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**Performance Review of Institutions for
Technology Policy in Ghana, Nigeria and
Tanzania**

**Anthony M. Goka, Paschal B. Mihyo
and Oserheim A. Osunbor**

January 1990

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FOREWORD

This report puts together three studies carried out between 1987 and 1988 on the past and present performance of the institutions responsible for science and technology policy in Ghana, Nigeria and Tanzania.

The studies were organized by the United Nations Economic Commission for Africa through a grant provided by the International Development Research Centre. Two similar studies (not included in this volume) were also carried out in Kenya and Guinea.

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 and 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 and T policy in other parts of the world, to suggest ways in which African institutions for S and 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 International Development Research Centre 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.

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PART I

PERFORMANCE REVIEW OF INSTITUTION FOR
SCIENCE AND TECHNOLOGY POLICY MAKING
BODY IN GHANA - THE CASE OF THE COUNCIL
FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
(CSIR)

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P R E F A C E

This study on Institutions for Science and Technology policy centres mostly around the Council for Scientific and Industrial Research (CSIR) of Ghana which is both the technical advisory and policy-making arm of government and the national focal point as far as Science and Technology policy-making is concerned.

The objective of the review is to highlight some of the problems faced by the Council over the years as well as some of the weaknesses and strengths inherent in the present structure of the CSIR within the structure of the Ghanaian Government. It draws heavily on secondary sources of data and the author's own experience in working within the system for over 10 years, since there was a disappointing turnover of questionnaires sent out in spite of repeated personal contacts. It also draws on the experience of some of the members who have served on the Council for many years.

ACKNOWLEDGEMENT

I wish to thank the Director-General of the CSIR for allowing me to take part in this study. My thanks to all those contacted and interviewed, especially those members of the Council who had served for several years on it but who wish their names to remain in confidence.

Many thanks to all who, through discussions and many diverse ways, assisted me in this work, especially the staff of the Central Reference and Research Library of the CSIR.

My thanks to Ms. Comfort Attah Kwadjo for her patience in typing this report.

Finally, I wish to thank the United Nations Economic Commission for Africa (UN-ECA) and the International Development Research Centre (IDRC) of Canada for the opportunity to serve in this humble way.

I accept full responsibility for this report.

A.M. GOKA
November, 1988

CHAPTER 1

B A C K G R O U N D

Brief overview of the socio-economic development scene 1986-88

The Economic Recovery Programme (ERP) presently being pursued by the Government of Ghana constitutes one of the first serious attempts over two decades to address issues relating to the proper management of macro-economic and structural adjustment policies. A strong foundation now appears to have been laid for the medium and long-term growth of the economy. The objectives of the Economic Recovery Programme can be summarised as aiming at:

- (a) improving the management and implementation of key economic and social programmes;
- (b) continuing the economic policy instruments pursued since 1983 (ERP 1);
- (c) continuing to rely on external donor assistance over the medium-term while at the same time maintaining a proper balance between programme and projects aids. These policy actions, if adequately implemented over the period 1986-88 should bring within reach the longer-term aims of the ERP, that is, the development of a buoyant, self-reliant and an increasingly integrated economy.

The second phase of the Government's Economic Recovery Programme (ERP II) was launched in January 1986 with the fundamental objective of consolidating macro-economic policies pursued during ERP I. The gains already made by such policies in promoting growth, price stability and an incentive structure geared towards

efficient production would be built upon. The major macro-economic objectives were:

- (a) a GDP growth of about 5% per annum, implying an increase of at least 1.5% per annum in per capita income;
- (b) a revenue growth based upon a reformed tax structure and significant administrative and management changes that would increase the revenue of the GDP ratio from 10% in 1985 to about 14% in 1988.

During this phase of the ERP II, the total expenditure is expected to increase from 15% to about 22% of the GDP by 1988, entailing a recurrent expenditure share of about 11% throughout and an increase in the share of development expenditure from 5% to about 11% by 1986. The distribution of expenditure is being based on a recently completed assessment of public expenditure in the recurrent area and of a core' three-year public investment programme. The investment ratio will increase from 10 to about 17% of the GDP, with the share of domestic savings rising from about 5 to 10% by 1988, and foreign savings over the period averaging about 7%.

A significant export will aim at increasing the export/GDP ratio from about 10% to about 19% of the GDP; while the import/GDP ratio will increase from about 15 to 25%. The overall deficit/GDP ratio, including projects financed by external aid, is expected to rise from 5 to about 8% in 1986, with foreign financing rising from about 4 to about 7%, while domestic financing remains at 1% throughout the period. An increase in the monetary stalk or broad money (M2/GDP ratio) through a deepening of the financing sector from about 12% to about 20% in 1988 is also anticipated.

CHAPTER 2

INSTITUTION FOR SCIENCE AND TECHNOLOGY POLICY (POLICY-MAKING MACHINERY FOR SCIENCE AND TECHNOLOGY)

2.1 Historical Perspective

Although the application of Science and Technology (S & T) to meet national economic development objectives has received attention from successive Governments both before political independence and after March 1957, there has been, in real practice, a tendency for Ghana's economic development policies to be viewed predominantly in economic terms, e.g. exchange rate policy, prices and income policy, debt repayments and external assistance.

There seems, however, to have been a long-standing realization on the part of Ghana's policy-makers that it would be impossible to implement most of the sectoral economic objectives without a real correlative review and development of the country's S & T policy within the overall context of economic and social development objectives and targets. Some noteworthy attempt has, therefore, been made since independence to organize, plan and pursue S & T development as an instrumental component of overall national economic and social development.

2.2 Creation of the National Research Council (NRC) as the predecessor of the Council for Scientific and Industrial Research (CSIR)

The attainment of independence brought with it a reappraisal of Ghana's development programmes. National development planning under President, Dr. Kwame Nkrumah, assumed a magnitude unknown before independence. The need to provide a scientific basis for all development schemes and to plan and co-ordinate scientific

research on a national scale commensurate with the range and complexity of the special problems of a rapidly developing new nation became evident. It was clear that this could best be met by the creation of a National Research Council with adequate funds and powers to be suitably effective.

The Council (NRC) originally came into being on 14th February, 1959 under the Research Act of 1958. After a suitable period of experience, it was reconstituted under the Statutory Corporation Act of 1959 (Executive Instrument 214 of 10th October, 1960) with a view to streamlining its activities. There could be no clearer indication of the importance the President attached to applied scientific research as a concomitant of all sound modern development than the fact that he became Chairman of the Council and presided over most of its meetings.

2.2.1 The Functions of the Council

The NRC was charged with the responsibility for scientific, social, economic, medical, technological and industrial research in Ghana. It discharged this by;

- (a) exercising control over any research scheme, unit or institute created by the Council;
- (b) co-ordinating research in Ghana in all its aspects
- (c) assisting and encouraging academic, commercial and other organizations undertaking research work in Ghana;
- (d) cooperating and liaising with national and international research organizations in any part of the world, and

- (e) securing the full use of the results of research by collecting and disseminating information and giving advice.

The Council could also discharge its responsibility in respect of research funds made available to it by:

- (a) giving grants or financial assistance or establishing within its own organization, schemes, units, institutes for carrying out research;
- (b) making grants towards expenditure incurred on research by other organizations or bodies whether within or outside Ghana;
- (c) making available funds for bursaries, scholarships or fellowships for individuals undertaking research projects within or outside Ghana; and
- (d) carrying out such other activities related to research as the President may direct from time to time.

The Council was made up of three statutory members and not less than six but not more than nine nominated members. The membership was thus,

- (a) Statutory members:
 - (i) The President of the Republic of Ghana
 - (ii) Minister responsible for research
 - (iii) Executive Secretary of Council and

(b) Nominated members:

- (i) Minister of Agriculture
- (ii) Minister of Education and Social Welfare
- (iii) Vice-Chancellor of the University of Ghana
- (iv) Vice-Chancellor of the University of Science and Technology
- (v) Secretary to the Cabinet
- (vi) Secretary to the National Council for Higher Education
- (vii) Executive Secretary of State Control Commission

The Council was served by a number of special committees composed of scientists and experts who advised on various research schemes. It had a Secretariat headed by an Executive Secretary with a number of Assistant Secretaries.

The Ghana Academy of Sciences began in 1959 as an Academy of Learning with a membership of about twenty Fellows. Its objectives were:

- (a) to promote the study, extension and dissemination of knowledge of all the sciences and of learning;
- (b) to establish and maintain proper standards of endeavour in all fields of science and learning in Ghana; and
- (c) to recognize outstanding contributions to the advancement of science and learning in Ghana.

But in 1961, it was renamed The Ghana Academy of Sciences and in 1963, it was merged with the National Research Council. The functions of the merger were:

- (a) to organize and co-ordinate all scientific research, both pure and applied, in all branches of knowledge;

- (b) to promote the study of all sciences and learning;
- (c) to establish and maintain proper standards in all fields of science and learning in Ghana;
- (d) to recognize outstanding contributions to the advancement of science and learning in Ghana; and
- (e) to discharge such other functions as might be assigned to it by the Government of the Republic of Ghana.

By this means, the Academy combined the role of a learned society with that of a national science organization. The NRC became, in effect, the research division of the Ghana Academy of Sciences.

The governing body of the Academy was the Presidium and was composed of the President of the Republic of Ghana as the Chairman, two Vice-Presidents as chairmen of sections of the Academy and not less than four and not more than seven elected Fellows of the Academy. The General Secretary of the Academy served as the Secretary of the Presidium.

The Executive Committee of the Presidium, the General Purposes Committee, had six sub-committees to handle matters of finance, personnel, maintenance and transport, development, training and scientific and technical co-operation.

The Academy had two main divisions; namely, the Academic Division and the Research Division. The Academic Division was divided into sections, each dealing with matters relating to a particular branch of knowledge. The Research Division dealt with matters relating to the execution of scientific and industrial research. A Research Committee planned and co-ordinated the work of this Division.

The General Secretary headed the Secretariat of the Academy and was assisted by a number of Assistant Secretaries. It is worth noting, however, that, under British Colonial rule, (i.e. prior to the establishment of NRC) a number of inter-territorial research institutions were established; namely, the West African Cocoa Research Institute (WACRI), the West African Institute for Oil Palm Research (WAIFOR), the West African Council for Medical Research (WACMR), the West African Institute for Trypanosomiasis Research (WAITR), the West African Building Research Institute (WABRI), the West African Rice Research Station (WARRS) and the West African Timber Borer Research Unit (WATBRU) with a co-ordinating office in Accra (Ghana). Also several Government Departments such as the Geological Survey, the Division of Mines, the Medical Services, the Meteorological Services Division and the Department of Agriculture undertook and carried out limited research activities in Ghana. In addition, some departments in the two Universities of Ghana, (Legon and Kumasi) were engaged in significant research activities.

