) manifesto 1973, the following list of national goals is formulated:

(1) Preserve political and economic stability as one of the main pre-requisites for uninterrupted and continuous economic and social advancement;

(2) Attain a higher degree of economic self-sustained growth, since political independence can be made meaningful only by achieving economic emancipation;

(3) Increase the welfare of the broad mass of population as the ultimate aim of development and to that end

achieve more equitable distribution of wealth and income;

(4) Achieve rapid expansion of productive capacity of the economy to create the basis for an accelerated pace of economic and social progress;

(5) Continue and intensify economic co-operation with other African countries, particularly with neighboring West African countries; and

(6) Promotion of development through aided self-help methods.

The Central Planning Unit and hence the Focal Unit, which is a part of it, interprets its functions in terms of these stated national goals.

3.2.2. Analysis and Commentary

It is, indeed, most desirable that rapid progress is made towards the realization of these goals. However, there are several circumstances - both internal and external - which influence the pace and pattern of the development process. At the same time, with the current difficult domestic economic situation and the continuing uncertainties and adverse trends in international economic relations coupled with lack of proper governmental support to the interim ad hoc standing Committee on Science and Technology for Development and shortage of science and technology capabilities in the Central Planning Unit, very little has been done, to achieve the above goals in terms of policy, plans and strategy where S & T are concerned.

What makes the situation in Sierra Leone particularly critical is that a statutory machinery, for the formulation of scientific and technological policy has yet to emerge from the stage of conception to that of a concrete reality. The functions for such a machinery would be among other things to advise the government from time to time, chart the evolutionary course in the application of S & T, break down resistance to change, establishment of the institutional machinery for research and development, provide intellectual backstopping to agricultural, industrial and ensure that institutions do not lack scientific and technological manpower. This is the sort of frame of reference for development which is the greatest need at this time in Sierra Leone. Within it, every scientific and technological programme can find an appropriate place.

4. ORGANIZATION

4.1 Structure

4.1.1 ISTP's position in government structure

The Focal Unit was established within the Central Planning Unit of the Ministry of National Development and Economic Planning. The Ministry is the central government body responsible for coordination of development planning. At present, it has three departments, namely: The Central Planning Unit, the Statistical Office, and the Administrative Department. The Ministry of course is headed by a cabinet minister and each division by a divisional head.

The task of the Statistical Office is to collect information relating to national accounts, business and industry, and household survey. The Central Planning Unit has sections dealing with:

- (i) regional planning;
- (ii) macro-economics;
- (iii) agricultural planning;
- (iv) infrastructural planning;
- (v) industrial planning;
- (vi) manpower planning;
- (vii) finance and budgetary planning and
- (viii) social services division - comprising of three ministries viz: Health, Education and Rural Development, Social Services and Youth.

As far as technology transfer and development is concerned, the role of the Ministry is handicapped by the absence of any mandate and policy guidelines from the National Planning Council.

It is therefore left to the discretion of most ministries and departments as to how they treat technology trans-

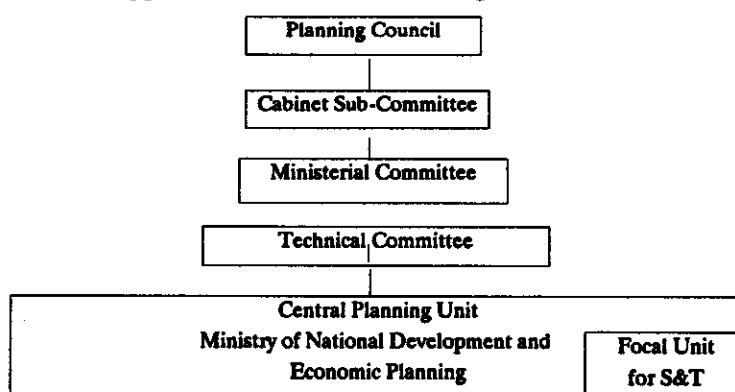
fer and indigenous technology in the implementation of their sectoral development programmes and projects. The only exception is the Ministry of Industry and State Enterprise which is now empowered under the Development of Industries Act of 1983 to screen applications for the establishment of industrial enterprises.

The organizational capability and efficiency of the Central Planning Unit through the formation of the National Planning Council which functions as previously stated in the text is enhanced.

While its functions implicitly include the spheres of technology, no specific institutional mechanism emerged to this effect but it is followed by various committee such as the Technical Planning Committees, and Technical Coordinating Committee on Food Aid. This, as a result of these developments, the Ministry of National Development and Economic Planning took the initiative to convene the National Committee on Science and Technology Development which was established in 1979, to assist the Government of Sierra Leone in the preparation of the national paper for UNCSTD. Subsequently, a Focal Unit was created within the Central Planning Unit to deal with the promotion and development of indigenous technology. Also it is mandated to undertake the following:

- promote the development of local technological skills;
- advise government on the acquisition of foreign technology;

**Organizational Chart
Approval of the National Development Plan**



The Ministry of Industry and State Enterprise under the Development of Industries Act of 1983, have to perform the functions relating to industrial development. Its divisions are the following:

- (i) industrial operations;
- (ii) industrial planning and statistical programme;
- (iii) small-scale industries and handicraft development;

As far as technology is concerned, the Act contains clauses that are of importance. First is the function of the Industries Department. These include, among other things:

- (i) to promote and assist import substitution industries which offer higher value - added and positive balance of payment effect;
- (ii) to create and establish a system of industrial licensing for the import of plant machinery, raw materials and spares.

The Development of Industries Act, is aimed at encouraging private investment, domestic and foreign. It acknowledges explicitly the importance of technology in Sierra Leone's industrial development.

Also the Ministry of Agriculture, Natural Resources and Forestry is a major consumer of technology whether for land preparation, production, harvesting, storage and distribution.

It engages in the production of technology through selective R and D activities. The Ministry has no specific guidelines on technology imports.

The importance of the office of the Administrator and General Registrar for technology transfer and development arises from the fact that it covers the industrial property system. Patent laws in Sierra Leone are an extension of the British system. The Administrator and Registrar General's Office has many other functions and therefore does not have a special-

ized unit to deal with the economic, commercial and developmental aspects of the system.

The Ministries of Energy and Power, Education and Cultural Affairs and Health among others have statutory functions with strong elements of science and technology.

4.1.3 Analysis and commentary

Sectoral coordination is low and meetings of various committees including the Interim Committee on S & T for Development are rather infrequent with a 50 per cent participation rate on average. The only committee that meets frequently is the Development Budget Committee whose participation rate according to analysis showed a 100 per cent.

Science and technology policy planning and implementation is an imperative for Sierra Leone. Failure to sensitize the policy-makers to recognize their potential and possible impact can only result in continued stagnation. It is therefore absolutely necessary for the various technical ministries and the Ministry of National Development and Economic Planning to work close with renewed determination for industrial and technological policies for the 1990s and beyond.

4.2 Composition

4.2.1 Organigram

Below is the organizational chart showing the upstream and downstream process in considering and approving the National Development Plan. It is of interest in view of the position of the Central Planning Unit within it, which is specifically mandated to promote technology issues.

SECTORAL MINISTRIES

The Science and Technology Coordinator in the Focal Unit is responsible to the Director of Planning who is the divisional head of the Central Planning Unit.

As stated earlier, there is no chapter in the plan separately devoted to science and technology. However, there is some realization of the significance of technology in the chapters dealing with the individual sectors. Furthermore, the need to formulate national science and technology policies that would form an integral part of the national planning process had been highlighted in the first National Development Plan (1974/75-1978/79) and strongly considered in the drafting of the second plan.

4.2.2 Policy-Making Body

There is no definite policy-making body on science and technology in the country. Nevertheless, since the second United Nations Development Decade (1970-1979) and up to the present, Sierra Leone has become more and more aware of the role of science and technology in development and the need to formulate coherent policy and plan strategies for its application to meet national development objectives as indicated in the plan. A rudimentary step had been taken in terms of the process through which the development, and application of S & T can be brought into a national policy framework and be coordinated with other sectors of the economy. This is the location of the science and technology secretariat - the Focal Unit - in the Ministry of National Development and Economic Planning. This is the lead ministry responsible for the planning and formulation of development policy, and coordination of administrative arrangements for economic and social development programmes.

Occasionally, government Ministers in relevant sectoral ministries, such as Trade, Industry and State Enterprises would make some kind of science and technology statements.

4.2.3 Committee

The Interim Committee on Science and Technology for Development assists the Focal Unit in implementing commissioned tasks/studies/seminars/workshops on science and technology usually intended to contribute to the building of national capacity and institutional structures for planning the development, application and transfer of technology.

There are several institutions that contribute perhaps implicitly towards the development of science and technology in the country. These include organs established by relevant sectoral ministries. Usually, these ministries present research budgets as part of their overall estimates in the national budget.

4.2.4 Departments

As indicated earlier in the text, the Central Planning Unit has sections dealing with development planning in various sectors including the Focal Unit which deals specifically with issues of science and technology. The Focal Unit itself is a one office outfit, with secretarial resources and facilities available in the Central Planning Unit readily accessible to it.

4.2.5 Personnel

The Central Planning Unit has a core of competent and capable planning officers, under the leadership of a Director. The Focal Unit is manned by the Science and Technology Coordinator, who is a Senior Planning Officer directly responsible to the Director of Planning.

4.2.6 Analysis and commentary

In spite of the various development thrust being made in various sectors such as agriculture, industry, rural development, energy, water, land resources and education, there is yet no effective national institutionalized framework to bring science and technology matters together in policy terms; neither is there a coordination mechanism to deal with issues to science and technology in a coherent fashion. There is no advisory mechanism to define science and technology issues for government on a system wide basis. In the absence of a statutory body, the Focal Unit is temporarily charged with aspects of such responsibility.

The ministry's role especially as it pertains to technology policy formulation, planning and strategies is handicapped by the absence of any clear mandate and policy instruments from the National Planning Council.

It is usually left to the discretion of most sectoral ministries as to how they treat science and technology issues, including technology transfer and indigenous technology in the implementation of development programmes. For example, projects on industrial development would be dealt with by the Ministry of Industry and State Enterprises.

In terms of manpower resources for science and technology policy, planning and strategies, the Central Planning Unit is very greatly constrained. The Focal Unit is inadequately equipped from a science and technology point of view and must resort to external consultancies. Otherwise, it relies mostly on the personal resources of a few keen members of the Interim Com-

mittee who would normally carry diverse schedule in their own permanent office.

4.3 Linkages

4.3.1 Links with other Science and Technology Institutions

There are a number of institutions actively engaged in science and technology activities. The representation below describes the nature of networking, albeit rather loose in some cases, between the Ministry of National Development and Economic Planning and selected S & T Institutions and/or productive sectors.

4.3.2 Links with productive sectors

Sierra Leone's industrial activities are in two main sectors - i.e. public and private sectors.

The public sector comprising many industrial enterprises are established wholly or partly from public funds, with components derived from foreign aids.

These are set up for the provision of support activities and R & D activities. They include programmes and projects within the Ministries of Trade, Industry and State Enterprises (e.g. Small-Scale Industries Programme, Growth Centre Programme), Agriculture, Natural Resources and Forestry (several agro-based industries, Seed Multiplication Unit, Torma-Bum Rice Research Station, Rokupr Rice Research Station, Magbass Sugar Industry), Mines and the National Workshop (Metal Working Industry).

The various efforts in this sector are not well coordinated and as a result the impact on the technology advancement of the country is minimal. While the Ministry of National Development and Economic Planning is required by its position in the Inter-ministerial Council to have links with the other ministries, especially with the Ministry of Industry and State Enterprises considering the important role which the latter plays in industrial development activities, links with the technical ministries are rather weak. It is of note that these ministries are represented on the Interim Committee of Science and Technology for Development and they played a primary role in the formation of the Committee. The Committee meets rather infrequently, convening only when it has assigned tasks. Such assignments have been few in recent years.

A large part of industrial development in Sierra Leone has been undertaken by the private sector, whether foreign or local. The modest industrialization effort consists mainly of light industries requiring the importation of most or all of the raw materials and

technical management, thus value added is very low. Also, relatively insignificant transfer of technology has occurred.

The Focal Unit is required by status to have links with the sector. Indeed, the Chambers of Mines, Industry, Agriculture and Commerce are members of the Interim Committee of Science and Technology for Development. Although the establishment of the Focal Unit appeared in its initial years to have improved the coordination of science and technology activities undertaken by the private sector, there is no strong linkage between the sector and the Ministry of National Development and Economic Planning as far as science and technology policy issues are concerned. What constitutes an exception in terms of the interaction between the private sector and government is that provided through the Development of Industries Act of 1983. The Act provides incentives by way of tax holidays that are basically attractive to the modern factory type industries and more particularly to agro-based industries and industries utilizing locally available raw materials. It also provides added incentives for industries located in remote areas as well as those to be developed by nationals.