After the overthrow of the First Republic of Ghana in February 1966 by the Military, a review body (a Committee of Experts) was appointed by the Government under the Chairmanship of the late Sir John Cockroft, O.M., F.R.S., to advise on the future of the Ghana Academy of Sciences. Following the recommendations of the Cockroft Committee, the Ghana Academy of Sciences was reconstituted into the present Council for Scientific and Industrial Research (CSIR) and the Ghana Academy of Arts and Sciences.

CHAPTER 3

Mission of the Institution for Science and Technology

Establishment of the Council for Scientific and Industrial Research

The Council for Scientific and Industrial Research was established on 12th October 1968 by NLC Decree 293 (as amended by the NLC Decree 329 of 1969 and the SMC Decree 66 of 1976). In effect, these separation orders simply restored the status quo ante January 1963.

The Council for Scientific and Industrial Research (CSIR), which was legally vested with the assets and liabilities of the Ghana Academy of Sciences, has remained the Central Agency charged with the responsibility for the promotion and coordination of scientific and technological research and for generally advising the Government on the formulation, planning and implementation of Science and Technology (S & T) policy in Ghana. Originally, the Ministry of Finance and Economic Planning had ministerial responsibility for CSIR. At present, this responsibility is exercised by the Ministry of Industries, Science and Technology which was created in September 1979. The Ghana Standards Board and Government Manufacturing Industrial Concerns are under this Ministry.

3.1.1 Statutory Goals and Functions

The main functions of the Council for Scientific and Industrial Research as stipulated under the decree (NLCD 293 of 1968) establishing it were:

- (a) to advise the Government on scientific and technological advances likely to be of importance to national development and, in particular, to advise the

Government or other agencies of Government on scientific and technological matters affecting the utilization and conservation of the natural resources of Ghana and on how best scientific research may be co-ordinated and employed in the interests of such utilization and conservation;

- (b) to encourage scientific and industrial research of importance to development in the national interest of industry, technology, agriculture and medicine;
- (c) to establish, where it thinks it necessary, research institutes, units and projects;
- (d) to exercise control over all or any of the research institutes, units and projects of the Council and to have power to dissolve or reconstitute as the Council considers necessary any such institute, unit or project;
- (e) to co-ordinate research in all its aspects in the country; and, in particular, to provide machinery which will ensure that the Council, its research institutes, the Universities of Ghana and other institutions engaged in research in Ghana co-ordinate their efforts and co-operate in research;
- (f) to encourage and assist in their efforts the individuals and organizations engaged in research in Ghana;
- (g) to co-operate and liaise with national and international organizations in any part of the world on research matters;

- (h) to undertake or collaborate in the collation, publication and dissemination of the results of research and of other useful technical information;
- (i) to encourage the training of scientific personnel and research workers through the provision of grants, fellowships, studentships and bursaries;
- (j) to arrange and organize such central and common services as may be required by organizations engaged in national research;
- (k) to ensure the uniformity of standards in the selection, grading and promotion of all persons for national research organizations;
- (l) to perform such other functions as the Government may assign to the Council or as are incidental or conducive to the exercise by the Council of all or any of the foregoing functions.

3.2 Analysis and Comments

If one compares the statutory functions of the National Research Council with those of the Council for Scientific and Industrial Research, one will easily see that those of the NRC were definite and clear in their objectives, while the CSIR's were too broad in scope and quite diffuse in their objectives.

Under the statute of CSIR, the Council was given the task of both leading and coordinating research throughout the country. But by its very name, it seems that the Council was primarily concerned with research while in fact it also had an advisory and implicit science and technology policy-making role. While the Council had the task of providing leadership and coordination, it

had no financial authority and, therefore, did not have the money to give in grants to institutions it was supposed by its statutory functions to coordinate, since several other scientific research institutions and services such as the Ghana Atomic Energy Commission, the Universities of Ghana and so on, were and still are outside its purview. Without the necessary financial authority, the Council could not and cannot coordinate research in any effective manner and can only depend largely, if that, on the goodwill and cooperation of these other research institutions outside the Council, whether or not the composition of the Council includes representatives of such other organizations.

3.3 Operationalization of Mission

3.3.1 Perceived Goals and Functions

The functions of the Council as already stated, included and still include advice to Government, co-ordination of research in Ghana, encouragement of research and initiation of such new research projects as may be deemed necessary. It thus combines advisory and executive responsibilities in its relationship with the Government. This has always been the situation, more or less, except that the legislative instrument under which the Council was established spells this out in more precise, unambiguous terms.

The Council maintains specialized, full-time research institutes and employs over 230 research scientists most of whom are Ghanians. Presently, it has the following research institutes, centres and special projects: Animal Research Institute, Building and Road Research Institute, Crops Research Institute, Food Research Institute, Institute of Aquatic Biology, Industrial Research Institute, Soil Research Institute, Water Resources Research Institute, Oil Palm Research Institute, Scientific Instrumentation Centre, Ghana National Atlas Project, Herbs of Ghana Project and Technology Transfer Centre.

Each Institute has a Management Board which is responsible to the Council. There is, however, a considerable delegation of responsibility to the directors in the day-to-day running of the research institutes. The membership of the Management Board of an institute includes representatives of bodies most interested in its work as user-agencies. They are expected to bring to the attention of the relevant institute any problems which they encounter in their operations. The Institute draws up research projects for the solution of these problems on a long and short-term basis and then submits them to the Management Board for vetting and approval. Approved projects are included in the annual budget estimates which are submitted to the Ministry of Finance and Economic Planning through the Council. The Institute is called upon to give a justification for funding its research projects at the annual budget session of the Government.

3.4 Analysis and Comments

Although the Council has the legal responsibility for advising the Government on national priorities in research, important decisions in this respect are made on a narrower basis in that the Management Boards of the Institutes are entrusted with the responsibility of determining the priorities. A badly constituted or poorly functioning Board may destroy the whole process of establishing effective programmes within an institute. All other Government-funded research institutions follow a similar, independent procedure in requesting for research funds. They are, therefore, also subject to similar defects in the process. There is, for this reason, no nationally planned scientific research and development mechanism (as in some developing countries of the world) which will ensure the coordination, implementation, monitoring and evaluation of planned activities on a national scale.

CHAPTER 4

ORGANIZATION

4.1 The Position of ISTP in Government Structure

The Council for Scientific and Industrial Research is a semi-autonomous scientific and technical arm of the Government under the Ministry of Industries, Science and Technology. It has an interim Chairman, Director-General and a Secretary. The Director-General is the chief executive who is responsible for the day-to-day running of the Council, while the Secretary looks after its administrative matters.

4.1.2 Sectoral Articulation

The 26-member Council is designed to include, broadly, representatives from important Ministries such as Agriculture, Finance and Economic Planning, Industry, Commerce, Health, Works and Housing to ensure strong intersectoral linkages so that the fruits of scientific research can be brought to bear on all sectors of the national economy.

4.1.3 Analysis and Comments

The mere representation of each important Ministry on the Council and the Management Boards of the research institutions be it under CSIR or other governmental institutions does not necessarily imply that a strong sectoral articulation can be achieved. For, in practice, it has become apparent that some of the representatives feel that they are representing themselves and do not carry out the Council's decisions to their respective Ministries. Even where this is done, one usually finds that no effective action can be taken at the highest level in an organization represented on the Council and that this lacks the

legislative powers to enforce any decisions taken, since by and large its function are seen as being mostly advisory. Of course a broad representation would also enable the Council as well as the Management Boards of institutions to collect vital information from those institutions on the Council to enable the research institutions to gear their activities towards achieving certain socio-economic objectives of the country, especially in the absence of any national, socio-economic development plans.

4.2 COMPOSITION

4.2.1 Organigram

A summary of the organizational chart showing the Council's position within the governmental set up is shown below:

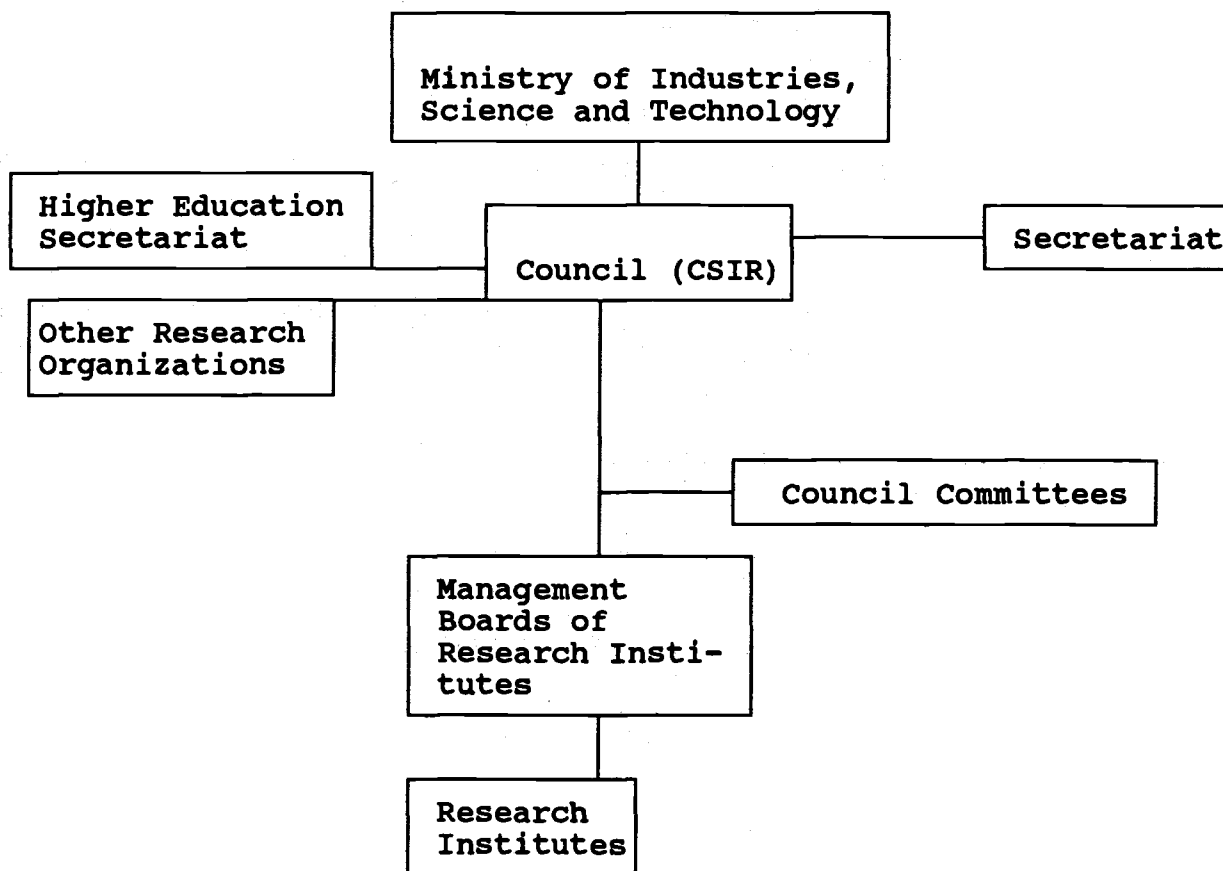


Fig. 4.1 The Council's context

4.2.2 Policy-Making Body

The Council for Scientific and Industrial Research is the Government body which has overall responsibility for the development of science and technology policy, planning and the application of science and technology to industry and agriculture. It is made up of 26 members, as we have seen, representing a much broader base than its predecessor, the National Research Council and are as follows:

- (a) Chairman (Interim)
- (b) The Director-General (who is the Chief Executive responsible for the day to day running of the affairs of CSIR as a whole)
- (c) Two persons appointed by the Government
- (d) Six persons appointed by the Government after consultation with the Ghana Academy of Arts and Sciences
- (e) Two representatives of the Directors of Research Institutes of CSIR
- (f) Secretary of the Ghana Academy of Arts and Sciences
- (g) A representative of the Ghana Atomic Energy Commission
- (h) A representative each of six selected Ministries
- (i) A representative each of the three Universities of Ghana

- (j) A representative of the Association of Ghana Industries (formerly Ghana Manufacturer's Association)
- (k) The Director of the Ghana Standards Board
- (l) A representative of the Higher Education Secretariat (formerly the National Council for Higher Education).

The Council meets 3 to 4 times in a year to deliberate on policy issues. The normal attendance at meetings ranges from 46% to 58% of its membership.

4.2.3 Committees of the Council

The Council functions largely through the committee system indicated below:

- (a) The Executive Committee which is the Council's principal committee acts on behalf of the Council in between Council meetings and meets 5 to 6 times a year. The membership which is 6 is drawn from among the Council members. Attendance at meetings is quite high and can be at 90% - 100%.
- (b) The Finance and Development Committee advises the Council on financial and physical development matters.
- (c) The Personnel and Establishment Committee advises the Council on personnel and administrative matters.
- (d) Sectoral Technical Committees on:
 - (i) Agriculture, Fisheries and Forestry
 - (ii) Health and Medicine
 - (iii) Industry and Technology
 - (iv) Social Sciences
 - (v) Natural Sciences

These committees were set up in August 1984 by the Council to enable it to discharge its national science and technology policy-making functions. Each committee has the following as its terms of reference:

- (a) to provide machinery whereby the Council can have a comprehensive overview of the sector to enable the formulation of a national science and technology policy based on a sound assessment of sectoral requirements and priorities with a view to promoting national scientific and technological capability and maximum productivity within the sector;
- (b) to advise the Council on scientific and technological advances within the Sector that are likely to be of importance to national development;
- (c) to co-ordinate research in all its aspects within the Sector and, in particular, to provide the machinery which will ensure that the research institutes engage on research in Ghana within the Sector, coordinate their research efforts and cooperate therein;
- (d) to identify the problem areas within the Sector not properly catered for under existing national programmes to which the Council needs to address itself in the interests of the national economy and to institute or recommend appropriate measures for dealing with them;
- (e) to deal with such problems within the Sector as may be referred to the committee from time to time.

4.2.4 Departments

The Secretariat of the Council has the following divisions and no departments:

- (a) Library and Scientific and Technical Information Services
- (b) Accounts, and
- (c) Internal Audit.

Within this set-up are also other service sections such as,

- (a) Estates and Maintenance,
- (b) Editorial and Printing Office, including those of the Ghana Journal of Agricultural Science and various other publications of the Council,
- (c) Publications - General
- (d) Public Relations and Scientific and Industrial Liaison Services. These generally provide common services for the Council and its research institutions, other organizations and government agencies as and when required.

4.2.5 Personnel

There are over 230 research scientists working in all the research institutes of the Council. This is quite apart from other scientists and researchers in organizations outside the Council's immediate supervision itself.

Within the Secretariat of the Council are about 30 professionals in all the divisions comprising 5 Ph.Ds and about 10 MScs, while the rest have bachelor degrees with various postgraduate diplomas. Even with this number and several supporting technical and administrative staff, it seems the Secretariat is still not adequately staffed to cope with the increasing volume of work and demands both from government agencies and private organizations.

4.2.6 Analysis and Commentary

It is pertinent to note that prior to the recent creation of the National Sectoral Technical Committees, the Council's existing machinery for coordinating research and formulating a national science and technology policy was not really satisfactory. Administrative matters, especially those affecting the institutes of the Council, tended to receive too much attention in the Council's deliberations. Furthermore, there was no clear-cut component of the structure of the Secretariat (the Headquarters) which really catered for the Council's coordination functions. The Planning and Analysis Group, which was set up by the Council in 1975, really came into being in 1979 and has a highly qualified professional staff of six consisting of:

- (a) An Agriculturalist
- (b) An Industrial Technologist
- (c) A Sociologist (Economist/Statistician)
- (d) A Bio-Medical Scientist
- (e) A Natural Scientist
- (f) A System Analyst

The explicit function of the Group are:

- (a) to provide analytical studies needed by the Council to carry out its broad advisory functions;

- (b) to collaborate with the Economic Planning Division of the Ministry of Finance and Economic Planning with a view to identifying the priority areas of national development where scientific and technological advice is needed;
- (c) to analyze and recommend assignment of identified projects to research organizations (institutes, agencies, universities and private organizations) which can best deal with them;
- (d) to maintain contact with various research organizations and to retrieve from them any findings (published and unpublished) which are likely to be of importance to national development, and to correlate and assess data from different sources for ultimate transmission to the Council;
- (e) to project requirements for manpower and other resources needed for investigating problems;
- (f) to recommend and organize ad hoc task forces for analytical studies when authorized by CSIR;
- (g) to carry out other functions assigned by the Council.

It is quite clear that the functions assigned to the Sectoral Technical Committees duplicate those of PAG. However, a much closer analysis reveals that these functions complement each other and in order that PAG should not be seen to be working independently of the Sectoral Committees, its members have been made member/secretaries and coordinators of the five Sectoral Technical Committees. Since each committee

has such wide national expert representation, there is no doubt that with such organic linkage with PAG, the necessary coordination and science and technology policy formulation and planning of the Council would hopefully be made more effective. The Planning and Analysis Group would have to be strengthened with younger assistants for the collection and analysis of data to enable it work more effectively in assisting the Council to make sound policy decisions regarding science and technology. The Sectoral Technical Committees have just been working for barely a year now and it is presently difficult to assess their effectiveness in S and T policy formulation and planning much less the coordination of research throughout the country.

4.3 LINKAGES

4.3.1 Links with other S and T Institutions and the Productive Sectors

The institutions which constitute Ghana's science and technology base include the following:

- (a) The Council for Scientific and Industrial Research, which has the following research institutes, centres and projects:
 - (i) Animal Research Institute
 - (ii) Building and Road Research Institute
 - (iii) Crops Research Institute
 - (iv) Food Research Institute
 - (v) Institute of Aquatic Biology

- (vi) Industrial Research Institute
 - (vii) Soil Research Institute
 - (viii) Water Resources Research Institute
 - (ix) Oil Palm Research Centre
 - (x) Scientific Instrumentation Centre
 - (xi) Ghana National Atlas Project
 - (xii) Herbs of Ghana Project
 - (xiii) Planning and Analysis Group
 - (xiv) Technology Transfer Centre
 - (xv) Ghana Atomic Energy Commission
 - (xvi) Centre for Research into Plant Medicine
 - (xvii) Cocoa Research Institute
 - (xviii) Environmental Protection Council
 - (xix) Forests Products Research Institute
- (b) The Ghana Standards Board
- (c) The Noguchi Memorial Institute for Medical Research
- (d) The Universities of Ghana with the following faculties, institutes, centres, schools, research stations: Agricultural Science, Social Sciences, Medical Schools, (Accra and Kumasi), Administration, Statistics, Social and Economic Studies, Architecture and Town Planning, Engineering, Pharmacy, Mining and Mineral Engineering, Material Sciences, Renewable Natural Resources, Technology Consultancy Centre, Centre for Development Studies and Education and Science Education, Educational Planning and Statistics.
- (e) The Fisheries Research and Utilization Unit of the Department of Fisheries.
- (f) The Scientific and Technical Services Departments of

Government Ministries such as Geological Survey, Meteorological Services, Research Departments of Banks, Ghana Survey Department, and Statistical Services.

The research institutes and centres of the CSIR undertake the bulk of the country's research and development activities, but in the work of the research institutes/centres, they collaborate closely with most of the research institutes, centres, government departments and the productive sectors of the economy whose activities bear a close relationship with the research projects of the institutes. This linkage is largely fostered by representations of the relevant agencies, both private and public, on the Management Boards of the research institutes or centres of the CSIR and vice versa and also on the council of CSIR.

As has already been mentioned, it is the Management Boards of the research institutes/centres which consider and approve the research programmes and projects of these institutes or centres and, therefore, their ultimate monitoring and evaluation and report to the council of CSIR.

It is, however, very contentious whether representation either on the Council or Boards of Research Institutions necessarily provide the strong linkage with the productive sector of the economy that is required. While one can admit to this being true to a large extent with the agricultural base research institutions which directly pass on their research findings to the Ministry of Agriculture and, therefore, to the farmer through the extension services systems of the Ministry, this cannot be said to be effectively carried out by the industrial research based institutions in this country. These institutions still have a long way to go in providing the necessary research and

development support for industries and for the technological take off of the country. This may, perhaps, be due to the very expensive nature of industrial research. In any case, where some kind of noticeable innovations have been made over the years, such as in food processing technologies, there is generally a lack of entrepreneurial response to the innovations. There is, therefore, a great need to establish the mechanism for marketing these proven innovations.

4.4 POWERS

(a) Statutory Powers

These have been discussed in previous sections; suffice it to state here that the Act establishing the Council gave it broad powers which cannot be effectively exercised since there is neither a strong legislative authority nor adequate financial resources to back it up. The Council Secretariat draws its budget from the national budget and has to defend it at the annual budget hearing at the Ministry of Finance and Economic Planning just as its research institutions. It cannot, therefore, exercise any monitoring powers on those organizations which are under its wing.

The powers perceived by the management of such institutions, which are all semi or largely autonomous, derive directly from the manager's perception of the functions and objectives of those institutions which, incidentally, are largely based on subject matters. This is clearly seen from the given list of Ghana's Scientific and Technological Research Institutions.

(b) Activities

S and T planning, programming, co-ordination, monitoring and

evaluation have not been nationally done in any way until recently. The first attempt at this was made to draw up a National Science and Technology Plan to accompany the National Socio-Economic Development Plan of 1981-85. The second attempt is still in the process of being done through the recently formed Sectoral Technical Committees and hopefully the draft will be ready for public discussion sometime in 1989.

It should be mentioned that it is only when a nationally agreed science and technology plan has been drawn up, including such activities as pertain both to R and D and its accompanying basic sciences, education and mass literacy campaign or education to make science and technology part and parcel of the culture of the people, that one could justifiably aim at monitoring and evaluating such data. This means that there will be a centrally managed fund to carry out the activities laid down in the plan and thus facilitate the necessary national coordination, monitoring and evaluation of S and T activities.