4.3.3 Analysis and commentary

Technology development and application require a multi-disciplinary approach which entails inputs from various institutions, disciplines, sectors and activities of the economy. In its central function of planning for industrial development in Sierra Leone, the Ministry of Development and Economic Planning needs to develop an effective link with Science and Technology Institutions, industrial enterprises and the business community. Indeed a close working relationship especially with technical ministries such as Industry and State Enterprises, Agriculture, Natural Resources and Forestry, and Education and Cultural Affairs, which implement development programmes and projects entailing decisions relating to technology acquisition either obtainable from domestic or foreign sources is most essential. These programmes and projects offer opportunities for utilization and development of indigenous technological capabilities, including technological unpackaging and adaptation, R & D, standardization, design, engineering and consultancy services.

It is relevant to note that sectoral chapters of the pending 1985/86 - 1989/90 plan stress the importance of

Linkages Between Science and Technology Institutions				
Organ	Function	Upstream Linkage	Downstream Linkage	Major Collateral Linkage
Ministry of National Development and Economic Planning	Coordination	Cabinet	Other Ministries, University, R & D Institutions	-
Ministry of National Development and Economic Planning	Advisory	Cabinet	R & D Institutions, Education Ministry	CPU
Central Planning Unit	Coordination	Ministry of Development and Economic Planning	-	R & D Institutions URDS
		Planning Council		IADPs
Agricultural Research Institute	R & D & STS	Ministry of Agriculture Ministry of National Development and Economic Planning Njala University College	NRDF	Extension Workers
Rokupr Rice Research Centre	R & D & STS	Ministry of Agriculture	NRDF	Njala University College
Small Scale Industrial Division	Extension Services and Scientific and Technological Education and Training	Ministry of Industry and State Enterprises		Private and Public Enterprises
Seed Multiplication Unit	R & D STS	Ministry of Agriculture		Njala University College
University Research and Development Services Bureau, (URDS)	R & D Education and Training	Ministry of Education		Institutes of Education
Schools and colleges	S & T Education and Training	Ministry of Education		Institutes of Education
Ministry of Health	STS	Ministry of Health		
Nurses Training School	S & T Education	Ministry of Health		University of Sierra Leone

Para- Medical School	S & T Education and Training	Ministry of Health		Institutes of Education
College of Medicine and Allied Sciences	S & T Education	Ministry of Health		College of Medicine and Allied Sciences
University of Sierra Leone				

developing the nation technology capabilities through research and development activities and in particular through the improvement of indigenous technologies, the importation, adaptation and absorption of appropriate technology as well as through the development of a viable national scientific and technological information system.

Thus, it should not be difficult for the Ministry of National Development and Economic Planning to strengthen its link with the sectoral Science and Technology Organs and Institutions. Already, there exists mechanisms and institutional arrangements for general coordination of economic development activities, so that effective mechanism and institutional arrangements for science and technology national policy formulation and strategies for implementation could well be organized within the overall framework of national development planning.

Possible ways and means of improving coordination and effecting strong vertical and horizontal linkages among the network of Science and Technology Institutions to ensure that science and technology activities have a bearing to national development objectives, include the national budgetary allocation process in which sectoral ministries negotiate their development budgets.

4.4 Powers

4.4.1 Statutory powers

The Ministry of National Development and Economic Planning has statutory powers to coordinate development planning process in Sierra Leone. The integral elements of development planning includes economic, social, science and technology policies planning. It is to be expected that the Central Planning Unit by virtue of its key position in the Inter-Ministerial Council (the technical committee which assists the National Planning Council) would have mastered the cooperation of all relevant Science and Technology Institutions and Organizations, in particular, the sectoral ministries. The National Planning Council is the authority responsible for making the decisions which determine the main directions of the overall National Policy.

4.4.2 Perceived powers

The Ministry of National Development and Economic Planning through its Central Planning Unit, specifically the Focal Unit undertakes activities which seek to integrate science and technology issues into

national development planning. However, it appears that it still requires unequivocal mandate and policy guidelines from the National Planning Council for the recognition by all as a statutory set up for the planning of national policy and strategies for science and technology until the eventual establishment of a permanent body with all the necessary powers and autonomy.

4.4.3 Analysis and commentary

As far back as 1979, the Government of Sierra Leone did establish a National Committee on Science and Technology for Development, attached as an Interim Technical Committee to the Ministry of National Development and Economic Planning. As stated earlier on in the text, the main function of the Committee was to advise government on the creation and institutionalization of a science and technology policy system within the framework of the National Development Plan. This task has since been executed, but the committee has remained and would be called upon from time to time to assist Government through the Central Planning Unit whenever it is so required. The Committee is still an adhoc body with no statutory powers. The Government of Sierra Leone consequent upon recommendations of the Interim Committee, had in a Cabinet conclusion No. CP (80) 397 advised the Ministry of National Development and Economic Planning to set up the machinery for the establishment of a National Council of Science and Technology for Development to be responsible for the formulation and coordination of national science and technology policy among other S & T functions.

Subsequently in 1985, the Central Planning Unit administratively set up a technical secretariat as an initial step in the emergence of the Directorate of the Proposed National Council. Prior to this, in the 1981/82 National Budget a vote head was designated specifically for science and technology for the first time. This vote has been redesignated applied research. It is clear from the foregoing that the government recognizes the need for the articulation of a science and technology policy. Somehow, the Ministry of National Development and Economic Planning appears unable to effect the legitimizing conditions; the task to draft the enabling Bill which it assigned to the Law Officers Department of the Ministry of Justice, is yet to be fulfilled even after eight years. From indications by the Ministry of National Development and Economic Planning it should not

be difficult for steps to be taken by means of another option to bring the council into being.

This option involved seeking Cabinet approval for the composition of the Council and subsequent gazetted notice announcing its establishment. The long delay in the setting up of a National Council of Science and Technology can be attributed to several factors; chief among these is that the National Planning Council has not focussed as much attention on issues of science and technology as a vital element of development planning as it would focus on economic and social policies issues.

It may be that decision - and policy-makers as well as administrators need to be continuously sensitized to the strong linkage which must be in place between

science and technology (as a development tool) and any plans for economic growth based on indigenous and self-reliant development programmes.

Sierra Leone needs to adequately recognize that in as much as the realization of development objectives depend on self-application of science and technological know-how available either within the country or abroad, it cannot without a body capable of formulating explicit science and technology policy and of advising governmental organs and institutions on a rational selection and application of science and technology, achieve the necessary integration of its various efforts in science and technology into overall national development strategy.

5 .ACTIVITIES

The government is aware of the important role that science and technology must play in the socio-economic development of Sierra Leone. It has taken some initial steps, already specified in previous chapters, towards the preparation for laying the foundation of the eventual creation of specific S & T policy formulation, arrangements and mechanisms to ensure the systematic integration of science and technology into the National Plan and its execution.

The current proposed plan which takes the form of a rolling plan, places implicit emphasis on the development of appropriate technologies in the agricultural and small-scale manufacturing sectors (formal and non-formal) and also on the promotion of renewable energy resources particularly for the benefit of the rural areas. The plan stresses the importance of promoting agriculture and allied industries that will have an impact on the rural population.

The manufacturing sector as a complement of the Agricultural Section has also been given higher priority than in previous plan. Having realized that the industrial sector has in the past been dominated by the formal sector which is largely controlled by foreigners, government has emphasized the need for developing the informal sector. The government is now convinced that the informal and small-scale industries will form the seed-bed for the future development of industries in the country. Each sectoral chapter stresses the importance of developing national technological capabilities through R & D activities and through the improvement of indigenous technologies and technology transfer.

Also, the plan is concerned with the enhancement of the integration of women in the development process of the country including the improvement of their productivity through skill development in the areas of agriculture and small scale industries based on the utilization of locally available raw materials.

In the development of the plan, the sectoral chapters are first prepared by the appropriate ministries and are reviewed by the Central Planning Unit of the Ministry of National Development and Economic Planning based on the available resources. The amended plans are then returned to the respective ministries for consideration. After a series of vettings by expert commit-

tees (i.e. the Technical, the Inter-Ministerial and Cabinet Sub-Committees), the plan is finally forwarded to the Planning Council which is headed by the President of the Republic, for ratification and adoption. At this stage the plan becomes the blue print of the government.

5.1. Programming

With respect to perceived development needs as indicated in the objectives of the plan, the development of Integrated Agricultural Programmes in the various districts has been accorded top priority by the government. This priority is also nowadays being implemented in terms of the concept of Green Revolution, and is reflected in the increased share of the sector in the overall projected investment for the plan period.

Some of the specific measures aimed at in sectoral development programmes include:

- implementing functional adult education programmes and in general basic education programmes for school age members of the population;
- providing extension services and credit packages to farmers; and
- promoting appropriate technologies for small-scale industries.

Some specific activities executed which have a bearing on the science and technology implications of the sectoral plans and in which the Focal Unit participated actively include the following:

- The establishment of fish processing units;
- Pilot Development of Industrial Development Programme;
- National Industrial Development and Financial Organization Project.

5.2 Coordination

5.2.1 Among Science and Technology

Institutions

Coordination among S & T Institutions is rather weak. Major technical ministries (e.g. Ministry of Industry and State Enterprises) which statutorily are charged with the execution of development programmes derived from National Development Objectives and Strategies are yet to work very closely with the

Central Planning Unit, especially as regards science and technology focus of programmes.

The relevant mechanisms and administrative arrangements for co-ordination is yet to emerge as it is with respect to the economic planning aspects of development programmes.

In the case of the annual allocation of funds for the execution of development programmes, these are specifically provided for in the Development Estimates. For the release of such funds certain laid down governmental procedures exist which necessitates close working by sectoral ministries with the Central Planning Unit.

As regards Research Institutions in the University, a close link than before with the Ministry of National Development and Economic Planning emerged with the establishment recently of the University Research and Development services bureau.

These projects relate to strengthening National Capacities and Institutional Structures for planning the development, application and transfer of technology within Sierra Leone's cultural heritage in the expectation of providing new dimensions and inputs from the Ministry of National Development and Economic Planning.

- the small-scale industries development growth centre programme.
- rehabilitation of small palm oil mills.

5.2.2 Reconciliation and harmonization of Science and Technology activities with National Planning

The extent to which the above prevails is not quite clear. Usually this aspect is left to the interpretation of the sectoral ministries.

The position cannot be readily assessed in the absence of published annuals or other periodic reports by the technical ministries. Such reports are hard to come by nowadays, where they exist.

Again, it seems that very little is done by planners to lay down in the plan documents strategy for assessing the extent to which the implementation of sectoral programmes is in line with National Policy.

5.3 Execution of programmed Science and Technology activities

5.3.1 Programme implementation

In the context of the science and technology implications of the sectoral chapters of the plan and in terms of

the recommendations of the 1984 National Seminar on Science and Technology Policies, the Ministry of National Development and Economic Planning, initiated science and technology related studies and/or supported certain programmes undertaken by sectoral ministries.

The aim in these programmes relates to fostering technological development through possible removal of technological, managerial and organizational constraints.

The main thrust directed towards improvement of the terms and conditions in which Sierra Leone acquires foreign technology or the strengthening of national capacity for the transfer, utilization and development of technology to contribute to the transformation of indigenous technology.

Some of the programmes were conducted in co-operation with relevant UN agencies such as UNCTAD, UNIDO, FAO and UNESCO. Among programme activities initiated by the Ministry of National Development and Economic Planning and accomplished were:

- (a) Examination of the overall policy and institutional structure for planning the development, application and transfer of technology.
- (b) Diagnostic analysis of technology and development perspectives in the food processing, metal and engineering and the pharmaceutical sector.
- (c) In-house and on-the job training courses for high level policy-makers, planners in technical ministries, and staff members in R & D institutions and private industrial establishments on policies, plans and guidelines for the development, application and transfer of technology.
- (d) Performance review of the manufacturing sector.

Some other major development activities which have taken place and which are expected to have an impact on the conditions in which S & T are applied in the country include the following:

- (a) Re-organization programmes in the then Ministry of Trade and Industry resulting in the formation of the Industrial Development Unit which later, pioneered the new "Development of Industrial Act of 1982".

- (b) The establishment of a number of specific public investment projects geared toward the provision of support services that will stimulate industrial growth (e.g. rehabilitation of the National Workshop, Metrication/Bureau of Standards, Small-scale Industries Project).
- (c) Educational reviews which are advocating educational requirements for a new type of education which should among others include more relevant form of technical, vocational curriculum. The conceptual basis of such curriculum should ensure that local innovative and creative energies are harnessed and utilized.
- (d) Establishment by the University of a Research and Development Services Bureau to coordinate research activities within the University and to ensure effective linkage to other productive sectors of the economy.

These activities have in one way or the other received the support of the Ministry of National Development and Economic Planning. For instance, the majority of these projects are UNDP/a UN Agency supported, with the Ministry of National Development and Economic Planning responsible for coordinating such interactions. Others are public investment programmes for which again, the ministry has some responsibility.

5.3.2 Monitoring and evaluation

Programmes and projects are subject to periodic review in accordance with relevant policies and procedures usually pertaining to such exercises.

The Ministry of National Development and Economic Planning has access to personnel either within its establishment or outside that would undertake such activities. It needs to be indicated that currently, the Ministry lacks qualified personnel to carry out activities specifically in the fields of science and technology.