(c) Goal attainment

At the moment, a measure of goal attainment as indicated in policy development, programming or even coordination cannot be adequately done as stated already. This becomes evident from reading the Annual Reports of Research Institutions as well as the summary in those of the Council. Activities always seem not to be time targeted and are largely imbedded in a long programme of activities of the institutions in which some projects may be so targeted. However, a critical analysis of the said reports also show that particular programmes and activities have been repeated over the years! In this wise, it is fair to state that research institutions have accumulated some significant research

results which could be applied to national development in spite of the seemingly repetitive nature of their programmes and activities. They have also been well involved over the years in a large number of ad hoc advisory functions to the Government. The Annual Reports are littered with the range of such services performed throughout any one year. There is no mention of figures and, therefore, commenting or evaluating such activities is difficult.

CHAPTER 5 STRENGTHS AND WEAKNESSES

5.1 Goals and Functions

As has already been mentioned, the goals and functions of the Council are clearly defined in the Act establishing CSIR. The functions are very broad and diffuse, to say the least. The entire Act needs a serious review and a strengthening of the necessary legislative powers.

5.2 The Structure

The Secretariat of the Council is steadily undergoing reorganization to make management and, therefore, co-ordination, program monitoring and evaluation more effective, through the present Sectoral Technical Committee System. It should be mentioned that the committees have a broad national representation (about 149 experts) and work through a sub-committee system to ensure that there is some kind of micro-level discussion of specialized science and technology subject areas that might need a national policy/project/programme thereon. There are about 121 sub-committees/working parties for various specialist areas.

Attendance at committee meetings tends to hover around 10-12 members, while there are about 28 to 30 members in some of the committees. Here lies the weakness in such structures. However, if one chooses a group of small but dedicated and experienced people, ready and willing to serve on such committees, then there is a chance they might in the long run serve the Council's function of policy-making, policy development and programming in some way.

5.3 Composition

As with the Sectoral Committees, one sees here that the 26-member Council (i.e. forming the CSIR Governing Council and, therefore, the science and technology policy-making body of the country) is designed to have a broad representation of all important Government bodies and agencies. Here again it seems a large membership does not necessarily imply effectiveness. Attendance at Council meetings over the years averages about 15 out of 26 members. Most members serve on other national committees and may have more interest in such committees than dabbling in areas of science and technology policy which might be relatively new to them. Most members of the Council need to be educated and to do serious reading in the areas of S and T policy making, formulation and planning to broaden their horizons and value. This is presently being done at the Sectoral Committee level by issuing members with the relevant documentation on a subject for study.

5.4 Linkages and Powers

The link between research institutions, the universities and industry and other end-user agencies have not been very strong and there are no legislative powers either to forge this or enforce it. Even the demands on the S and T system from either the Government or end-users and other agencies have not at all been very consistent and demanding enough. This seems to be due to the pre-occupation of the preceding governments after 1966 with macro-economic policies aimed at curbing inflation and improving the supply situation of consumer items instead of looking at factors or elements that could keep the economy of the country at a sustainable and self-supporting level. One of these crucial elements is the strong building up of an S and T sector to support all aspects of the economy. The sector is, therefore, used on an ad hoc basis at the moment.

One must also make the point that part of the weaknesses of the S and T system could equally be blamed on the scientists and technologists themselves, who choose to remain at the periphery of government instead of rubbing shoulders with the political system and thereby bringing S and T to bear on more of the economic policy decisions of the Government. It must be mentioned that most of the members of the Council are scientists and technologists some of whom have very strong links on an individual basis with key politicians and, therefore, could subtly advance the cause of S and T through private discussions. Maybe by this process the political leadership could come to see S and T as the key to the socio-economic development of the country.

CHAPTER 6 RESOURCES AND THEIR UTILIZATION

6.1 Human

The current distribution of the scientific and technological manpower resources of Ghana is shown in Table 6.1. This is still being updated as it is done every year by CSIR.

The three Universities of Ghana have been the major source of first and sometimes second science degree graduates. There are quite a number now graduating from Eastern European universities in addition to those coming from the Western universities. The number of qualified scientists and technologists has, therefore, been on a steady increase over the last few years.

Postgraduate research training of promising research scientists and technologists has been rising both at home and in the relevant institutions abroad. But the present emphasis seems to be on training second degree graduates at home to work on problems pertaining to national scientific and technological development. Some of these post-graduate programmes are now being done jointly with counterpart universities abroad so as to expose post-graduate students to much broader scope and ideas as well as to new and emerging technologies.

6.2 Material

The institutions that form Ghana's scientific and technological base have already been mentioned. Most of them have fairly well established research and development facilities. Even though over the years some of the infrastructural facilities have declined in the face of the harsh economic difficulties of Ghana, most of them have been fairly maintained with the assistance and

Table 6.1 Scientific and Technological Manpower in Ghana

| Year | Popula- -tion (Million) | Total Stock (thousand) | Scientists and Engineers (Breakdown by field educational training in units) | | | | | T e c h n i c i a n s | | | | | |
|------|-------------------------------|------------------------------|--|---------------------------|-------------------|--------------------|--------------------|------------------------------|------------------------------------|-------------------|--------------------|--------------------|-------------------|
| | | | Natural Science | Eng. & Techno- logy | Agric. Science | Medical Science | Social Science* | Total Stock (thousand) | Engineer- ing and Technology | Agric. Science | Natural Science | Medical Science | Social Science |
| 1965 | 7.7 | 4,074 | 712 | 436 | 271 | 1,348 | 1,307 | 10,111 | 1,086 | 1,086 | 1,749 | 6,260 | - |
| 1975 | 8.6 | 5,433 | 949 | 582 | 361 | 1,798 | 1,743 | 13,483 | 1,449 | 1,355 | 2,332 | 8,347 | - |
| 1975 | 9.6 | 8,002 | 1,512 | 874 | 503 | 2,698 | 2,415 | 21,737 | 2,173 | 2,047 | 3,498 | 14,021 | - |
| 1980 | 11.1 | 8,589 | 1,575 | 910 | 579 | 2,810 | 2,715 | 22,740 | 2,130 | 2,130 | 3,741 | 14,605 | - |
| 1985 | 12.6 | 10,346 | 1,890 | 1,092 | 723 | 3,372 | 3,269 | 27,175 | 2,717 | 2,559 | 4,373 | 17,526 | - |

* excludes lawyers

Sources:

1. Directory of High-Level Manpower in Ghana Volume IV. CSIR, Accra. November 1976.
2. Directory of High-Level Manpower in Ghana Volume V. CSIR, Accra. November 1977.
3. Assessment of Manpower situation in Ghana. Ghana Manpower Board, Accra 1984.
4. Current Statistical Data on Manpower in Ghana. Government Statistician, Accra November, 1985.

NB: Figures represent personnel at post during the period 1965 - 85. From about 1975 onwards emigration seriously affected S & T manpower at post.

cooperation of foreign donor agencies and countries and international bodies through joint research efforts, while some are undergoing systematic rehabilitation.

6.3 Financial

Research and development activities are largely financed by the government of Ghana through annual budgetary provisions. This is shown in Table 6.2. Some support, however, comes from multilateral and bilateral arrangements with friendly donor countries and international bodies. Inadequate Government financial support has seriously hampered the effectiveness and productivity of R and D institutions in Ghana. The government has, however, announced plans to introduce a policy of generating funds for R and D activities by directly taxing manufacturing industries. R and D and other S and T institutions are also being encouraged to supplement their annual financial appropriations from Government through consultancy and other services to both the public and the private industry.

6.4 Analysis and Comments

The Table (6.2) on trends in financial expenditure in R and D and S and T services as a ratio of the gross domestic product (GDP) does not reflect the actual position, since the money involved is a composite of administrative overheads as well as actual expenditure on R and D and S and T services which were quite difficult to obtain from many S and T institutions involved in research and development in the country. However, the ratio of R and D and S and T services expenditure as a ratio of the national recurrent expenditure budget reveals the fluctuating nature of the economic situation and also reflects how the nation's managers of the economy see scientific and technological

activities as contributing to the growth of the national economy. One should not be deceived by these figures because they largely represent salaries, allowances and the running costs of vehicles, including administrative overheads!

Another study being carried out by the author since 1985 on the research institutes of CSIR alone is shown in Table 6.3. The compilation is not complete as the Chief Accountant of the Council is still compiling returns from the institutes. But as will be seen, the actual R and D expenditure of the institutes over the total expenditure has been decreasing over the period 1974 to 1981 and this is reasonably true for other research and development organizations in the country. On this account, it is reasonable to say that research scientists and technologists are just receiving salaries without actually having real financial and material resources for research work that would go to improve the economy.

Table 6.2 TRENDS IN EXPENDITURE IN R & D AND SCIENCE SERVICES

| | A | B | C | D | E | C/B (%) | C/D (%) |
|------|--------------------------|---|---|--|--|---|---|
| YEAR | POPULATION (Millions) | TOTAL GOVERNMENT EXPENDITURE (RECURRENT AND DEVELOPMENT) (MILLION CEDIS) | TOTAL ESTIMATED R & D AND S & T SERVICES EXPENDITURE (MILLION CEDIS) | GROSS NATIONAL PRODUCT (GNP) AT 1975 PRICES (MILLION CEDIS) | GROSS DOMESTIC PRODUCT (GDP) AT CURRENT PRICES (MIL- LION CEDIS) | TOTAL ESTIMATED R&D AND S&T SERVICES TOTAL GOVERNMENT EXPENDITURE | TOTAL EST R&D AND S EXPENDITU GROSS DOM PRODUCT (|
| 1975 | 9.6 | 1161.5 | 30.2 | 5241 | 5283.0 | 2.6 | 0.57 |
| 1976 | 9.6 | 1438.6 | 38.7 | 5046 | 6526.2 | 2.7 | 0.59 |
| 1977 | 10.1 | 1945.7 | 52.8 | 5186 | 11163.4 | 2.7 | 0.47 |
| 1978 | 10.1 | 3017.6 | 138.2 | 5633 | 20986.1 | 4.6 | 0.66 |
| 1979 | 10.6 | 4094.3 | 212.5 | 5489 | 28230.6 | 5.2 | 0.75 |
| 1981 | 11.2 | 7719.3 | 361.5 | 5302 | 72626.1 | 4.7 | 0.50 |
| 1982 | 11.5 | 8844.0 | 240.2 | 4935 | 86450.8 | 2.7 | 0.28 |
| 1983 | 11.8 | 14755.3 | 100.3 | 4717 | 184038.4 | 0.68 | 0.06 |
| 1984 | 12.2 | 26691.0 | 1173.4 | 5103 | 270560.6 | 4.4 | 0.43 |
| 1985 | 12.4 | 45764.0 | 2583.6 | 5345 | 343048.4 | 5.7 | 0.75 |
| 1986 | 12.8 | 70659.0 | 3225.8 | 5601 | 511372.7 | 4.6 | 0.63 |
| 1987 | 13.1 | 102135.0 | 2262.2 | 5870 | 745999.9 | 2.2 | 0.30 |

Table 6.3 TRENDS IN EXPENDITURE IN R & D AND SCIENCE SERVICES

| YEAR | A POPULATION (Millions) | B TOTAL GOVERNMENT EXPENDITURE (RECURRENT AND DEVELOPMENT) (MILLION CEDIS) ** | C TOTAL ESTIMATED R & D AND S & T SERVICES EXPENDITURE (MILLION CEDIS) ** | D GROSS NATIONAL PRODUCT (GNP) AT 1975 PRICES (MILLION CEDIS) *** | E GROSS DOMESTIC PRODUCT (GNP) AT 1984 PRICES (MILLION CEDIS) | C/B (%) % | C/D (%) % | C/E (%) % |
|------|-------------------------------|--|--|--|---|--------------|--------------|--------------|
| 1974 | 9.6 | 1161.5 | 30.2 | 5241 | | 2.6 | 0.58 | |
| 1975 | 9.6 | 1438.6 | 38.7 | 5046 | | 2.7 | 0.77 | |
| 1976 | 10.1 | 1945.7 | 52.8 | 5186 | | 2.7 | 1.0 | |
| 1977 | 10.4 | 3017.6 | 138.2 | 5633 | | 4.6 | 2.5 | |
| 1978 | 10.6 | 4094.3 | 212.5 | 5489 | | 5.2 | 3.9 | |
| 1979 | 10.9 | 4671.5 | 1745.5 | 5453 | | 37.4 | 32.0 | |
| 1980 | 11.2 | 7719.3 | 361.5 | 5302 | | 4.7 | 6.8 | |
| 1981 | 11.5 | 8844.0 | 240.2 | 4935 | | 2.7 | 4.9 | |
| 1983 | 11.8 | 14755.3 | 100.3 | 4717 | | 0.6 | 2.1 | |
| 1984 | 12.2 | 26691.0 | 1173.4 | 5103 | 270560.6 | 4.4 | 23.0 | 0.43 |
| 1985 | 12.4 | 45764.0 | 2583.6 | 5345 | 343048.4 | 5.7 | 48.3 | 0.75 |
| 1986 | 12.8 | 70659.0 | 3225.8 | 5601 | 511372.7 | 4.6 | 57.6 | 0.63 |
| 1987 | 13.1 | 102135.0 | 2262.2 | 5870 | 745999.8 | 2.2 | 38.5 | 0.30 |

Sources: ** Provincial Estimates, Ministry of Finance and Economic Planning

*** Quarterly Digest of Statistics, Statistical Services
December 1985 & June 1988

NB Annual rate of population growth is 2.6%

TABLE 6.4

R & D EXPENDITURE FOR THE COUNCIL FOR SCIENTIFIC AND
INDUSTRIAL RESEARCH (CSIR) 1974 - 81

| YEAR | Total (personal Emoluments and R & D Expenditure) | Actual Expenditure on Research Projects | R & D Expenditure Total Expenditure |
|------|--|--|--|
| 1974 | 3,234,750.28 | 385,172.52 | 11.9 |
| 1975 | 6,209,995.78 | 403,157.01 | 6.5 |
| 1976 | 6,097,486.02 | 311,244.75 | 5.1 |
| 1977 | 7,406,122.40 | 323,644.23 | 4.4 |
| 1978 | 14,737,758.70 | 336,649.60 | 2.4 |
| 1979 | 17,702,026.95 | 516,824.93 | 2.9 |
| 1980 | 19,129,043.45 | 1,279,112.63 | 6.7 |
| 1981 | 37,242,304.18 | 1,031,468.27 | 2.7 |

Source: Annual Report of the Chief Accountant of CSIR

CHAPTER 7

RECOMMENDATIONS

7.1 Goals and Functions

The Council should be strengthened by giving it additional legislative powers and the finance to give to institutions that are very important and that are doing a good work while at the same time it pulls up those that are not doing so well through appropriate financial allocations. It is only by this means that S and T activities will be properly coordinated and made more effective in the national economic development process.

7.1.2 Organization and Structure

The present position is that the Council is under the Ministry of Industries, Science and Technology. Therefore any policy decisions of a national nature must first go through the Ministry on its way to the Cabinet. Since science and technology permeates the entire socio-economic development process, the Council should not be placed under any one Ministry. Instead the following alternatives are recommended:

- (1) The Council should be placed directly under the Head of Government who should be its Chairman as happened before in the 1960s. Only then will it enjoy the strong representation, voice and authority that will secure its performance.
- (2) There should be an interministerial or Cabinet Committee on science and technology where the Director-General of CSIR can serve as a member in an advisory capacity the way the Governor of the Central Bank sometimes does at Cabinet meetings. This committee

will then deliberate on matters of policy emanating from the Council and should itself direct CSIR to carry out some of its own policy decisions. It must be stated that even with the present Sectoral Technical Committee system of CSIR, any final policy decisions taken by the Council as a result of the work of the Sectoral Technical Committees, will have to go through the Ministry of Industries, Science and Technology and this is not good enough.

- (3) A third alternative would be to create a Department of Science and Technology under the Head of Government or State to serve as an executive arm on matters of science and technology to assist in monitoring, evaluating and directing where the country's S and T should go. This Department could even be placed under a National Development Planning Commission in which case the present CSIR set-up could be accommodated. A Ministry of Science and Technology would be too bewildering and is not recommended, because it could have the problems at the Cabinet level that we have already indicated.

7.1.3 Composition

The composition of the Council (26 member) even though designed to embrace all possible interest groups, is too large and should be reduced to the level of about 15. After all the average attendance at Council meetings averages 12 to 14 or 15 members and, therefore, the suggested reduction would render it more effective and active in a way.

7.1.4 Linkages

Linkages with the agricultural sectors are reasonably strong, but those with the industrial sector are weak and a proper and effective mechanism will have to be devised to remedy this.

7.1.5 Powers

If CSIR has to stay in its present form, then the hands of the Council need to be strengthened with strong legislative powers to back the broad functions assigned to it. For example, one cannot coordinate research in all its aspects in the country' when not backed with the right financial and legal authority to finance projects and therefore be able to monitor, evaluate and see to their proper implementation and execution.

7.1.5 Resources

Conscious efforts will have to be made over the next few years to:

- (a) rehabilitate all the scientific and technological infrastructure of the country presently broken down;
- (b) increase the output of good science and technology graduates;
- (c) ensure that scientists and technologists are given the proper financial remuneration as well as the right financial and material resources to work with and thus keep them at post to produce and develop the full scientific and technological capability in all important areas of science and technology in the national quest for development.

Presently, there is an over-production of arts graduates vis a vis the sciences and even the scientists and technologists being produced drift off to other areas such as economics and banking where either financial remunerations are better or where they do not need too much sophisticated equipment and literature to produce results of scientific significance.

CONCLUSION

There is a need to reorganize the present S and T policy making institution to make it more effective and put it at the apex within the structure of the Government to enable it plan, formulate and implement effective science and technology policies in the socio-economic development of Ghana.

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2. Approach and Guidelines for the Preparation of a Technology Plan for Ghana, September 1978.
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APPENDIX I

N.L.C.D. 293

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL
RESEARCH DECREE, 1968

ARRANGEMENT OF PARAGRAPHS
I-ESTABLISHMENT OF COUNCIL

Paragraph

1. Council for Scientific and Industrial Research.
2. Membership of the Council
3. Secretary of the Council
4. Functions of the Council
5. Functions of Council in relation to Standards Board and amendment of N.L.C.D. 199.
6. Terms of Office of members.
7. Filling of vacancies.
8. Remuneration.

II-MEETINGS AND COMMITTEES OF COUNCIL

9. Meetings of the Council.
10. Committees of the Council.

III-ADMINISTRATION AND STAFF MATTERS

11. Secretariat of the Council.
12. Provision of pensions, etc, for Council's employees.
13. Research institutes, units and projects.
14. Management of Institutes.

IV-FINANCIAL PROVISIONS

15. Funds of the Council.
16. Provisions relating to gifts.
17. Estimates of Expenditure.
18. Accounts and Audit.
19. Annual Report.
20. Commissioner's powers.

V-MISCELLANEOUS

Paragraph

21. General powers of the Council.
22. Bye-laws and regulations of the Council.
23. Council's powers of proposing amendments to Decree.
24. Transfer to Council of Assets and Liabilities of the Academy of Sciences.
25. Tax and rates exemption.
26. Employees of the Academy of Sciences to be employees of Council.
27. Repeal, revocation and transitional provisions.
28. Interpretation.
29. Commencement.

RESEARCH ACT, 1958

ARRANGEMENT OF SECTIONS

No. 21 of
1958.

Sections

1. Short title, interpretation and commencement.

PART I

THE NATIONAL RESEARCH COUNCIL

2. Constitution of National Research Council.
3. Functions of Council.
4. Annual programmes of research.
5. Government grants.
6. Annual report by Council.
7. Staff of Council.
8. Committees of Council.
9. Functions of Committees.

PART II

THE RESEARCH INSTITUTES

10. The Cocoa Research Institute.
11. Institutes for agricultural research.
12. Research institute for pests and diseases.
13. Institute for economic and social research.
14. Power to set up other research institutes.
15. General provision as to research institutes.
16. Duties of Boards of management.
17. Committees of Boards.
18. Directors of institutes.
19. Staff.

PART III

GENERAL

20. Ancillary powers of Councils and Boards.

21. Compulsory acquisition of land.
22. Restriction on disposal of land.
23. Application of Pensions Ordinance.
24. Pension Schemes.
25. Accounts and audit.
26. Power to dissolve Council and Boards.

PART IV

WEST AFRICAN COCOA RESEARCH INSTITUTE

27. Provisions to augment in winding up of W.A.C.R.I.
Schedule-Constitution of Council and Boards

THE RESEARCH ACT, 1958

No. 21 of
1958

GHANA

No. 21 of 1958

Assented to in her Majesty's Name and on Her Majesty's behalf this 6th Day of August, 1958.

K.A. KORSAH

Acting Governor-General

AN ACT to establish a National Research Council and make other provisions as to research.

(6th August, 1958)

**Date of
assent.**

BE IT ENACTED by the Queens's Most Excellent Majesty, by and with the advice and consent of the National Assembly of Ghana in this present Parliament assembled, and by the authority of the same as follows:-

1. (1) This Act may be cited as the National Research Act, 1958.

(2) In this Act the express "Minister" means the Minister responsible for research.

(3) This act shall come into force on such date as the Minister may by order appoint and he may appoint different dates for different provisions.

Short
title, inter-
pretations and
commencement.