5.4 Advice

It is the Ministry of National Development and Economic Planning, in cooperation with the technical ministries which prepares the National Plan and budgetary estimates in respect of resources required for national development. Furthermore, it has the task of conducting and preparing reports on overall needs assessment for various sectors as required for develop-

ment planning. Although on the whole, output (publications/occasional papers) on S & T activities has been minimal, these have been substantive in content and they deal with science and technology policy issues geared to identifying national development objectives and guiding industrial growth.

5.5 Advocacy

The Ministry of National Development and Economic Planning, in particular through the Interim Committee on Science and Technology for Development and the Focal Unit for Science and Technology within the Central Planning Unit has over the years carried out reasonable level of activities (which have been noted already in the text) designed towards laying the foundation for an eventual integration of a science and technology policy into the National Development Plans and Strategies.

It succeeded for the first time in the 1981/82 Financial Year in allocating funds (though insignificant in quantum) in the Development Budget specifically for science and technology. In later years this budget line becomes redesignated Applied Research, which is not limited only to areas of science and technology.

Nowadays, by all accounts, the advocacy efforts in respect of science and technology has waned. Efforts ought to be renewed.

5.6 Commentary

In order to continue to perform its assignment and work programme relating to the development of S & T potential in the country, the Focal Unit will need to recruit scientific and technological personnel. Also, it would require active governmental involvement to be manifested in the allocation of meaningful financial resources and infrastructure.

It ought in its immediate plan of action to work out an overall strategy for strengthening the country's technological capacity as well as guidelines on science and technology planning as an integral part of sectoral development priorities. These of course should take into account a number of issues such as science and technology manpower needs, encouraging effective linkages between the Ministry and industrial sectors of the economy, guidelines on commercialization and utilization of results of R & D and overall promotion of indigenous technologies, among others.

6. GOAL ATTAINMENT

Overall, whether in terms of planning, coordination, execution of programmed S & T activities, advice and

advocacy, the movement towards desired goals as indicated in the National Development Plan is rather slow and results are still minimal.

7. STRENGTHS AND WEAKNESSES

Sierra Leone is technologically dependent like most African countries. This is true and is due to the limited nature of her existing scientific and technological capacity. Agricultural pesticides, insecticides and fertilizers are imported. Building materials and paints are also imported. The national ambition is to reduce progressively this technological dependence so that social and economic take-off may be unencumbered. The government of Sierra Leone is committed to the evolution of a grand scientific and technological strategy within the framework of its economic and social development as spelt out in the National Development Plan; this has, therefore, led the government to realize, from its own experience since attaining a sovereign status and from an examination of the contemporary situation in other developing countries, that before science and technology should take-off certain developments must take place. Perhaps the most important of which are the eradication of the institutions and committees weaknesses, viz:

- the establishment of the Interim Committee into a statutory body; acceptability of the functions of the Interim Committee on Science and Technology;
- increase the commitment of government's funding for S & T; and
- establish a well defined science and technology policy and the establishment of a proper mechanism for coordination among the organizations and departments for science and technology. Consequently there must be adequate attention to science and technology with adequate powers which the institutions lack of the proper functioning and implementation of science and technology.

7.1 Resources and their utilization

7.1.1 Human

The key to all development is centered around human resources which are accorded high-priority in the Lagos Plan of Action and in the programme for the Industrial Development Decade for Africa. The ability to exploit technological advances is closely related to the ability to develop the skilled personnel to utilize research results.

Therefore, any national action plan for the development of national capacity and capability for a more effective utilization of science and technology for development needs to place heavy emphasis on the development of human resources and skills. This would necessitate long-term programmes of a comprehensive nature ranging from the position of sound educational facilities and re-orientation of curricula to vocational training, the creation of specialized cadre of technicians, scientists and specific training related to the selection, acquisition, adaptation and development of technology. Such programmes should, in addition, take note of the requirements of the decentralized sector and of the need for engaging women in household in productive work.

The human being is indeed the centre of the innovation process. Experience shows that innovation often sprang from groups of individuals, working closely together and developing skills and experience in a specialized way.

The most chronic groups of problems in scientific and technological development in Sierra Leone is manpower. It includes the education and training, the supply and demand, the placement and retention, and the welfare and job satisfaction of management, administrative, scientific technological supervisory and skilled personnel.

The structure and offerings of the university and technological institutions, if any, require a thorough review so that the education and training they give may be relevant to the needs of the economy of the country. By this is meant the various manpower required in agriculture and such industrial production as housing materials, food products, drugs, chemicals, fuel, should know their employment destination's.

The major problem however, is the training of intermediate manpower in adequate numbers. Existing facilities as it is in most developing countries, are very inadequate. The secondary school system must also give terminal courses in a number of technical discipline, like food processing and preservation, cookery and catering chemical technology, automobile mechanics, laundry and dry cleaning, bakery and confectionery, dressmaking and shoe making, sheet-metal work, printing etc. Without these, the shortage of middle manpower cannot be reduced.

7.1.2 Material

The Focal Unit by virtue of its position in the Central Planning Unit (CPU) shares the utilization of those materials which belong to the CPU with other divisions of the Ministry.

7.1.3 Financial

From budgetary history and analysis it is clear that not much financial resources has been invested nor allocated for the development of the necessary national scientific and technological capacities, manpower and institutions, to ensure not only a smooth operation of those projects but also their backward integration for economic development.

The problems of financing science and technology activities is directly and mostly related to the financing of scientific and technological institutions. The financing of these institution has been grossly inadequate. One of the problems encountered in Sierra Leone in the development and utilization of science and technology for industrial development has always been the inadequate allocation and utilization of financial resources. In this connection, it is to be noted that the long-term investment required for the development of science and technology although recognized by decision-makers in

Sierra Leone has not been reflected adequately in the national budgetary allocations in the magnitude that is compatible with the role its results are expected to play on the development of the national economy.

While some african countries are increasingly allocating more funds from their national budgets for the development of science and technology, Sierra Leone still lags behind. This perhaps is due to some factors viz: lack of well defined national science and technology policies and plans; undeveloped national machineries and institutions for industrial and technological research and development and lack of suitable science and technology information systems to name a few. As the figures speak for themselves, only a small proportion of the government resources has been allocated to the development of science and technology education and training programmes, laboratory requirements and instruments. This leads to the conclusion that if Sierra Leone's commitment in respect of science and technology development are to be met, the bulk of science and technology education and training, especially for engineers, industrial managers and workshop operators will have to be carried in Sierra Leone and that means allocation of more financial resources to the sector.

8. RECOMMENDATIONS

8.1 Goals and functions

There are in the country some of the basic elements (e.g. political will and institutional structures) necessary for the establishment of specific science and technology policy-making body.

The Central Planning Unit of the Ministry of National Development and Economic Planning has recognized the issue of capacity and institutional building in S & T as a pre-requisite for reducing Sierra Leone's technological dependence.

As a stop gap measure, it has set up a Focal Unit to put in place institutional arrangements by which policies, strategies and plans regarding productive technology can be nationally identified, formulated and implemented through various development programmes in coherent fashion. However, this mechanism is still a long way from becoming fully operational; its scope has been limited and the extent to which its activities has influenced any systematic advancement of the S & T potential has been negligible.

The proposed objectives for industrial development in the plan period 1986/87 - 1988/89 which is still current, include the following:

- (a) Initiate and sustain a process of rapid industrial growth;
- (b) Mobilize domestic and foreign resources and technology for industrial development;
- (c) Generate substantial employment opportunities, thereby reducing the high level of unemployment;
- (d) Develop entrepreneurial, managerial and labour skills.

With the strong commitment by government to attain these objectives, the strengthening of the Focal Unit should be seen as an urgent action and this is strongly recommended.

The Focal Unit must then proceed to work out a programme of action for the immediate establishment of the long overdue National Council on S & T for Development.

The structure and functions of this council has already been extensively considered and recommended to government. It is detailed in the report of the 1984 National Seminar on S & T policies. Its main role will be to promote and sustain endogenous development of

S & T capabilities and assist the country in reducing its present state of scientific and technological dependence.

8.2 Organization

8.2.1 Structure

In order to cover the main course of action regarding relevant inter-related set of programmes and measures for S & T for development within an overall development strategy such as:

- identification of priority sectors in which focussed activities would lead to accelerated development;
- assessment of endogenous capacities in each of the priority sectors with a view to identifying gaps and prospects in achieving development goals;
- analysis of the pattern and effectiveness of resource flows (financial, information and others) into science and technology in terms of development objectives in the short and long terms;
- assessment of the contribution made by external assistance in building endogenous capacities in science and technology;
- blue print for national S & T body.

More trained personnel in the field of science and technology management and planning should be recruited to serve in the Focal Unit which should be called the Directorate for S & T.

It should comprise of the following division, namely:

- (a) Policy, planning and training;
- (b) Project development (techno-economic, R & D and Advisory services);
- (c) Legal;
- (d) Information and documentation; and
- (e) Administrative and Finance.

8.2.2 Composition

The Directorate is a technical secretariat and should be staffed by competent professionals, scientist, technologist, economist, social scientist, science and technology managers and planners.

The Interim Committee should be upgraded into a statutory body and should serve the Directorate in an advisory and consulting capacities.

8.2.3 Linkages

The Directorate should obviously have close functional linkages with all relevant technical ministries, R & D institutions, Chamber of Commerce, all parties having a stake in the scientific and technological development of the country.

8.2.4 Powers

The Directorate should be accorded the necessary statutory powers vital for its proper functioning supported in the Ministry of Development and Economic

Planning to the extent that it can master the cooperation of all relevant S & T institutions.

Also, a specific chapter should be devoted to S & T in the National Development Plan.

8.3 Resources

Financial resources should be specifically allocated for science and technology in the National Development Budget and Recurrent Expenditure, such a specific vote should be utilized by the Directorate for the execution and management of its clear cut S & T programmes.

CONCLUSION

The state of science and technology in Sierra Leone reflects some stark realities which cannot be ignored.

The first realization is that Sierra Leone must not only express the necessary political will; but must also be prepared to adopt relevant policies, legislation, plans and programmes and establish an effective institution as appropriate, or strengthen existing ones.

The population of the country is growing fast. Although, there is a general awareness of the role of science and technology in the development process, this awareness is not adequately reflected in development strategies, and therefore the country has been unable to develop indigenous scientific and technological capacities. As a result of this, technological dependence is growing very rapidly and unless timely action is taken, Sierra Leone will be excluded from the mainstream of the world economic system.

Another important realization is that the needs of the population continue to grow. Therefore technological dependence will become more and more acute in the realms of agriculture and food, housing and habitat, health and drugs, clothing and chemicals, transport and communications, energy and fuel. The state will then be reached where living standards will fall and the economy of the country will be brought into greater disequilibrium. The way out of this pending predicament is to accelerate the development of science and technology capacities through all possible means including the development, transfer and adaptation of technology. Sierra Leone from past experience, shows that it cannot by her own means effect all the required changes, consequently urgent action should be taken to institute measures of the technological transformation of the country.

The implementation of the national programmes, would inevitably require additional inputs of human, material and financial resources. It is realized that there is a deficiency in human resources which is often related to existing educational policies and programmes, which are not equipped to cope qualitatively and quantitatively with the entire spectrum of industrial activities, especially those related to the development of local industries.

In the light of the above, there is a need to take concrete action for the accelerated development of human resources for industrialization. Any national action plan for human development for industrial development would necessitate long-term programmes of a comprehensive nature ranging from the provision of sound educational facilities and reorientation of curricula to vocational training, the creation of specialized cadres of technicians, scientists, entrepreneurs, etc.

In addition to the above, there is the need to give adequate support to research and development institutions to enable them to be supportive to a wide range of small industries in the areas of food and agriculture, housing and health care to engender economic growth and sustainable development in these sectors. The tasks to be accomplished should include both horizontal and vertical transfer of technology, technological information and extension work. Thus, there exists a great need in Sierra Leone for building up an independent capability for policy-making, planning and effective management with a view to the application of science and technology to the development process of the country, which automatically would require among others identifying training needs at all levels, especially at the middle level.

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**PERFORMANCE REVIEW OF SCIENCE
AND TECHNOLOGY POLICY
INSTITUTION IN ZIMBABWE**

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EXECUTIVE SUMMARY

There is only one ISTP in Zimbabwe, the Research Council of Zimbabwe which was established by an Act of Parliament in 1986. The Council operates within the Office of the President and reports to the President of the state. Its roles are primarily to advise on matters of policy and to promote research in the country. This role specification has in real terms proved basically too limited in terms of meeting the objectives of actual national advancement on matter of science and technology through activities of the council. This is so primarily because council has no capacity to provide research funds and thereby to influence research programmes. Its advisory activities do not amount to much policy influence in the presence of various Ministries of Government which have very specific and critical interests in those areas of research which affect their development mandate and actually hold their own parliamentary mandates to guide research and the progress of scientific and technological development in those areas.

Notwithstanding these limitations, the Research Council of Zimbabwe has registered notable successes particularly in areas of bringing together the research community to share research ideas, review research activities, and in the process, Council has facilitated discussions which would harmonise the general scientific thought in the country.

Council is run as an extra-curriculum activity by researchers and academics who are full time professionals elsewhere. The secretariat of only two professionals is far too small to provide council with any meaningful technical advice and in some instances to actually effect any coordination programmes the council may wish to carry out.

Until it has established a Scientific and Industrial R&D facility which is currently being planned, council would have no research capacity of its own and, without influence on practices relating to research funding or technology procurement, council would remain largely an observer on the S&T scene in the country.

1. PREFACE

1.1 Objectives of Review

This report is a review of Science and Technology policy making institutions in Zimbabwe. Commissioned by the United Nations Economic Commission for Africa in Addis Ababa, Ethiopia, the report has sought to review the structures set up by Government to oversee, supervise, or co-ordinate science and technology policy and science and technology activities in the country to include, research policy, research and research and development (R&D) policy activities and programmes, the funding of these activities and the linkage between enabling science and technology activities supervised by the ISTPs and the productive sector.

Primary consideration was given to the review and analysis of ISTPs' parliamentary mandates, their success in executing these mandates, and the degree to which they have actually mustered the policy-making and programme co-ordination and supervision roles in support of the country's effort in S&T development.

The review was carried out at a time when the relevant ISTP institution in Zimbabwe, the Research Council of Zimbabwe, is beginning a transition from being purely policy advisory body as it was perceived under the colonial governments into an active policy initiator with an established research capacity vested primarily in a research institution directly under its control as opposed to the current situation where the council seeks to influence the research agenda of a number of institutions which in effect have no mandatory allegiance to it and are required by acts of parliament to account for their activities to cabinet through Ministries of Government which have no mandatory relationship with the Research Council.

By and large, the review has found that the mandate of council as enunciated in the Research Act of the Parliament of Zimbabwe which establishes the council is quite enabling in terms of giving Council the power to intervene in the thrust of the research activities of public sector research institutions in the country. This enablement, however faces two very formidable hurdles: The first is that the council is not provided with the necessary financial resources through which it could influence research decisions and that this funding power rests with external institutions and with the Government of Zimbabwe which actually disburses research funds without consulting the opinion of council. The second is that the powers implied in the Research Act for the Council tend to conflict with parallel powers of sectoral ministries of Government which control sector specific research policies and programmes run by research institutions under their supervision.

Further, the involvement of council in determining research programmes is resented by the existing research institutions which argue for continued sector specific autonomy and question the justification for Council's intervention, particularly as the latter body does not determine funding for the former's research efforts.

1.2 Acknowledgements

The producers of this report are indebted to the ECA which commissioned this review and provided funding for it, and to the Research Council of Zimbabwe's scientific liaison office for providing information on the role and activities of council. Further thanks go to the research institutions which responded to a questionnaire on the perceived role and performance of council.

2.BACKGROUND

2.1 Rationale for Establishing the Research Council:

Zimbabwe like most developing countries has recognized the important role played by science and technology in the national development process. In this direction it has established a body to be overall in charge of policy formulation and advice to Government in the field of science and technology. Presently this body is constituted as the Research Council of Zimbabwe.

2.2 History of the Research Council of Zimbabwe (RCZ):

The history of science and technology policy making institutions in this country dates back to the days of the Federation of Rhodesia and Nyasaland - a federation that included the present day Zimbabwe (then Southern Rhodesia), Zambia (then Northern Rhodesia) and Malawi (then Nyasaland). In 1959 the Federal Government employed the services of a Mr. D.G. Kingwill who recommended among other things:

The institution of a Research Act designed to

- facilitate scientific and industrial research including agricultural veterinary and tsetse.

The establishment of a research foundation and the provision for the establishment of research councils in the Federation.

The Research Act was then enacted in July, 1959. Pursuant to the provisions of the Research Act, in 1964 the Rhodesian Government established the Scientific Council of Rhodesia directly under the Office of the Prime Minister. It was also under the same Act that the Agricultural Research Council was established in 1970 and the Medical Research Council was established by the Minister of Health in Rhodesia in 1974. These bodies were to play a vital role in promoting research in their specific S&T disciplines.

These research councils are direct predecessors to the present day Agricultural Research Council of Zimbabwe and to the Medical Research Council of Zimbabwe respectively. Because of the long history of the existence of these research councils, it is not surprising to note that in Zimbabwe, apart from research being carried out at or under the University of Zimbabwe the most successful research in the country has been in agriculture and health.

When it was established, the Scientific Council of Rhodesia was envisaged as an advisory body to the Prime Minister. Later its role and terms of reference were revised and expanded to emphasize shaping national science policy. This was done in response to a recognition of the role of science and technology in overall economic development.

The terms of reference of the Scientific Council of Rhodesia were:

(1) To undertake a review of the areas of research at present carried out in Rhodesia; to indicate other areas of research which, in the national interest, could be usefully investigated and to suggest suitable lines of research within such areas, together with responsibility for this research.

(2) To recommend ways and means whereby the above review can be carried out on a continuing basis.

(3) To keep under review those areas of science for which responsibility is not clear-cut and to make recommendations thereon.

(4) To provide, when required, advice on scientific priorities to the Treasury and to the Ministry of Commerce and Industry.

(5) To advise Government on matters affecting overall national scientific policy.

Four years after independence, in 1984, the Scientific Council of Zimbabwe was constituted and it was given its formal mandate when in 1986 the Scientific and Technological Research Act was passed in Parliament. This Act repealed the Research Act (Chapter 336) under which the previous Scientific Council of Rhodesia had been established.

The Scientific and Technological Research Act (1986) conferred on the Scientific Council of Zimbabwe functions and powers to undertake:

- "The promotion, direction, supervision and coordination of scientific and technological research including agricultural, industrial, health and mining research.
- The provision for the establishment of research councils and research institutes to conduct research and for the control of such research councils and research institutes by the council".

The Scientific and Technological Research Act (1986) gave the S & T Policy making body wider powers

than the merely advisory role of its predecessor. Thus, the Scientific Council of Zimbabwe could establish, set up and run research centres. In addition, its scope of operation was also widened to include other areas not previously under the jurisdiction of the Scientific Council e.g. mining and industrial research.

In 1988 the Scientific and Technological Research Act was amended. It became known as the Research Act (1986). The Scientific Council of Zimbabwe consequently changed its name to the Research Council of Zimbabwe. Its mandate was revised and widened to cover all research carried out in Zimbabwe as opposed to scientific and technological research only as per the 1986 Act. The 1988 Act gave the Council control over research conducted by all bodies or persons in Zimbabwe. The Council was also empowered to levy and collect fees from foreign researchers who wish to conduct research in Zimbabwe. In addition, it became a requirement for foreigners conducting research in Zimbabwe to seek the approval of, and to register with the Research Council of Zimbabwe and to deposit with the Council a report of their research within two years of completion of the research. The RCZ was also empowered to request a report from the researcher at any stage during the course of the research.

This amendment has the following significant implications :

(1)First, it recognizes that there is a very narrow but unnecessary line dividing scientific and technological research on the one hand and other types of research which made the boundaries of the mandate of the Scientific Council also difficult to define

(2)It further recognizes the interdependence between the various disciplines of research and their complementarity in achieving overall national developmental goals. Thus, as an example it has been widely recognized and accepted that sociological research (which previously was not under the S & T policy making body) plays a very critical role in defining the parameters for introduction and implementation of technological innovation. It would therefore be counter-productive to have sociological research being carried out outside the aegis of the body responsible for scientific and technological research.

(3)It places all research and research bodies in the country under the control of one body - the Research Council. The previous arrangement meant that different aspects of research came under different bodies.

(4)By making it a requirement that all foreign researchers request the approval of, and register with the Research Council, the amendment not only enables the Research Council to keep abreast of what research was being done by foreigners in Zimbabwe, but also established a formal channel for information collection as it is a further requirement under the amended Act that on completing their research foreign researchers must deposit a copy of their research report with the Research Council. The RCZ is further empowered to demand progress report from the researchers at any time during the course of the research.

As the Research Council will have a record of all research going on in the country, it would be better equipped to play its role of coordinating all research and identifying gaps where urgent research needs to be done. It may be added that local bodies which are not required to get clearance from the Research Council of Zimbabwe before they start their research are required to inform Council of their research activities through annual returns when they are asked to submit brief reports of their activities for the Zimbabwe Research Index, an annual publication of the Research Council which gives a summary of the research work done by various researchers at all institutions in Zimbabwe. Also quite important is that the RCZ in vetting foreign researchers could determine what research could or could not be done by foreigners in the country.

(5)For the first time Council was given a channel for regular fund collection by empowering it to levy foreign researchers. The Council could then employ these funds towards any projects which it deemed important. This fund contributes significantly to the revenue of the RCZ especially in light of the small annual grant the RCZ receives from Government. In 1989 this grant was about ZWD80,000 and in 1990 it was ZWD150,000. The research fees levied during this period amounted to about ZWD7,500 in 1989 and was slightly higher in 1990.

In conclusion, the history of the science and technological policy making organ in Zimbabwe illustrates a growing and increasing recognition of the importance of this organ in the development of this country - its mandate evolving from merely advisory one (the Scientific Council of Rhodesia) to an executive one with the Research Council of Zimbabwe.

Through its history the STIS Policy body has remained in the Office of the Head of Government

reflecting the importance that has been attached to its role, and the need for the STIS policy body to be able to give instructions or directions to research councils and institutes.

3.GOALS AND FUNCTIONS OF THE RESEARCH COUNCIL OF ZIMBABWE (RCZ)

3.1 Mission of the RCZ.

3.1.1 Statutory Goals and Functions

The functions of the RCZ are spelt out in the Research Act (1986) amended in 1988 as indicated earlier. Under Section 16 of the Research Act, the Research Council of Zimbabwe "shall generally be responsible for the promotion, direction, supervision and coordination of research with particular reference to the interests of Zimbabwe".

To achieve this the Research Council will -

- (a) exercise the power of control conferred upon it by or under the Act over research councils and research institutes.
- (b) make donations or grants and award fellowships or scholarships to individuals, groups or institutions.
- (c) promote, assist or encourage research in Zimbabwe and cooperation with individuals, organisations and institutions in the coordination of research in Zimbabwe.
- (d) make recommendations of person(s) or association(s) for an honour or award for outstanding achievement, invention or discovery and pay the recipient from moneys appropriated for the purpose by Parliament.
- (e) cooperate with persons or organisations or institutions from any other part of the world in matters of research.
- (f) collect and disseminate information on research results for the benefit of the whole country.
- (g) make recommendations in relation to -
 - the formulation of and implementation of a national science and technology policy.
 - the research needs of Zimbabwe and priorities.
 - the establishment of research councils or research institutes to conduct research.
 - the constitution of the said research councils.

the approval and monitoring of research conducted in Zimbabwe by scholars and other persons who are not citizens of Zimbabwe.

- (h) to tender advice to the Minister on the overall management of research programmes and the allocation of funds and other resources for research.

The Minister referred to here is the Vice President of Zimbabwe.

3.1.2 Analysis and Comments

For the RCZ to effectively carry out its mandate, it needs to have at its disposal adequate resources which, unfortunately, it has not had up to now.

Control:

It is very difficult for the RCZ without research funds of its own, to dictate or direct what research can to be carried out even if it identified priority areas for research.

In addition, existing research councils (e.g. the Agricultural Research Council, the University Research Council and the Medical Research Council) and other research organisations (e.g. the Blair Research Laboratory, Department of Research and Specialist Services, Tobacco Research Board etc.) receive their votes from Parliament independently of the RCZ. They will therefore not feel obligated to abide by any research priorities which the RCZ may set if these differ from those of the organization. Similarly research funded by external donors will also tend to reflect the priorities as seen by these donors as the researchers can approach the donors and conclude research agreements without reference to the Research Council of Zimbabwe. Funds from donors are channelled directly to the local institutions without reference to the RCZ.

With the small secretariat available to the RCZ it is not possible to supervise the research work that is going on in the country without seriously hampering its progress.

Coordination and Supervision:

For effective coordination the RCZ needs to have at its finger-tips full accurate and up-to-date information on the research that is taking place in the whole country. For this to happen, there is need for an efficient information gathering systems and close cooperation by the researchers in all categories - individuals, private sector and public sector and public sector institutions. The secretariat used to publish annually the Zimbabwe Research Index which showed who is doing what research

and where. The secretariat has now been without a librarian for the past four years. As a result, it has not been able to compile the Research Index on a regular basis. The RCZ is therefore in the dark with respect to research taking place in the country.

Experience has also shown that private companies doing their own little research are rather reluctant to reveal details of their research work. The Research Index has therefore tended to be filled with work done at the University and Government research establishments.

Further, all individual foreign researchers wishing to carry out research in Zimbabwe have to be approved by Council.

Making Donations, Grants and Awards:

Despite its small grant from Government, Council has been able to provide a small grant in support of the Zimbabwe Science News, a local quarterly scientific journal, and it has made awards for outstanding scientific endeavour. Two awards have been granted so far: These are, the President's award which is described latter under section 6.2.1 of this report, and an award to the Young Scientists Exhibition which is held every two years and is to become a regular support activity of the Research Council since its activities are now included in the Council's annual estimates of expenditure.

There remain, however, serious limitations in this regard due mainly to the funds available to council for these three functions. In fact, Council has not been able to make any significant donations to support research.

It must be viewed positively, though, that council has at least been able to disburse funds in the direction of awards and grants under a very limiting budget.