PART I
THE NATIONAL RESEARCH COUNCIL

2. (1) There shall be a National Research Council with the functions assigned to it by this Act. (2) The provisions of Part I of the schedule to this shall have effect as respects the constitution of the Council, and its proceedings. Constitution of National Research Council
3. (1) The National Research Council shall be generally responsible for scientific, social economic and industrial research in Ghana and shall discharge its responsibility - Functions of Council.
- (a) by exercising the control conferred on it by this Act over the research institutes set up under Part II of this Act and by itself undertaking research, and
 - (b) by assisting and encouraging academic, commercial and other organisations who are undertaking research and inviting their co-operation in the co-ordination of research, and
 - (c) by co-operating with national or international organisations in any part of the world in matters of research, and

(d) by securing full use of the results of research by the collection and dissemination of information and by the giving of advice.

(2) The Council shall not incur any expenditure in respect of research undertaken outside Ghana except with prior approval of the Minister.

(3) The Council may in particular discharge its responsibility for research -

(a) by making annual grants to the research institutes set up under Part II of this Act,

(b) by making annual grants towards expenditure incurred on research by other organisations or bodies, whether within or outside Ghana,

(c) with the approval of the Ministry, by making available bursaries and scholarships for individuals undertaking research projects either within or outside Ghana,

(d) by making grants to inventors,

(e) with the approval of the Minister, by co-operating with educational authorities and educational scientific or 5 technical societies in the promotion of -

- i) the teaching of science in schools, technical colleges and universities,
 - ii) the training of investigators in pure and applied sciences, and in technical processes,
 - iii) the training of craftsmen and skilled artisans,
- (f) by making arrangements for association with academic bodies with a view to the promotion of research or learning.

(4) The Council shall in the discharge of its duties observe any general or particular directions which may be given by the Minister.

4. (1) The National Research Council shall, for each financial year, prepare a programme for the research to be carried out in the following financial year and submit it for approval by the Minister.

Annual programmes of research.

(2) Each annual programme may include, as well as research institutes set up under Part II of this Act, research carried out by, or under arrangements made with, the Council, and the programme shall include full particulars of the expenditure which will be incurred by the

Council and the Research Institutes in carrying out the programme.

(3) Each annual programme shall be prepared not later than six months before the beginning of the financial year to which it relates, and the first financial year for which an annual programme is to be prepared shall be that beginning on the first day of July, 1959, or, if the Minister so directs, that beginning on the first day of July, 1960.

(4) The annual programmes prepared and approved under the foregoing subsections shall be based on a general review of the progress of research, and the expenditure involved, being a review undertaken by the Council once in every five years.

5. The Minister may, out of moneys provided by Parliament, make grants to the National Research Council to enable the Council to perform their functions and in particular to carry out any programme approved by the Minister under the last foregoing section.

Government grants.

6. The Council shall annually compile a report on the research for which the Council is responsible carried out in the preceding year, including full particulars of the expenditure and liabilities incurred and shall submit the report to the Minister who shall lay it before Parliament.

Annual report by Council.

7. (1) There shall be a secretary to the Council and such other officers and servants as the Council may determine. Staff of Council.

(2) During the period of three years beginning with the commencement of this Act, the power of appointing the secretary of the Council, and determining the terms and conditions of this employment, shall be exercisable by the Minister, and the Minister shall not appoint a person to be secretary to serve beyond the end of the said period of three years.

(3) After the end of that period the said powers of appointing and determining the terms and conditions of service of the secretary of the Council shall be exercisable by the chairman with the approval of the Council.

(4) The power of appointing and determining the terms and conditions of employment of other officers and servants of the Council shall be exercisable by the Council.

8. (1) The Council shall appoint four committees, respectively responsible for agricultural, industrial, social and economic, and medical research and may appoint such other committees as they think fit. Committees of Council.

(2) The Council may include among the members of any committee persons who are

not members of the Council and all members of any committee of the Council, whether members of the Council or not, shall hold office for three years, and be eligible for re-election.

(3) One of the members of each committee, who shall be a member of the Council, shall be appointed by the Council as chairman of the committee and shall hold office for three years, and be eligible for re-election.

9. The Council may delegate to any of its Committees any functions, other than any function affecting the constitution of the Council or its committees or the officers and other staff of the Council.

Functions of
Committees.

PART II THE RESEARCH INSTITUTES

10. There shall be an institute, to be called the Cocoa Research Institute of Ghana, for the purpose of undertaking research into, and investigation of, all problems and matters relating to cocoa, and for the provision of information and advice relating to cocoa.

The Cocoa
Research
Institute.

11. (1) Subject to the provisions of this section, there shall be an institute, to be called the Agricultural Research Institute, for the purpose of undertaking research into, and investigation of, all problems or matters relating to agriculture

Institutes for
agricultural
research.

or agricultural products.

(2) The Governor-General may, at the request of the National Research Council, at any time by order direct that there shall be one or more research institutes, bearing such name or names as may be specified in the order, concerned with particular agricultural products so specified, and an order under this section may correspondingly restrict the scope of the matters for which the Agricultural Research Institute is responsible.

12. There shall be an institute, to be called the Institute for Research in Parasitology for Entomology for the purpose of undertaking pests and research into, and investigation of, those subjects.

Research
Institute for
pests and
diseases.

13. There shall be an institute, to be called the Institute for Economic and Social Research, for the purpose of undertaking research into, and investigation of, all economic and social matters.

Institute for
economic and
social
research.

14. (1) The Governor-General may, at the request of the National Research Council, at any time by order direct that there shall be such other research institute or institutes in Ghana as he may specify in the order and an order under this section may contain any supplementary or incidental pro-

Power to set
up other
research
institutes.

visions, including provisions:-

- (a) for the designation of any institute established under the order,
- (b) for any consequential modification of the functions of any other institute set up under the part of this Act, and for the transfer of any research station or other assets belonging to any existing research institute so set up,
- (c) for the matters on which it is to conduct research.

(2) The National Research Council shall at an early stage in the preparation of their programmes for the conduct of research undertake a survey of the facilities for medical, road and engineering research with a view to making a request under this section for the setting up of further research institutes to work in those fields.

15. Each institute set up under this Part of this Act shall be managed by a Board in whom all the property of the Institute shall be vested and whose constitution and proceedings shall be governed by Part II of the Schedule to this Act.

16. It shall be the duty of each Board:-

Duties of
Boards of
Management.

- (a) to prepare and approve a programme of research within the field for which that institute is responsible for the first and each subsequent period of five years beginning with the setting up of the institute, together with detailed estimates of the expenditure which will be required to carry out the programme,
- (b) each year to review, and if necessary revise, the programme approved under the foregoing paragraph for the following year, together with the estimates of expenditure for that year,
- (c) to submit the five-year programmes and estimates of expenditure, and any annual revisions, together with any recommendations which the Board see fit to make to the National Research Council,
- (d) To carry out the programmes of research submitted to the Council, with any modifications approved or made by the Council, and

- e) to perform such other duties as may be conferred on the Board by the Council.

17. A Board under this Part of this Act may of appoint committees and delegate to them any of their functions, other than any function affecting the constitution of the Board or its committees.

Committees
Boards.

18. (1) For each institute set up under this Part of this Act there shall be a director appointed by the National Research Council on such terms and conditions as they may determine.

(2) If a director of an institute is unable for any reason to discharge the duties of his office the Council may appoint a person temporarily to act in his place.

19. Each Board shall have power to appoint officers and servants to serve under the director of the institute subject to any directions which the National Research Council may give as to numbers and as to their salaries and other terms and conditions of service.

Staff.

**PART II
GENERAL**

20. (1) Subject to the provisions of this Act, the Council and each Board under this Act shall have power to do anything and to enter into any transaction which in its opinion should be done in the proper discharge of its functions.

Ancillary powers of Council and Boards.

(2) The Council and Boards shall in particular have power to acquire and hold land and other property.

21. (1) Where there is any hindrance to the acquisition by purchase or lease of any land or building required by the Council or a Board for carrying out their functions the Governor-General, on the application of the Council or Board and after such enquiry as he may think fit, may declare that the land or building is required for the service of the Council or Board, and he may direct that proceedings be taken under the provisions of the Public Lands Ordinance for acquiring the land or building for the Government and for determining the compensation to be paid to the parties.

Compulsory acquisition of land.

(2) When the land or building has been acquired under the Public Lands Ordinance,

the Governor-General may vest the land or building in the Council for Board by means of a certificate under the hand and seal of the Commissioner of Lands to the effect that the land or building has been made over to the public.

(3) The compensation for the acquisition shall in the first instance be paid by the Government, but the Council or Board shall refund to the Government any compensation so paid and all expenses incidental to the acquisition which have been incurred by the Government.

22. Neither the Council nor any Board shall without the consent in writing of the Minister dispose of or charge any land or building or any interest in any land or building.

Restriction on disposal of land.

23. (1) It shall be lawful for the Governor-General by order to declare that the office of secretary to the National Research Council or any other office under the Council or any of the Boards under Part II of this Act (but not the office of member of the Council or of a Board) shall be pensionable office for the purpose of the Pensions Ordinance.

Application of Pensions Ordinance.

(2) The provisions of the Pensions Ordinance shall, subject to the provisions of subsection (3) of this section, apply or

continue to apply to persons holding offices declared to be pensionable under the foregoing subsection in the same manner and to the same extent as the said provisions would apply to those persons if they were serving in a civil capacity in a pensionable office under the Government.

(3) For the purpose of this section the Pensions Ordinance shall have effect as if, in subsection (1) of section 7 and subsection (2) of section 9, for the words "chief secretary" and "governor" there were substituted references to the National Research Council.

(4) Nothing in the provisions of subsection (2) of this section shall prevent the appointment of a person to a pensionable office on terms which preclude the grant of a pension under the Pensions Ordinance to such a person in respect of his service in the office.

24. The Council shall make arrangements, whether on a contributory or non-contributory basis, for the payment of pensions gratuities and other like benefits to such class of officers and servants of the Council and of the Boards under this Act as the Council may, after consultation with the Minister, determine, being officers and servants to whom the Pensions Ordinance does not apply.

Pension schemes.

25. (1) The Council and each Board under this Act shall keep proper accounts and proper records in relation to the accounts and shall prepare for each financial year not later than 31st day of December following the end of the financial year a statement of accounts in such form as the Accountant-General may direct.

Accounts and
audit.

(2) The accounts of the Council and Boards shall be audited and published in such manner as the Council may, subject to any directions given by the Minister responsible for Finance, determine.

(3) The Minister shall lay a copy of the statement of accounts prepared by the Council and each Board, together with a copy of any report made by the auditors on the statement of accounts, before Parliament.

26. (1) The Governor-General may at any time by order direct that either:-

Power to
dissolve
Council and
Boards.

(a) the Council and all the Boards under this Act, or

(b) any one or more of the Boards under this Act, shall be dissolved.

(2) An order under this section may contain any incidental or consequential provisions, including provisions for dis-

charging the outstanding liabilities of the body to be dissolved, for disposing of any assets belonging to the body, and for compensating any officers or other servants of the body.