Promoting, Encouraging and Assisting Research:

The ability of Council to carry out this set of functions is, indeed, a function of funding. To the extent that these remain limiting, Council's role in these activities will also remain minimal. The awards, grants mentioned above, however small, do represent an effort to promote and encourage research in the country. By far the most notable promotional activity of Council is the holding of the bi-annual S&T symposium. It should also be noted that, since the awards mentioned above are based on the value of research carried out by an individual, the awards constitute a very specific and focussed mode of encouragement to the individual.

Cooperating With Foreign Institutions:

This role has been carried out to a reasonable degree of satisfaction and particularly with the Commonwealth Science Council whose activities are required by the CSC to be channelled through the Research Council.

Council has also exhibited a strong desire to cooperate with other institutions and to enlist their opinions on major Council projects. The international workshop on the establishment of the Scientific and Industrial Research and Development Centre is a case in point.

Collection and Dissemination of Scientific Information:

Council, through its bi-annual symposia provides a vehicle for the collection and dissemination of massive amounts of information for public and specialized consumption. Council also has a library with thousands of volumes of documents, a few periodicals and journals, and very few books. There is a tendency, however, that most of the documents held by the Council library are the type of free materials obtainable from United Nations institutions or the Commonwealth Science Council.

Council also requires lodgement of all reports by foreign researchers who have carried out research in Zimbabwe. This source of information has, however, had the weakness that these reports are not professionally indexed in the library and are, therefore, not easily accessible. Even the collection of these reports from researchers is not strictly enforced mostly due to lack of manpower at Council to follow up these collections.

A even more disconcerting factor is that the Council library is not readily accessible to the public as it has no public membership facility.

Although the term Scientific Liaison Office suggests interface between Council and the scientific community, the office has so far been unable to carry out liaison activities on a day-to-day basis.

Making Recommendations On the Establishment of Research Councils and Policy:

Council has played an important role in reviving the Medical Research Council of Zimbabwe which had become dormant. There also plans to set up a Mining Research Council at the recommendation of the RCZ.

Tendering Recommendation of Funding and Management of Research:

Council's only effort in this regard has been limited to a submission made by Council recommending that it be given more powers in deciding allocations of research funds from Government to public research institution as well as to the University.

This recommendation was, however, not accepted in its initial form of presentation but Council was asked to make certain revisions in their recommendations.

Occasionally, Government refers to Council on issues of S&T.

Such references have been made, for example, on the problem of the water hyacinth weed polluting major water bodies in the country, and the problem of water pollution in the Harare area. These two incidences, however, are not enough to enable one to pass judgment on how far Council has gone in establishing its position as an effective advisory facility to Government.

3.2 Operationalization of Mission

3.2.1 Perceived Goals and Functions

The day-to-day management of the RCZ affairs is constituted in the Scientific Liaison Officer and an assistant. In the view of this office, the goals and functions of the Office are to implement the decisions of Council and to carry out the requirements of the Research Act. This management has, however, and quite understandably acknowledged the weaknesses of the office as presently staffed and has folded back to doing best the little they could do. The bulk of the time at the office, therefore, had to be spent on such major activities as preparing for the symposia, coordinating meetings of Council and its committees, and the effort to establish such major projects as the SIRDC. Operationally, the Liaison Officer sits on these committees and is generally responsible for the documentation of committee activities and operationalising its decisions.

The function, therefore, becomes mainly routine administration of activities related to these major tasks. Activities also include carrying out preliminary vetting of foreign researcher and issuing research permits to these researchers.

This, of course, is not the perception of the office with respect to its roles. Rather, this represents a tactical reorientation in the face of limited financial and

manpower resources. Because of this situation, the actual strategic planning and implementation of the Research Act suffers to the extent that the office is only able to carry out a small fraction of its responsibilities as outlined in the Act.

Heads of affiliated institutions such as the sectoral Councils, however, have a rather lukewarm view of Council's roles. These sectoral Councils have basically remained quite independent of Council except in so far as their institutions are represented on committees of Council.

3.2.2 Analysis and Commentary

The activities and the duties that the Council end up managing to perform through the Scientific Liaison office are far below the powers afforded Council by the Research Act and, indeed, far below the public's interpretation of the role of Council. It is well known that the manpower deficiencies in the Liaison office are a major limitation to the operations of Council. The question should therefore be raised as to why in the past six years that Council has been in operation as the Research Council of Zimbabwe, this situation has not been rectified. In 1984 when Council was re-constituted as the Research Council of Zimbabwe, it was manned by only one professional. Today in 1991 the office is manned only by a liaison officer and an assistant liaison officer. The liaison officer who was appointed in 1989 to replace the first liaison officer who had been appointed in 1984-85 has since moved to another department of Government leaving only one professional in place.

It should be noted that the longest a liaison officer has stayed in office at the liaison office is only four or five years. This is a major source of operational weakness in that there is no consistent build-up of expertise in running the office.

The issue of providing more professional staff has been on the liaison office agenda for a long time but still no additional professional staff have been appointed. It is not clear why Government has failed to honour this requirement even if it has accorded scientific research a high standing in its programmes through the creation of the research council and placing the council in the Office of the President.

4. ORGANIZATION

4.1 Structure

4.1.1 The Position of RCZ in the Government Structure

The RCZ is well placed in the President's Office, the highest office in Government, and reporting directly to the Vice President. As a result it has political clout above all government ministries, thus enabling it to give directions and institutions to ministries and research institutes on what research to be done.

4.1.2 Sectoral Articulation

Sectoral research programmes are articulated through sectoral research councils where these have been established. To date these are the Agricultural Research Council (responsible for promoting research and development (R & D) in agriculture, the Medical Research Council (for research in medicine) and the University Research Council which controls research at the University of Zimbabwe. There are plans to set a Mining Research Council.

4.1.3 Analysis and Comments

The Research Act does not spell out how these sectoral research councils should relate with the RCZ although it gives the RCZ power to request, for its consideration and approval, research programmes from any research council and any reports which the RCZ may deem necessary. As a result there are no formal communication channels between the RCZ and these sectoral research councils.

Thus, while a member of the Medical Research Council sits on the Standing Committee on Health Sciences of the RCZ at the moment there is no link between the RCZ and the Agricultural Research Council nor with the University Research Board. Although the University Research Board sends minutes of its meetings to the RCZ, this tends to be more for information rather than for direction or advice.

There is a danger, therefore, that these sectoral research councils may not be aware of what the RCZ expects of them and could pursue programmes contrary to the priorities as perceived by the RCZ since, and to compound the problem the RCZ may not be even aware of what programmes these research councils or their institutes are following. This is because, although the RCZ is empowered to request regular reports from

these councils, it has not actually done so because of manpower shortages at the RCZ secretariat.

Since the RCZ has no financial clout it is not entirely well equipped to direct research being undertaken at research institutes. Research priorities have therefore tended to be dictated by either by personal preferences of the researcher or his institute or has tended to follow the direction dictated by foreign funding organisations.

It is therefore strongly recommended that formal communication channels and regular reporting procedure be established between the RCZ and existing sectoral research councils and that this approach be followed for any future research councils. This could be done by linking each sectoral research council with the corresponding standing committee of the RCZ. For instance the chairman of the Medical Research Council could be a member of the RCZ Standing Committee on Health; the Chairman of the Agricultural Research Council could be a member of the Standing Committee on Agricultural Science of the RCZ etc.

The RCZ should also exercise its power to demand its approval for any major research programmes by sectoral research councils or institutes and insist on reports from these institutes of councils at its meetings. For this purpose Chairmen of sectoral research councils or heads of research institutions could be invited to meetings of the RCZ. The RCZ should also be given control over the allocation and distribution of research funds. This way, it will be able to direct research towards national priority areas.

4.2 Composition

4.2.1 Organization

The RCZ has what could be described as a 'flat' structure. The main body of the RCZ can have ten to fifteen members and is headed by a Chairman under whom is the Vice Chairman. Membership of the RCZ is derived from scientists and senior managers in government and private sector. The operational arms of the RCZ are its committees. Each committee is chaired by member of the Council.

While the Council looks at overall science and technology issues as they affect national development standing committees are formed to examine developmental problems to deeper technical details in particular disciplines. Standing Committees are therefore made up

of specialists in a particular area to address issues at a professional level, but also including experts in supporting disciplines to ensure a balanced coverage of the developmental issues. Thus, for example, the Standing Committee on Health Sciences will consist of not only medical practitioners and health administrators, but also representatives from pharmaceutical companies and economists etc.

4.2.2. Composition of the Research Council

According to the Research the Research Council should be made up of not less than eleven and not more than 14 member. All these members are to be appointed by the President. The Act is silent on the sectoral representation on Council.

The present composition of Council is fourteen. Four of these are engineers, two are agricultural scientists, one a mathematician, one is a physicist, one is a medical practitioner, one is a biochemist, one is a biologist, two are social scientists and one is a remote sensing specialist. One member of council has also served as scientific liaison officer.

Council's membership is heavily dominated by the university. On the present Council there are eight members from the university. The representation of Government is at present nil. All chairpersons of Council have so far come from the university and they have come from the science disciplines.

So far the impact of this university bias of Council has not been detected. It can be argued, however, that the dominance of the academia may lead to undue greater emphasis on academic research at the expense of applied research. This bias may hurt the standing of Council among heads of institutions with a mandate to carry out applied or extension-ready research.

4.2.3 Committees

At the moment the RCZ has nine standing committees. The committees and their functions are described below:

Agricultural Sciences:

- Promoting research and development to boost the country's agricultural base including crop and animal production.

Natural and Environmental Sciences:

- Promoting research and development in natural sciences, environmental planning and conservation of the environment.

Industrial Development:

- Industrial support research in areas such as meteorology and standardisation, biotechnology, microelectronics and materials sciences, especially in relation to natural resources.

Energy resources including conventional and renewable technologies.

Mineral Resources and Earth Sciences:

- Mineral resources exploration and mapping, extraction and utilisation of water and mineral resources.
- Promoting research in metals and minerals and their beneficiation.

Health Sciences:

- Promoting research in preventive health services, nutrition and sanitation.
- Encouraging research in vaccines, pharmaceutical drugs development and epidemiology information.

Remote Sensing:

- Early warning systems in crop monitoring, assessment of yields and monitoring of droughts.
- Location of underground water and targeting of mineralized zones and cartography.

Social Sciences:

Base-line data in socio-economic, cultural and demographic indicators for appropriate planning.

Informatics:

- To formulate policies and to encourage research in the development of information technologies and practices.

Foreign Researchers Committee:

- To review and vet applications from foreign researchers who want to carry out research in Zimbabwe.

In addition to these Standing Committees the RCZ, from time to time, also sets up ad hoc committees to address specific tasks. The ad hoc committees are wound up after accomplishing these tasks. The following are some such ad hoc committees.

- The Committee on the Second Symposium on Science and technology.

- The committee on the establishment of the Scientific and Industrial Research and Development Centre (SIRDC) etc.

4.2.4. Departments:

The Research Secretariat is presently too small to be divided into any departments and none such departments exist at present.

4.2.5 Personnel

The liaison office is presently manned by one professional and 4 support staff. The professional has a Masters degree in Health Administration and the other personnel include a librarian with a BA General degree, two typists and a messenger.

4.2.6 Analysis and Commentary

Generally committees of Council represent all sectors of the economy and at committee level the university and academic bias alludes to above is somewhat diffused. All committees of Council are, however, chaired by a member of council. This fact, nonetheless, does not mean the perpetuation of university ideas.

Personnel in the Council would refer only to staff of the Liaison Office. These as indicated earlier are very few and indeed, too few to carry out the full load of Council duties. Council has sought to by-pass the personnel limitations, albeit to a limited extent, by making of specialised professionals on ad-hoc committees. Such committees have included the Committee on the Symposium on Science and Technology and the Committee on the Establishment of the SIRDC.

4.3 Linkages

4.3.1 Links with other S & T Institutions

The Research Council has links of one form or another with national and foreign S & T institutions.

- Links with national institutions;

These take three basic forms;

- (a) Direct links through (a) the Research Councils mandate to vet foreign researchers applying for affiliation with a research institution in Zimbabwe. This is direct Research Council involvement in the decision processes of research institutions. It represents the closest R.C. intervention into the activities of research institutions in Zimbabwe.

While the council's vetting committee may be made up of qualified professionals, these people only have very little time to study the applications. The liaison

office which should carry out preliminary vetting does not have adequate staff to carry out this responsibility.

The vetting procedure has had some reactions from the affected research institutions. Most of these institutions appreciate the need for vetting and approve of the role of council in this respect. The common complaints about delays in most vetting or approval processes have not been raised with respect to council.

- (b) Indirect involvement through influencing the general research programmes of public research institutions.

This can be done in two ways: First by influencing research policy in the country, and second by appealing to research institutions in the country to emphasize certain areas of research.

In this regard, the council relies on its bi-annual research symposia held to discuss research work in progress, completed research results and to attempt to influence research to concentrate on certain areas the council considers important.

In reality of course, council does not as such influence research themes as it does not have the financial resources to influence research decisions taken by individual research institutions which have their own statutory mandates. These mandates do not at all refer to the research council although that of the research council gives it power to influence the activities of the research bodies.

The authoritative linkage is further weakened by two other factors. The first is that each research body reports to a responsible minister through a board of governors which has no recourse to council.

The second is that each research institution bids for government and donor funds directly from government and external donors respectively, without recourse to council. Council does not have any control over research funding in the country and under such an arrangement, it is not possible to argue that council has any effective authoritative linkage with research institutions in Zimbabwe.

Council, however, is resident in the President's Office and through decrees of the President and acts of Cabinet, the opinions of council may prevail over ministries responsible for the various research institutions.

At the moment, Council is assisting with the drafting of a document on national research policy. Since this document will be table in Cabinet, the opinion of Council will form part of cabinet deliberations on S&T policy

and would in this manner become national policy on S&T.

4.3.2 Linkage with Productive Sector

The productive sector in Zimbabwe is highly foreign owned, 38% excluding mining and the metals sector, and a much higher percentage including these two sectors which are basically foreign owned. The private sector, thus, does not conduct any research beyond product adaptation and quality control in factories. Rather, they rely heavily on mother company R & D initiatives overseas and on journal information for product improvement or for new initiatives (R.S Maya & P Englen 1983). There is no basis, therefore, for Council's intervention unless such intervention is for purposes of propping up research in private industry.

There are, however, some remote communications through the symposia where private companies exhibit their S & T initiatives and through participation on Council committees by members of the productive sector.

Private industry have also taken positively the national symposia on S & T arranged by Council. In 1984 they had the majority of exhibits and they also gave papers at the symposium.

Linkages with foreign institutions also exist. These are, however, limited to funding support from international funding agencies.

To-date co-operation has mostly been with bilateral donor agencies and United Nations organizations. These institutions, however, have direct funding linkages with research institutions and their funding

practices are not influenced by the opinions of Council except in very few instances, for example, with the Commonwealth Science Council, where the RCZ acts as a contact point for external institutions interested in S&T activities in Zimbabwe.

4.3.3 Analysis and Commentary

The Council has weak linkages with both the research community and the productive sectors of the economy. This weakness derives mostly from the legislative freedom all these institutions have been granted by cabinet and from the fact that council does not control any financial resources with which to entice researchers to venture into areas of research it considers crucial.

Council is, however, working on the establishment of the new Industrial and Scientific Research and development Centre (SIRDC) which will be a national R & D centre to serve the R & D needs of the public and the private sector. This institution will be directly responsible to Council and will have its own R & D budget. Its coming into existence, however, does not automatically mean the improvement of Council's linkages with other research institutions.

It might actually result in greater alienation as Council concentrates on its newly won capability and the older institutions continue with their own programmes.

The latter actually prefer greater independence for as long as their funding is not directly derived from Council. They, however, appreciate involvement on Council committees.

5. ACTIVITIES

5.1 Planning

5.1.1 Policy Development

The Research Act which established the Research Council specifically empowers the council to advise government on issues related to national policy on research. There are various methods council could use to provide such advice and to influence research policy in general. These could be formal, where council actually provides solicited recommendations to government, or informal, where council engages in informal activities with government or with the research community on issues that shape a national thought on research activities.

To-date council has carried out very few formal activities on policy. The only notable role they have is the writing of a draft national policy document S & T. This activity indeed, is perhaps more meaningful than any flurry of small intervention because if adopted in its form or in modification, the document will be the corner-stone of national policy on S & T. and will be a guide to all research activities in the country including funding priorities.

The Chairman of the Research Council reports to the Office of the President and Cabinet and conducts regular briefings with this office. To the extent that his briefings are more effective than those of ministers of government who control research institutions, his opinion as chairman of council would very much influence, at least, the President's position on S & T.

With respect to the informal route to policy development, council, as stated in other sections of this report has managed rather successfully to create a forum for scientists in various disciplines to discuss S & T issues. Council has held three major conferences on S & T since its inception in 1986.

The first was a consultative meeting which recommended the establishment of the proposed scientific and industrial R & D Centre (SIRDC). This conference brought together over 300 national scientists and foreign experts from Zimbabwe's neighbours and elsewhere abroad. The conference also discussed broader policy issues which would affect the future of research in Zimbabwe.

Some of these have since begun to influence opinions of the research establishment in the country.

The other two conferences are the inaugural S & T symposium held in 1988 and its sequel in 1990. Both symposia were quite successful in bringing together experts from the country and the region to review progress in research in the country. While none of these three was a policy meeting, the discussions held there do have an impact on the national view on S & T.

5.1.2 Programming

Council does not have any specific program of S & T development or research, nor does it formally influence the research agenda of individual research institutions. However, to the extent that these informal interactions continue, Council would be considered as having successfully facilitated and coordinated discussion on the national research agenda. The actual research programmes, however, remain the uninterrupted domain of individual research facilities.

5.2 Coordination

5.2.1 Among S & T Institutions

The council does not carry out any formal coordination activities. In fact, council does not obtain any inventory of research programmes for individual institutions except for purposes of publishing the National Research Index which is a listing of completed and on-going research.

5.2.2 Reconciliation and Harmonization of S & T Activities with National S & T Policy

To-date Zimbabwe does not have a national policy on S & T. There are, however, stated S & T objectives which appear in the National Economic / Social development plan known as the National Development Plan.

These objectives, like all other objectives in the plan, are the domain of specific ministries of government and the attainment of each of them is subject to funding and other resources. These are controlled by the Ministry of Finance Economic Planning & Development which has very little or no communication with Council and besides, makes resource provisions to ministries on the basis of their own opinion and on the strength of the proposals submitted for funding by each ministry. Coordination and harmonization of S & T activities by Council would, for these reasons, be quite difficult, therefore.

Council believes, however, that through its by-annual symposia it can achieve this harmonization.

5.3 Execution of Programmed S & T Activities

5.3.1 Programme Implementation

The only specific S & T programme run by council is the S & T symposia. These are intended to be held every two years. The implementation of these has been on schedule. There has been some difficulty, however, in producing conference proceedings as these

were delayed in the editorial process and the small core staff at the liaison office could not effectively coordinate the production.

Council is also implementing a project for the establishment of the SIRDC which is referred to in other sections of this report.

The implementation of this project has, as perhaps is expected of such large projects, been slow. The concept of SIRDC started as early as 1982 with the Department of Energy which wanted to establish an R & D laboratory. The idea developed into a much larger concept for a National R & D facility for industrial and scientific research. The idea was then passed to Council which has developed it into a concrete project now in its advanced planning stages.

The implementation of this project involves obtaining the concurrence of cabinet and facilitation from the Ministry of Finance Economic Planning and Development. The project for which the Council has established a steering committee has to be slow going and, indeed, cannot provide a basis for assessing Council's capacity to implement its programmes as most decisions on this subject are external to Council.

5.3.2 Monitoring and Evaluation

Council does not monitor or evaluate any programmes except those it may itself implement. It may, however, seek information on research projects being carried out in the country for purposes of compiling the Research Index.

5.4 Advice

Council, as already stated elsewhere, advises government on issues pertaining to S & T.

Activities to this end have included direct briefings with the office of the President, and solicited reports on S & T policy. Council has not, as such, undertaken advisory activities with respect to research activities carried out by individual research institutions due mainly to lack of manpower and to conflicting statutory

mandates of the Council and those of research institutions.

5.5 Advocacy

Advocacy work carried out is hard to determine in an environment where Government and the research establishment are already fully convinced about the significance, of and need for, S & T programmes to support the national development effort.

What Council could see itself doing in this regard is to popularize S & T and to source funding for S & T programmes at various levels of social and economic development in the country.

The symposia mentioned earlier are one such activity with respect to this option. Other notable activities have included the Young Scientist Exhibition which council runs for school children from Grade 3 upwards, and the publication of the Research Index which is the only compendium of its kind in the country for S & T projects.

Perhaps the biggest push in terms of promoting S & T in the country will come with the establishment of SIRDC which will fall directly under council and will run laboratories in all areas of R & D relevant to national development including:

- Biotechnology
- Energy
- Electronics
- Mechanical Engineering
- and Construction Engineering.

5.6 Commentary

It would be unrealistic to attempt to evaluate the effectiveness of council on its role in programme implementation, monitoring, evaluation, coordination and advocacy for S & T development.

This is because, while Council's mandate includes these responsibilities and even control of research institutions, Council has had a very limited opportunity to carry out these responsibilities under this new mandate. Besides being very thin on the ground in terms of staff, controlling or coordinating research will be handicapped by the institutional problems already discussed in this report.

This will be worse so with respect to the university (which is by far the biggest pool of human resources for S & T work in the country) which holds very strong sentiments about academic freedom.

Again, Research Council could by-pass all these handicaps by raising and controlling sufficient research funds to persuade research to take a certain orientation. This approach will, of course, entail curtailment of the

breadth of research as Council alone cannot meaningfully determine areas of research in the country. There will, therefore, be need for caution if this approach is to be adopted.

6. GOALS ATTAINMENT

In assessing the success or failure of the RCZ, the following factors should be borne in mind.

- (a) RCZ members are part-timers to the STI, being in full employment elsewhere. In addition, members of the RCZ tend to come from top management levels in their organisation. This further reduces the amount of time that they can devote to RCZ activities.
- (b) The RCZ is serviced by a small secretariat. The costs of running the Secretariat Office are borne by Government. Follow-up on the Council's decisions and recommendations tends to be hampered further by the limited resources available to the Secretariat. The Secretariat has to rely on pool facilities for most of their operations (vehicles, secretarial and other support services).
- (c) In essence the RCZ is made to rely on resources (human and material) outside its control for implementing its programmes. This is not a very conducive to success or to efficiency.

The RCZ has, so far, been receiving a small annual grant (Z\$80 000 average).

This is not enough for the RCZ to set up a contestable research fund which would give the RCZ effective power to control and direct research in priority areas it would have identified. It is the organisation that gives the funds for research that calls the tune.

- (d) The RCZ is a fairly young organisation still to find its own feet.
- (e) The RCZ still has to operate within the Government bureaucracy (perhaps until it gets its own secretariat - and not depending on the secretariat provided by Government). The implementing/operating procedures have to follow laid down Government rules. This tends to slow down implementation of decisions.

6.1 Planning

6.1.1 Policy Development

In the light of the above it is encouraging to note some of the achievements of the RCZ:

- (i) The RCZ has now been included in the National Consultative Council, (NCC) - the supreme body in national planning. In the NCC, RCZ can influence national plans to recognize and emphasize the role of Science and Technology.
- (ii) The drafting of the national S & T policy is at an advanced stage. The national S & T policy will go along way in guiding government and research organisation in their work.
- (iii) Plans are also at an advanced stage to set up a national S & T the SIRDC research centre which will initially carry out research in biotechnology, energy remote sensing, microelectronics mechanical engineering, and building engineering is expressed to play a vital role in technology generation and commercialisation of research results.
- (iv) Council has been consulted by Government on a number of S&T issues including the problem of the water hyacinth weed which now threatens large water bodies and their recreational value.

6.2.1 Programme

The RCZ is the contact point for the Commonwealth Science Council (CSC) the NON-ALIGNED MOVEMENT (NAM centre for Science and Technology, and the International Council for Scientific Unions (ICSU). In this position, it can influence S & T inputs by outside organisations into Zimbabwe's programmes of STI.

Foreign researchers now have to seek RCZ permission to conduct research in Zimbabwe and a number of them have been registered with the RCZ.

This helps the RCZ to control the type of research that can be carried out by foreign researchers.

The RCZ has already organised three National Consultative Meetings at which the national S & T are tabled and two national Science and Technology Symposia at which local and international scientists meet to discuss and exchange research ideas and research results. Future symposia are planned at two-year intervals for the time being. It is planned to have these meetings more

frequently when the staff situation at the Secretariat improves.

It may be noted that the SIRDC project mentioned earlier was developed partly through these national consultative meetings.

In an effort to popularise science and technology and to encourage S&T innovations council has instituted awards for outstanding achievements in Science and Technology. These fall into four categories

(a) The President's award to an individual:

This is given in recognition of an individual's contribution in Science and Technology. This is the highest honour an individual can get in Zimbabwe. It consists of a Certificate of Distinction and prize money. The award has been given twice so far. The first one was awarded in 1988 to local scientists for outstanding work in the design of a low cost ventilated privy (The Blair Toilet) and also for outstanding work in efforts to eradicate the tsetse fly. The second award was given in 1990 for outstanding work in cancer research.

(b) President's Award to a Company:

This is awarded to a company that has contributed most significantly to technological advance in Zimbabwe using indigenous or local facilities and personnel. The award consists of a certificate of merit. The award was introduced in 1990 and has already been given to a company that had contributed considerably to the local development of Computer-Aided Design (CAD) and Computer Aided Manufacture (CAM) of industrial steam boilers.

(c) RCZ Sectoral Awards to Individuals:

These awards are given to individuals who although they have contributed significantly to the development of Zimbabwe through their achievements in Science and Technology do not qualify for the President's Award. The awards recognize outstanding achievements on a sectoral basis, the sectors coinciding with the standing committees of the Council. Thus it is intended to give awards for achievement in the areas of:

- agriculture
- health
- industrial development
- informatics
- mineral resources
- natural and environmental science

- social sciences and
- remote sensing

This was introduced in 1990 and one prize in industrial development has been awarded for outstanding work in the local design and manufacture of cranes and hoists to a Bulawayo based engineer.