PART IV
WEST AFRICAN COCOA RESEARCH INSTITUTE

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| 27. (1) The provisions of this section shall have effect if in pursuance of an order under section 17 of the West African Cocoa Research Institute Ordinance the Institute is dissolved. | Provisions consequent on winding up of W.A.C.R.I. |
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(2) Any assets of the Institute or of its managing committee which, whether in pursuance of the order or otherwise, will on the dissolution of the institute belong to the Government of Ghana shall forthwith be transferred to and vested in the Cocoa Research Institute of Ghana established under Part II of this Act.

(3) Any agreement, whether formal or informal, between the West African Cocoa Research Institute or its managing committee and any of their officers or servants employed in Ghana which is in force at the time when the Institute is dissolved concerning the terms and conditions of their employment shall have effect as if the Cocoa Research Institute

of Ghana (represented by its Board) were substituted in the agreement for the West African Cocoa Research Institute or its managing committee, and thereafter the Cocoa Research Institute of Ghana shall observe all the terms of any such agreements, whether legally binding or not.

SCHEDULES

FIRST SCHEDULE

CONSTITUTION OF COUNCIL AND BOARDS

PART I

THE NATIONAL RESEARCH COUNCIL

1. The National Research Council shall have a chairman who shall be appointed by the Prime Minister, shall hold office for a period of three years and shall be eligible for re-appointment.

2. (1) The National Research Council shall consist of:-
 - (a) the chairman,
 - (b) the Principal of the University College of Ghana,
 - (c) a person appointed by the Development Commission,
 - (d) the Permanent Secretaries to the Ministers of Agriculture, Health, Works and Education,
 - (e) the directors of institute set up under Part II of this Act,
 - (f) the Principal of the Kumasi College of Technology,
 - (g) the secretary to the Council,

(h) such other members, not exceeding three, as the Council may co-opt.

(2) Any of the Permanent Secretaries to the Ministers of Agriculture, Health, Works and Education may, if he thinks fit, appoint an officer of the department of which he is Permanent Secretary to be a member of the Council in his place, and either of the Principals of the University College of Ghana and the Kumasi College of Technology may, if he thinks fit, appoint a member of the Council in his place.

(3) An appointment under this paragraph may be terminated at any time by the person making the appointment who shall thereafter again become a member of the Council, unless and until he makes a further appointment.

(4) The Council may at any time withdraw their decision to co-opt any person as a member of the Council.

3. The administrator of the West African Research Office may participate in the deliberations of the Council, but shall not be a member of the Council and shall not vote on any decision of the Council.

4. The Council may at any time appoint persons to act as advisers to the Council and a person acting as adviser shall be eligible for appointment as a member of the Council.

5. (1) The Council shall be a body corporate having perpetual succession and a common seal and may sue and be sued in its corporate name.

(2) The application of the seal of the Council shall be authenticated by two signatures, namely -

(a) the signature of the chairman or some other member of the Council authorised by the Council to authenticate the application of the seal, and

(b) the signature of the secretary to the Council or some member or officer authorised by the Council to act in the secretary's place for that purpose.

(3) Any instrument or contract which, if executed or entered into by a person other than a body corporate, would not require to be under seal, may be executed or entered into on behalf of the Council by the secretary, or any member of the Council if the secretary, or as the case may be that member, has previously been authorised by resolution of the Council to execute or enter into that particular instrument or contract.

(4) Every document purporting to be an instrument executed or issued by or on

behalf of the Council and to be sealed with the common seal of the Council authenticated in the manner provided by sub-paragraph (2) of this paragraph, or to be signed by the secretary or a member of the Council authorised in accordance with sub-paragraph (3) of this paragraph by the Council to act for that purpose, shall be received in evidence and be deemed to be executed or issued unless the contrary is shown.

6. No remuneration shall be paid to a member of the Council or of a committee of the Council (other than the remuneration paid to the secretary of the Council for his services as a secretary) but the Council may, with the prior approval of the Minister, reimburse a member of the Council or of a committee of the Council for any reasonable expenses incurred in attending a meeting of the Council or committee.
7. (1) The Council shall ordinarily meet for the despatch of business at such times and places as the Council may from time to time appoint, but not less than once a year.

(2) The chairman of the Council may, and on the request in writing of not less than 5 members of the Council shall, call a special meeting of the Council at such time and place as he may appoint.

(3) At every meeting of the Council the chairman shall if present preside but in his absence the Council shall appoint one of the members to preside.

(4) Every question which comes before the Council at any meeting shall be decided by a majority of the votes of the members present.

(5) The member presiding at any meeting of the Council shall have a vote, and in the case of an equality of votes, a second or casting vote.

(6) The quorum at any meeting of the Council shall be seven.

8. Minutes of the proceedings of every meeting of the Council shall be regularly entered in a book to be kept for that purpose, and minutes of proceedings of meetings shall, after approval, be signed.

9. Copies of the agenda and of records of proceedings at meetings of the Council shall be sent to the Minister within the times laid down by him.

10. (1) The Council may from time to time make, amend or revoke standing orders, not inconsistent with this schedule, to ensure due notice being given to members of the meetings of the Council and to regulate the proceedings of the Council or any committee of the Council.

(2) The standing orders for the time being in force shall be followed and observed and shall be binding upon the Council and any committee of the Council, as the case may be.

11. The validity of any proceedings of the Council shall not be affected by any vacancy among its members or by any defect in appointment of any of its members.

PART II
THE RESEARCH INSTITUTES

1. (1) Each Board shall consist of:-

- (a) eight members appointed by the National Research Council, of whom not less than two shall be members of the Council and of whom one shall be appointed by the Council as chairman,
- (b) three members appointed by the appropriate committee of the Council,
- (c) the director of the institute,
- (d) such other members, not exceeding three, as the Board co-opt.

(2) Members of the Board appointed by the Council or by the appropriate committee of the Council shall hold office during the pleasure of the Council or, as the case may be, of the committee, and the Board may at any time withdraw their decision to co-opt any person as the member of the Board.

(3) In this paragraph the "appropriate committee" means such committee of the Council as the Council may designate in relation to the institute in question.

2. (1) Each Board shall be a body corporate having perpetual succession and a common seal and may sue and be sued in its corporate name.

(2) The application of the seal of a Board shall be authenticated by two signatures, namely:-

(a) the signature of the chairman or some members of the Board authorised by the Board to authenticate the application of the seal, and

(b) the signature of the director or some member or officer authorised by the Board to act in the director's place for that purpose.

(3) Any instrument or contract which, if executed or entered into by a person other than a body corporate, would not require to be under seal, may be executed or entered into on behalf of a Board by the director or any member of the Board if the director, or as the case may be that member, has previously been authorised by resolution of the Council to execute or enter into that particular instrument or contract.

(4) Every document purporting to be an instrument executed or issued by or on behalf of a Board and to be sealed with the common seal of the Board authenticated in the manner provided by sub-paragraph (2) of this paragraph, or to be signed by the director or a member of the Board authorised in accordance with sub-paragraph (3) of this paragraph by the Board to act for that purpose, shall be received in evidence and be deemed to be so executed or issued unless the contrary is shown.

3. No remuneration shall be paid to a member of a Board, but the Board may, with the prior approval of the Council, reimburse a member of the Board for any reasonable expenses incurred in attending a meeting of the Board.

4. (1) Each Board shall ordinarily meet for the despatch of business at such times and places as the Board may from time to time appoint, but not less than once a year.

(2) The chairman of a Board may, and on the request in writing of not less than 3 members of the Board shall, call a special meeting of the Board at such time and place as he may appoint.

(3) At every meeting of a Board the chairman shall, if present preside but in his absence the Board shall appoint one of the members to preside.

(4) Every question which comes before a Board at any meeting shall be decided by a majority of the votes of the members present.

(5) The member presiding at any meeting of a Board shall have a vote and, in the case of an equality of votes, a second or casting vote.

(6) The quorum at any meeting of a Board shall be four.

5. Minutes of the proceedings of every meeting of a Board shall be regularly entered in a book to be kept for that purpose and minutes of proceedings of meetings shall, after approval, be signed at the next ensuing meeting by the member presiding.

6. (1) Each Board may from time to time make, amend or revoke standing orders, not inconsistent with this schedule to ensure due notice being given to members of the

meetings of the Board and to regulate the proceedings of the Board at any committee of the Board, as the case may be.

7. The validity of any proceeding of a Board shall not be affected by any vacancy among its members or by any defect in the appointment of any of its members.

This printed impression has been carefully compared by me with the Bill which has passed the National Assembly, and found by me to be a true and correctly printed copy of the said Bill

LEO. P. TOSU

Acting Clerk of the National Assembly

EXECUTIVE INSTRUMENTS
GHANA ACADEMY OF SCIENCES INSTRUMENT, 1963
ARRANGEMENT OF PARAGRAPHS

Paragraph

1. Establishment of Academy.
2. Incorporation of Academy.
3. Objects of Academy.
4. Governing body of Academy, etc.
5. Notification of Praesidium decisions to Fellows.
6. Constitution of Praesidium.
7. Principal officers of Academy.
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17. Elections of Fellows.
18. Election of Honorary Fellows.
19. Election of Associates.
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21. Majority required for election.
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37. Finance.
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39. Common Seal.
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41. Bye-laws.
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GHANA ACADEMY OF SCIENCES INSTRUMENT, 1963

In exercise of the powers conferred on the President by sections 1 and 2 of the Statutory Corporation Act, 1961 (Act 41), this Instrument is made this first day of January, 1963.

1. There shall be established a body under the name of the Ghana Academy of Sciences.

Establishment
of Academy.

2. The Ghana Academy of Sciences shall be a body corporate, shall have perpetual succession and a common seal, and may sue and be sued by such name.

Incorporation
of Academy.

3. The objects of the Academy shall be-: Objects of Academy.
- (a) the organization and co-ordination of all scientific research, both pure and applied, in all branches of knowledge;
 - (b) the promotion of the study of all sciences and learning;
 - (c) the establishment and maintenance of proper standards in all fields of science and learning in Ghana;
 - (d) the recognition of outstanding contributions to the advancement of science and learning in Ghana, and
 - (e) the discharge of such other functions as may be assigned to it by the President of the Republic of Ghana.
4. (1) The governing body of the Academy shall be the Praesidium. Governing body of Academy, etc.
- (2) There shall be not less than one meeting of the Praesidium every three months.
5. (1) All decisions of the Praesidium shall be notified to Fellows at a General Meeting of Fellows. Notification of Praesidium decisions to Fellows.

(2) There shall be not less than one General Meeting of Fellows every six months.

6. (1) The Praesidium shall consist of the following persons:-

- (a) the President;
- (b) the two Vice-Presidents;
- (c) the Chairman of the Sections of the Academy;
- (d) not less than four and not more than seven Fellows of the Academy elected at a General Meeting of the Fellows of the Academy.