(d) Other Awards:

These include the RCZ awards to the Zimbabwe Young Scientists Exhibition. Two regional prizes and one national prize - awarded to the best researched young scientists project or exhibit. This

was introduced in 1990 and one regional prize has been awarded so far.

6.2 Analysis and Comments

The environment within which the RCZ operates has already been described. While some achievements have been made, it must be noted that a number of unfavourable factors have tended to reduce the effectiveness of the RCZ in fulfilling its mandate. The following suggestions are put forward and may be considered in future efforts to enhance the RCZ.

- (a)** A much bigger secretariat dedicated to the execution of RCZ programmes must be provided. The Secretariat should also be provided with adequate resources for information handling and collection, processing, storage and dissemination. This requires the availability of - vehicles to visit research stations.

- computers for data management.

reprographic equipment (e.g. desk top publishing systems) and photocopying facilities.

- (b)** On their part, the RCZ should also embark on more aggressive fund raising and exercise their control over research organisations.
- (c)** While the awarding of prizes by the RCZ to individuals for outstanding achievement in Science and Technology is very commendable, the RCZ should get involved in promoting and facilitating these 'outstanding achievements'.
- (d)** The RCZ should also strengthen its interaction with industry and commerce. This will facilitate the adoption of the recommendations by the RCZ on strategies for industrialization.

7. STRENGTHS & WEAKNESSES

The role of Council is in most cases to suggest "areas of research which, in the national interest, could be usefully investigated" and to recommend methods of streamlining responsibility for certain areas of research.

Making recommendations and suggestions alone weaken the role of Council. This is particularly so in the face of very strong independent powers of Ministers to supervise and to take responsibility in cabinet for the activities of research institutions under their ministries.

Opinions of the Research Council for example will not override those of the Minister of Agriculture who is the one answerable to Cabinet on the activities of R&SS. In any case the management at R&SS and their research staff are better informed than Council about the research needs of Agriculture. The same applies to every other research discipline.

It is true, however, that the sector specific research institutions may have a narrow perspective on research programmes and Council would have a much broader perspective which would ensure the necessary intersectoral linkages in the research programmes of the various institutions.

7.1 Goal and Functions

The goals and functions of the Council are outlined earlier.

The function of Council or its terms of reference have a number of inherent weaknesses and are prejudiced by certain legislations which pertain to or governs the activities of research institutions which must fall under the umbrella of council.

7.2.1. Structure

Council is headed by a chairman who reports to the President of the state. He carries out the mandate of the Council which is advised by its standing committees. These in turn can set up ad-hoc committees to advise them on certain issues.

There is thus no inherent weakness in the structure of Council. There may, however, be weaknesses related to the calibre of the persons actually selected for the consultations.

This is a very fine element of the structure of Council which is not discussed here.

7.2.2. Composition

The composition of Council may not provide adequate disciplinary representation but Council has, however, established special committees as shown in its structure which was described earlier in this report.

These committees have people of various backgrounds in the hard-core sciences, technology, and social sciences. This disciplinary spread should enable council to comment effectively on all areas of research in the country - more so as members to these committee are members of the research community in the country.

In this regard, the composition of council and its standing committees does not provide handicaps to its operations.

7.2.3. Linkages

Most research institutions interviewed had no formal communication with council except in seeking approval for foreign research affiliates and on issues relating to the national S & T symposia.

No formal communications exist with respect to research programmes. This weakness is perhaps associated with the manpower constraints of the liaison office which has only two full time professionals to run the office.

Further on linkages, the research establishment, except for those who sit on committees of council, feel that they are not consulted on decisions made by council or with respect of the powers of council and in some respects view council with some resentment.

7.2.4 Powers

Council cannot facilitate research without a research budget under its control. The total research expenditure in the country is closely tied to specific research needs of Ministries of Government for purposes of conducting research closely linked with their development mandates as spelt out by Cabinet. The private sector research expenditure is basically based on private sector support for research very specific to the industry providing research funds.

Those funds supplied by external donor organisations are often provided through a specific ministry of government which would have demonstrated the need for research support in a research area the donor also considers significant.

Council thus has no financial strength and is not at all consulted on issues of research funding.

Research institutions are also of the opinion that council does not have sufficient manpower resources to appreciate research problems in the various development areas represented by each ministry of government, at least not to the extent that they can seek to guide research prioritisation.

There is a further structural weakness also pointed out by research institutions resident in government and at the University. This relates to the fact that each research institution has its own statute which outlines its decision making process and reporting procedures as indicated earlier. In the background of such

autonomy, council appears to have been given power to get involved in the activities of these institutions.

This is generally regarded as interference leading to the fact that no research institution feels required to report to council or to consult with council.

8. RECOMMENDATIONS

8.1 Goals and Functions

Some of the goals and functions of the Research Council conflict with, or duplicate, some aspects of goals and functions of other government institutions established before it. Council has not exercised its roles with respect to these goals and functions, and in this weakness, it has helped avoid collisions which would take place if Council exercised its full mandate.

The goals and functions of Council should, therefore, be more carefully carved out and assurance must be demonstrated that Council's functions are complementary and not restrictive to the freedoms researchers are wary of losing.

The way these functions and goals have been enunciated in the present act appears hurried and haphazard. For example, the past and present chairpersons of the Council are academics at the University of Zimbabwe which holds a large pool of S&T professionals. The University itself strongly guards against any academic infringement and yet the same University professional appear to be engaged by Council to centralise research decisions, a major infringement of academic freedoms.

As a major improvement of Council's role and purpose, it is recommended here that Council be viewed as a facilitator of research effort in the country and that it takes this role from a complementary perspective. Under this format, individual research institutions should be allowed to pursue their own sector specific research activities and Council should assist in these efforts by seeking complementary funding which it could provide for research in specific areas that it itself considers to straddle sector specificity or in which there is no general research interest on the part of the research establishment.

Council may also take up the role of ensuring that the S&T community is maintained in Zimbabwe through advising Government on how best to satisfy the remunerative needs of the research profession and on how best to generate interest in this profession by beginning professionals.

8.2.1 Structure

The structure of Council is quite satisfactory, save for the need to expand the secretariat office to include more professional staff capable of handling the wide

diversity of research fields which the Council must deal with. This will be necessary to help review proposals and pass technical recommendations to Council committees which make decisions.

The structure of Council with respect to existing institutions should, however, be clarified so that there are no statutory overlaps between the powers of Council and those of Ministries of Government to whom research institutions report. Council has also drawn a certain structure which suggests that there is a hierarchical relationship between itself and research institutions. This may be the relationship as perceived by Council but the opinion of most research bodies is different. The latter are not aware of this hierarchical relationship in which Council appears as the mother body. The mother body in the view of each research institution is the responsible ministry to which it is accountable.

If this relationship is not clarified, a situation may develop in which Council may be resented and the good things that Council could do, overshadowed in such reservations.

8.2.2 Composition

The composition of Council is quite diverse at the present time. There is no clear need to alter it particularly since Council can always access the advice of specialised experts through standing and ad hoc committees. It may help, however, to increase the involvement of private sector industry on Council committees since this is the sector which would benefit the most from R&D results.

8.2.3 Linkages

There are virtually no effective linkages between Council and industry or between Council and research institutions. This is an area which needs thorough reconsideration. The improvement of these linkages are, however, going to depend more on goodwill and understanding than on any statutory power that Council may wield. It is important, therefore, that Council works to win the respect of the industrial and research communities ahead of any attempt to impose itself on these very sensitive communities. One possible beginning point is for Council to present itself as a distant facilitator which seeks to handle residual research and research support.

8.2.4 Powers

These have been dealt with in some of the foregoing sections. It must be stressed, however, that Council, from the Research Act, has very extensive powers which are in fact almost impossible to effect without causing disgruntlement in the S&T community and even a stir in Parliament where ministries of Government would seek to defend the logic of having themselves, and not

Council, supervise research decisions in social and developmental areas where ministries have parliamentary obligations to supervise.

The few powers that Council should seek are those which will help it provide funding for residual of leading edge research, ensure dialogue within the community, provide advice on policy, and enhance the image of the S&T professional in the country.

9. CONCLUSIONS

Although Zimbabwe has recognized the need to form a central body for the review and promotion of the country's progress and requirements in S&T development, it has so far failed to transform the institution established for this purpose into an effective organization. The reasons for failure are quite inherent in the roles prescribed for the organization and in the mode of its operation which is tied too closely to the regular bureaucracy of Government. Besides, while the RCZ is billed as a promoter of S&T activities in Zimbabwe, the powers ascribed to it in the Research Act project it more as a policing and controlling body. This position puts Council into direct conflict with the ideas of the re-

search establishment which adheres to research freedom.

All in all, the concept of the Research Council is noble although the actual day-to-day activities of Council have not received an effective level of support from Government. Council itself has not made a strong enough argument for the strengthening of its se and has not done enough to seek alternative funding.

Inspite the problems alluded to above, Council has made reasonable progress in carrying out its mandate especially considering that they have only been in operation for only six years.

PERFORMANCE REVIEW OF SCIENCE AND TECHNOLOGY POLICY INSTITUTION IN THE GAMBIA

SURUWAWAWA -JAITEH

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SEPTEMBER 1991

SUMMARY

In most African countries, with little long-term experience of formal socio-economic development planning and management and in a harsh and uncertain international economic climate, the stated goals of development have often been unrealistic. Imported inputs and technology have failed to produce the predicted results and a possible solution lies in maximizing the use of suitable and known indigenous resources, skills, technologies, motivation and social structure.

There are many national issues to be debated such as the desirable balance between pure technical growth and balanced socio-economic growth; the basis for development planning; suitable and understood development strategy; the optimum level and mix of disciplines; the choice of rehabilitation, improvement or new research schemes and the selection of institutional options. These introduce many factors which must be considered individually and collectively in deciding how best to train and expand national capabilities/capacities for Science and Technology development and management. Foremost among these factors are those concerned with human resources and skills and the transfer of knowledge and experience to the beneficiary community. Research, training and dissemination services have a role of major importance in this context.

For any Science and Technology Policy related research to succeed, it is essential that the component research activities be properly conceived, organized and managed. This is true for activities of all scales although there are distinct differences in the requirements of different types, some calling for a clearly commercial and strictly disciplined approach whereas others, notably rural type community initiatives, may be more in the nature of a complement to the existing indigenous practices. It seems likely that future trends will be towards an intensification of indigenous practices if a balanced socio-economic growth is desired. Consequently, design and management tasks will not be so limited to production targets but will call for greater attention to social needs, sustained efficiency of resource use and the creation of further incentives for success and improvement in welfare standards. The role of government agencies can be expected to shift towards one of initial support and stimulation rather than participation.

1.PREFACE

This study is commissioned by the United Nations Economic Commission for Africa (UNECA) and Carnegie Corporation of New York. It is a performance review of selected country Institutions for Science and Technology Policy (ISTP). The study specifically deals with The Gambia, one of the countries selected for the continental performance review.

Whilst science and technology policy for national development is a second-order issue in the Gambia, recent economic misfortunes are dictating explicit policy pronouncements and framework that would respect the issue in principle and in application. As years went by, the need for explicit policies for science and technology as a vehicle for national development started to creep in, albeit at a turtle pace.

For the purpose of this study, selected institutions were written to and then sent questionnaires to be accomplished. In selecting these institutions, two considerations played complimentary roles. The selected institutions are involved in some form of Science and Technology Research and Development activities for national development; consequently UNECA, Carnegie Corporation of New York and the Authors have a continuing interest in them in a number of ways. Further, the institutions written to, represent a varied array of Science and Technology Research and Development systems, varied in terms of their sectoral research systems development patterns and sectoral thrusts.

The study that was carried out excluded the informal sector from its scope because of the immense data-gathering problems and the probable rate of irregularities that were anticipated in a study covering that sector. Again, due to the ease of collecting data and the expectation of prompt responsiveness, the study concentrated on public institutions, parastatals and non-governmental organisations. Out of a total of 25 questionnaires sent out, only two institutions returned them accomplished. This confirms the second-order issue affiliated with anything 'science and technology'.

Nonetheless, we were able to interview some concerned personnel from the public and private sector.

A simple method was followed in gathering, organising and analysing the elicited information. A review of available literature was made and then the elicited information was updated and correlated with information derived or obtained through discussions with personnel of the institutions contacted. Considering that these systems and/or institutions are supposed to change and develop, a heavier reliance was placed on the views expressed and what is seen to exist on the ground. Thus the depth of coverage and of presentation vary with such views.

In the absence of a National Institute for Science and Technology Policy, the study focusses on the sectoral activities and the place of the national coordinating ministry. Within such a scenario weaknesses are bound to be uncovered. In which case the study has provided appropriate recommendations for consideration.

1.1 Objectives

The objective of this study, therefore, is expressly to study past and present performance of institutions responsible for Science and Technology policy in the Gambia. The study is geared to identifying past strengths and weaknesses, indicate present obstacles and potentials and search for future viable reforms and improvements.

The specific objectives are as follows:

(i) To evaluate if Research and Development facilities are adequate and whether existing facilities are properly utilised and, for this purpose, take such steps as are necessary to improve the quality of, and output from, research and development activities;

(ii) In the absence of an ISTP, to review the performance of the institutions concerned with institutional research and development activities and relate this to the national policy on development;

(iii) Access the role of the coordinating ministry in aiding, promoting and coordinating institutional Research and Development within the framework of the national policy on development.

1.2 Acknowledgement

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2. BACKGROUND

The Gambia did not inherit any significant science and technology base at the time of independence, which exerted an impact on the country's rate and style of development. Situations in the Gambia are prefaced by an examination of the country's environment on the grounds that the direction, nature and extent of institutional/scientific research and development are of the existing environment. Social conditions in the Gambia are a reflection of, as well as a casual factor behind, the low level of available technology for national development. The very nature of colonial administration introduced by the colonialists was not conducive to the promotion of science and technology for development. High rate of underemployment, resulting from low rates of economic growth, produced low-waged economy content with few basic necessities. The working class lacked and was not exposed to development skills as a *modus operandi* of the colonial masters. The predominantly rural character of society punctuated by an overwhelming illiteracy created a cherished venue for groundnut production principally aimed at supplying the needs of the colonisers home industries. The main sufferers of this type of administration or maintenance dependence syndrome are the rural farmers and indigenous craftsmen who, inspite of having a good indigenous technology level, cannot play their rightful part in making the Gambia self-sufficient in some of its technological requirements.

The importance of building up a strong and sustainable indigenous technological capability expeditiously, right after independence was generally lost of sight of under the pressure of or desire for a cherished western style industrial development. This strategy was being pushed in the face of rapidly growing population, food shortages, socio-political problems and above all the absence of a trained manpower required for the definition of goals, purpose, and scope of institutional research and development to support sectoral development activities for the nation on a continuing basis. Up to this point in time, no institution existed to plan/advise on the most appreciate time, no institutional research and development for an agricultural country like the Gambia that would provide progressive development of agriculture, forestry and fisheries as a springboard to agro-based industrialization.

The adverse effects of the absence of a proper institutional mechanism and a well coordinated policy on institutional research and development for sustainable development are reflected by the present state of the country's spending on royalties and technical fees for consultancy and, the apparent failure of all import-substitution enterprises. According to conservative estimates, the agricultural sector alone has spend about \$100,000,000 during the last two decades on short/long term consultancies, management and technical services without any meaningful impact on the national development scenario. This clearly indicates that the country will continue to depend heavily upon foreign sources of technology and pay exorbitant prices/fees for such services unless serious efforts are made to enhance the national research and development institutions that are presently working at sub-critical levels on issues that are ill-defined and not adequately related to the agricultural sector. This unfortunate situation is seriously reinforced by insufficient financial and manpower resources.

2.1 Rationale for Establishment of the Institute for Science and Technology Policy (ISTP)

Before the Economic Recovery Programme (ERP) in August, 1985 institutional research and development system of the Gambia was ill-defined and essentially a scattered set-up. One who has written about the Research and Development System at the time has said that it was an undesirable situation "characterised by research not making any substantial impact on the economy despite the large sums of money/funds being spent annually; hardly any planning and coordination at the national level with whatever research and coordination then was being limited to few research and development institutions; and inefficient use and fragmentary distribution of research resources so that efforts were made mostly to embark on activities that would enhance personal positions, financial or higher positions, seldom to solve the national problems.

Various attempts to introduce some order into the research and development activities at the national level or at the sectoral level through a coordinating agency was soon forgotten or played down very low, as it became apparent that the national temper was not yet right for such undertaking.

When the IMF conditioned Economic Recovery Programme was instituted, followed by an Administrative Reform Programme, a seemingly new atmosphere set in, one conducive to one sided fast and determined administrative action in the government. These reform programmes only benefitted the administrative service with little or no impact on action agencies that are supposed to generate meaningful innovations for sustainable national development.

In the absence of an ISTP, any need for coordination and monitoring is partly done by the Ministry of Economic Planning and Industrial Development. The coordinating role of this ministry is fraught with constraints. There is the conspicuous lack of trained and skilled manpower to execute this role and the seemingly low level of loyalty shown to the coordinating role of the ministry. This situation is so, because most research and development activities are ministry/department specific, where research and development units are maintained by each of the ministries or departments.

2.2 History of the Institution of Science and Technology Policy.

Presently, there is no national institution for science and technology policy. All activities exercised under this auspices are in a very scattered set-up across ministries and departments. A purposeful and well defined national development strategy presupposes the existence of a national research and development system which, in our specific Gambian case would embrace agriculture, forestry and fisheries as a systematic method of joining and applying knowledge efficiently not only to the biological, physical, and economic phase of producing, processing, and distributing farm, forest, and fishery products, but in improving consumer health and nutrition, as well as the social and economic aspects of national well being.

With this unfortunate scenario at the national level, there is the need, therefore, to use the basic guidelines of relevance, excellence, and cooperation towards the development of a national technological research and development programme based on a multi-disciplinary, inter-agency, and a system approach for the various sectors. Such a system must not be seen to be only sensitive to the current needs of an advancing and developing citizenry BUT should also be forward looking if it is to make most effective use of available money and manpower.

3. GOALS AND FUNCTIONS.

From the standpoint of a developing country, with little or no known innovative base for ramified development, the ART is to identify problems in the various sectors of the economy, determine priorities and draw up long-term and short-term programmes of intervention within the framework of the existing national development policy.

Currently, the national development goals include some or all of the following:

- Pursuance of a sustainable development strategy that will yield rapid increase in per capita national income;
- Research and development intervention geared to the generation of minimum level of disequilibrium in the balance of payment problem;
- For the agricultural sector, to pursue production technologies linked to self-sufficiency in national staples;
- Intensified crop research programme linked to the establishment and maintenance of a stable level of nutrition for all citizen;
- Sustained import-substitution production strategy linked to a gradual industrialization strategy;
- Investigations into and promotion of research and development activities that would lead to reduction of poverty and inequalities in personal income.

Good planning is capable of translating these into worthwhile sectoral tasks. An adequate and sustainable transformation of these strategies is a necessary condition for the launch of the development process.

3.1. Mission of the Institute for Science and Technology Policy (ISTP)

In the absence of an ISTP, the Ministry of Economic Planning and Industrial Development (MEPID) serves as the coordinating ministry. At the divisional level, the coordination role is passed on to the Divisional Commissioners. This arrangement is, in itself, insufficient to ensure genuine coordination and monitoring based on know-why. Whilst the Know-how is easily incorporated into manuals, blueprints and other forms of documents, the know-why which can only come from general policy statements/guidelines is lacking in the skills of those

tasked with institutional research and development activity monitoring. General knowledge of basic sciences, which is needed to understand the basis upon which numerical data, mathematical dimensions, and geometrical configurations are calculated, selected and acted upon, cannot be concentrated in a neat container to be transferred/packaged from one person/ministry/department to the other. This kind of know-why barrier is a serious constraint to development mission of most research and development agencies.

3.1.1 Statutory goals and functions

While the Ministry of Economic Planning and Industrial Development coordinates institutional research and development activities of most agencies exception is with the department of Agricultural Research. This department is serviced by a national agricultural research board. The board, per se, does not conduct research as such but functions to advise on the formulation of and review the research and development programmes of the department to ensure maximum quality and effectiveness.

3.1.2 Analysis and Commentary

In terms of coordination functions, the coordinating bodies of most sectoral institutional research and development activities are better classified as loose coordinating mechanisms, as these bodies do not have the appropriate professional expertise vis-a-vis the

disciplines they coordinate and, they do not have or do not exercise clearly strong coordinating functions/powers. Invariably, they do not have budgetary powers to speak of, neither could they hire or fire.

3.2 Operationalisation of Mission

Part of the difficulty with regards the operationalisation of R&D missions is that it must be conducted at several levels of the Country/government. There is often confusion and duplication within and between these levels and it is sometimes felt clear-cut operational modalities need to be spelt out.

3.2.1 Perceived Goals and Functions

Different levels of public/immediate levels of beneficiary participation are necessary for different activities. The analysis of limitations of goals and functions points to conflicting views about the technology/innovation being promoted. Problems of social acceptability, technical feasibility, accessibility, economic viability and compatibility with the beneficiaries value system seem to be preminent. These confirms the unavailability of accepted technologies or innovations at

the outset of intervention as a result of conflicts in the perception of goals and functions as understood by sector heads, management and the immediate client.

3.2.2 Analysis and Commentary

The analysis points to the need for participatory operations in technological research and development activities. It is the view of most of the R&D practitioners that innovations/technologies suited to the clients socioeconomic and environmental conditions must be researched upon, tested and disseminated/packaged. Institutional R&D must address the problems/constraints of the clients through quick diagnosis, adaptive research and location-specific testing. It must also be seen that linkages are strengthened between the researchers and the clients. Properly organized and managed, participatory R&D provides, perhaps, the most positive approach to multidisciplinary and integrated research for development generation. It is important that objectives of clients be considered alongside the long-term objectives of sustainability and viability.

4. ORGANISATION

4.1 Structure

Institutional R&D as a basis for development has become a political imperative. Earlier, it was the concern mainly of government.

Today it has become the concern of the masses as well as of the government.

Development and (it must be added) decline have always been with us however, as a conscious concern for the upliftment of human living on a self-sustaining basis for the masses of people, institutional R&D is a modern phenomenon for the Gambia. Development ethos suffuses state policies to such an extent that, governments credibility and consequent legitimacy often hinge on the issue of meeting the demands of development.

An aspect of this concern is the need for an integrated or nationally coordinated Science and Technology Research and Development policy felt by people, in general, and by planners, in particular. The need is a natural consequence of the fragmented, disparate and Ministry or Department-specific view of development, whereby development is taken mainly as a matter of delivering/packaging a "commodity" like health, education, roads, bridges, improved production packages to a "target" sector. This view of sectoral research and development activities has proved to be unrealistic and counter productive, for it does not cor-

respond to the truth about men as self-determining and autonomous centres of creativity.

4.1.1 Institute for Science and Technology Policy's Position In Government Structure

As mentioned earlier, there is no institute for science and technology policy in existence in the Gambia. Additionally, the government has no comprehensive and explicit policy on science and technology. All that is happening are sectoral interventions made possible as a result of multilateral and/or bilateral donor assistance. Most of these interventions last as long as the donor assistance last. They die a natural death with the end of donor/foreign funding phase.

4.1.2 Sectoral Articulation

Most interventions on research and development activities in the Gambia are sector based and, are mostly, in response to a constraint expressed/perceived by a community or village. Studies on tidal irrigation by Mr. Suruwa Jaiteh as a dependable alternative to the often unreliable, time and resource consuming, import dependent lift-pump irrigation succeeded in attracting donor financing for mass adoption of "tidal irrigation" production system. This programme will go on as long as the donor support component lasts. Only donor supported programmes/projects survive and, this is because they rely on their expatriate component for the survival.

4.1.3 Analysis and Commentary

It is unfortunate that there is no ISTP in the Gambia and no explicit technology policy. There is no substitute for the self-reliance of a country like the Gambia to be able to plan, organise, and manage institutional research development so that they can coordinate and channel donor assistance more effectively. Donors are concerned that their inputs should be coordinated within the framework of national research and development strategies and plans. By so doing, donor assistance will avoid being additions to graveyard of projects scattered in the country as in other parts of the continent. Donor assistance is meaningful only if it builds the capacity for self-sustained growth and development and, is dovetailed into existing institutions/agencies for continuity and viability.

4.2 Composition

As mentioned earlier, technology policy and/or research and development activities are, essentially, second-order issues in the Gambia. While implicit policies may abound, there is no explicit policy that

commits the government to this or to that. Hence, the absence of an ISTP or a similar board or council responsible for science and technology issues. The ministry of Economic Planning and Industrial Development which coordinates all developmental activities in the country is also charged with the responsibility for Science and Technology. This ministry has only two staff working part-time on science and technology issues. Due to the low priority given to the subject these personnel have never attended a course on science and technology but were only exposed to few international conferences. At the Department of Community Development only around five staff were assigned the task of improving and mastering the development of the Indian type biogas and the "Kumba Gaye" improved cooking stove. Infact, the situation is even worst at the Gambia Renewable Energy Centre where one staff is responsible for popularising all energy issues and the development of prototype solar water heaters. The only place which has to some extent trained scientist is the ministry of agriculture where around 82 staffs are engaged in research and development.

5. ACTIVITIES AND OTHERS

At the October, 1990 workshop of the West Africa Science and Technology Policy Studies Network in Banjul; out of 26 invitations sent to public agencies, parastatals and non-governmental organisations, only a token five responded by attending the opening policy session. This goes to confirm what the absence of policy on a particular issue could mean, that is, nobody would publicly want to be seen associating himself with it.

6. GOALS ATTAINMENT

In the absence of a clear cut policy on science and technology in the Gambia the nation has achieved very little capabilities in this field. However, government has realised this major short fall and stated it as a priority in the new educational policy to the year 2000. The new educational policy emphasises the improvement of science laboratories in terms of equipments and encouraging more students to be science majors. The Department of Community Development through its adoptive research has successfully developed the Indian type biogas in three villages as pilot projects. It is envisaged that these biogas systems will be promoted at secondary schools to provide much needed gas in the science laboratories. The establishment of the Gambia