(2) The Secretary of the Academy shall be Secretary of the Praesidium. He shall not be a member of the Praesidium unless he has been elected as such under sub-paragraph 1 (d) of this paragraph.

Constitution
of Praesidium.

7. The principal officers of the Academy shall be:-

- (a) the President;
- (b) the two Vice-Presidents;
- (c) the Secretary.

Principal
officers of
Academy.

8. Subject to the other provisions of this Instrument, the Praesidium shall have sole management of the property, income and funds of the Academy and of the other affairs and concerns thereof, and may appoint officers and servants of the Academy and provide for the payment of salaries, pensions and allowances

Functions of
Praesidium.

to or in respect of officers and servants so appointed.

9. (1) The Praesidium shall ordinarily meet for the despatch of business at such times and in such places as the Praesidium may from time to time appoint.

Meeting of Praesidium.

(2) A meeting of the Praesidium shall be convened by the Secretary on the instructions of the President.

(3) An emergency meeting of the Praesidium may be convened at any time by the Secretary on the instructions of the President, and the President shall cause such a meeting to be convened on a request in writing specifying the business to be transacted signed by a least five Fellows, and in this case the meeting shall be convened not later than twenty days after the receipt of such request.

10. (1) The President, if present, shall at every meeting of the Praesidium or in his absence one of the Vice Presidents present at the meeting and elected by the members present. In the absence of a Vice-President at the meeting, the members present may elect any person from among their number to preside. A person presiding at a meeting in place of the President

Procedure at Praesidium Meetings.

shall exercise at the meeting such powers as the President is entitled to exercise at meetings of the Praesidium under this Instrument and any bye-laws made thereunder.

(2) Subject to the provisions of this instrument, all questions proposed at a meeting of the Praesidium shall be determined by a simple majority of the members thereof present and voting, and in the case of an equality of votes the Chairman of the meeting shall have a second or casting vote.

(3) Except as otherwise provided in the bye-laws, all voting at meetings of the Praesidium shall be by a show of hands or upon the voices of those present.

11. Except as otherwise provided in the bye-laws, the quorum at all meetings of the Praesidium shall be seven.

Quorum at
Praesidium
Meetings.

12. Minutes of every meeting of the Praesidium shall be prepared by the Secretary and sent to each member as soon as practicable after the meeting. They shall be presented for confirmation at the next meeting of the Praesidium.

Minutes of
Praesidium
Meetings.

13. (1) Any member of the Praesidium may resign his membership by writing under his hand addressed to the President.
(2) An ex officio member of the Praesidium who resigns his member-

Resignation
retirement
and filling
of vacancies.

ship of the Praesidium shall be deemed at the same time to have resigned from the office by virtue of which he was appointed to the Praesidium and vice-versa.

(3) Any casual vacancy on the Praesidium shall be filled by the person or persons responsible for making the original appointment as prescribed by this Instrument. A person appointed to fill a casual vacancy shall retire at the time when the person whose place he was appointed to fill would have retired.

(4) Each member of the Praesidium, except those appointed ex officio, shall retire after serving for a period of two years but shall be eligible for re-election.

(5) Ex officio members of the Praesidium shall retire only if they cease to hold the office by virtue of which they were appointed to the Praesidium.

14. The President shall be elected by the Praesidium from among the Fellows, subject to the approval of a General Meeting of Fellows. A person so elected shall hold office for two years and shall be eligible for re-election.

Election of President.

15. There shall be two Vice-Presidents elected by the Praesidium from among the Fellows. A person elected to the office of Vice-President shall hold office for two years and shall be eligible for re-election.

Time for holding certain elections.

16. Every election of a President or a Vice-president shall take place, whenever practicable, in the month of December and shall take effect as from the first day of January next following.

17. (1) Any person who is President or a citizen of Ghana and who in the opinion of the Praesidium has made an original and significant contribution to any branch of science or learning may be elected a Fellow at a General Meeting of Fellows called by the Praesidium for the purpose.

Election of
Fellows.

(2) A decision of the Praesidium that a person is qualified for election under this paragraph shall be of no effect if more than two members of the Praesidium voted against the decision.

(3) Not less than two General Meetings for the election of Fellows shall be called by the Praesidium in each calendar year.

(4) The first Fellows shall be all those persons who immediately before the coming into force of this Instrument were duly appointed or elected members of the Ghana Academy of Sciences (under the Instrument of Incorporation made on November 21, 1959, as subsequently amended).

18. (1) The Praesidium may elect any person of eminence in science or learning who is not a citizen of Ghana but who has rendered service to the extension of science or learning in Ghana or elsewhere to be an Honorary Fellow of the Academy, so, however, that not more than two Honorary Fellows shall be elected in any one year.

Election of
Honorary
Fellows.

(2) An Honorary Fellow shall enjoy like privileges and precedence within the Academy as a Fellow, so, however, that he shall not be entitled to take part in the election of Fellows.

19. (1) The Praesidium may elect as an Associate of the Academy any person who, in the opinion, is not qualified to be a Fellow but who has made a significant contribution to any branch of science or learning.

Election of
Associates.

(2) A person elected under this paragraph shall cease to be an Associate on the expiration of the period of seven years next following his election or if, within that period, he is elected a Fellow of the Academy.

20. (1) The election of any person at a General Meeting under this Instrument shall be invalid if more than the permissible number of adverse votes

Majority
required for
election.

(as specified in sub-paragraph (2))
are recorded.

(2) "The permissible number of adverse vote" shall be one in a case where the number of persons present and voting is less than eight, and in any case shall be a number equal to one-fifth of the number of persons present and voting or, if their number is not a multiple of five, the number nearest one-fifth.

21. Only Fellows shall participate in any election of Fellows and Honorary Fellows of the Academy.

Participation
in election.

22. (1) The Academy shall be divided as follows:-

Divisions of
the Academy.

(a) The Section of the Academy;

and,

(b) The Research Division of the Academy.

(2) The Sections shall be concerned with scientific and learned problems of a basic nature relating to the various branches of study represented in the Academy.

(3) The Research Division shall be concerned with the organization and pursuit of research specifically related to national, economic and social development.

(4) The Sections of the Academy shall be directed by the Sectional Co-ordinating Committee.

(5) The Research Division of the Academy shall be directed by the Research Committee.

(6) One of the Vice-Presidents shall be designated to preside over and co-ordinate the affairs of the Sections of the Academy through the Sectional Co-ordinating Committee and the other shall be designated to preside over the affairs of the Research Division of the Academy.

(7) The secretarial functions relating to the Divisions as a whole shall be discharged by the Secretary of the Academy who shall be assisted by an Assistant Secretary appointed under paragraph 31.

23. (1) The Fellows of the Academy shall be divided into such number of Sections representing district fields of study as the Praesidium may from time to time determine.

Sections of
the Academy.

(2) Each Fellow shall be assigned by the Praesidium with his concurrence to one or more Section.

(3) The members of each Section shall have power to co-opt any persons of their choice, not being Fellows of the Academy,

to be members of the Section, with the prior approval of the Praesidium. The membership of such co-opted persons shall not exceed a period of one year, but may be renewed.

(4) Two representatives from every Society affiliated to the Academy will be invited to attend at least one meeting in each year of the Section of the Academy concerned with the field of study of such Society.

(5) The function of each Section shall be to deal, on behalf of the Academy and relating to the pursuit, encouragement and dissemination of that Section's particular branch of knowledge in Ghana in all its aspects, especially those aspects which are of fundamental rather than an applied nature.

(6) Each Section shall also advise the Praesidium or any of the Principal Officers of the Academy on any matter referred to it. It shall also make suggestions to the Praesidium or any of the Principal Officers of the Academy concerning its branch of study.

(7) Each Section shall elect one of its members, being a Fellow, to be its Chairman. A person so elected shall hold office for two years and shall be eligible for re-election.

(8) Each Section shall submit through the Sectional Co-ordinating Committee to the Praesidium once a year at a time to be determined by the Praesidium a report of its activities during the preceding year and a statement of its programme of activities for the ensuing year.

(9) Each Section shall have power to make rules governing its procedure, subject to the approval of the Praesidium.

(10) The responsibility for planning, directing and co-ordinating the work of the Sections shall be entrusted to the Sectional Co-ordinating Committee, which shall deal with the Praesidium in all matters affecting the Sections.

(11) The Sectional Co-ordinating Committee shall be composed of the following:-

- (a) The Vice-President designated for the Sections under paragraph 22 (6) who shall be its Chairman;
- (b) The Vice-President designated for the Research Division under that paragraph;
- (c) Every Chairman of a Section;
- (d) A member representing each Section; and
- (e) The Secretary.

(12) The Secretary of this committee shall

be the Assistant Secretary referred to in paragraph 22 (7).

(13) The members of this committee shall hold office for two years.

24. (1) The functions of the Research Division of the Academy shall be to deal, on behalf of the Academy, with all matters falling within the objects of the Academy and relating to the execution and application of scientific, social, technological and industrial research, especially those aspects which are likely to assist in the economic and social development of Ghana.

(2) The Secretary shall be the secretary of the Academy and he shall be assisted by an Assistant Secretary appointed under paragraph 31.

(3) The responsibility for planning, directing and co-ordinating the work of the Research Division of the Academy shall be entrusted to the Research Committee, which shall deal with the Praesidium in all matters affecting the Research Division.

(4) The Research Committee shall submit to the Praesidium of the Academy once in every year at a time to be determined by the Praesidium a report of its activities during the preceding year and a statement

of its programme of work for the ensuing year.

(5) The Research Committee shall also submit once in every year to the Praesidium at a time to be determined by the Praesidium an audited statement of its expenditure for the ensuing year.

(6) The Research Committee shall be composed of the following:-

- (a) The Vice-President designated for the Research Division of the Academy under paragraph 22 (6), who shall be its Chairman;
- (b) The Vice-President designated for the Sections under that paragraph;
- (c) Three members of the Academy representing the Sections;
- (d) Three persons appointed by the President of the Republic of Ghana; and
- (e) The Secretary.

(7) The Secretary of this Committee shall be the Assistant Secretary of the Research Division of the Academy.

(8) The Committee may invite specialists to its Meeting, if required.

(9) The members of this Committee shall hold office for two years.

25. The Praesidium shall be empowered to Committee.

appoint any committees or form itself into such committees as it thinks desirable for any of the purposes of the Academy. It shall have power to determine the term of office of any such committee so, however, that such term shall not exceed two years.

26. (1) The Praesidium may establish such number of research projects and institutes as it may determine under either the Sections of the Academy or the Research Division or the Sections and determine their remuneration and conditions of service.

Projects and
Institute of
Academy.

(2) The Praesidium shall have power to appoint any suitable person as the Director of any of the research projects and institutes established under the Research Division or the Sections and determine their remuneration and conditions of service.

27. (1) The President, if present, shall preside at every General Meeting of the Academy and every Meeting of the Praesidium at which he is present.

President.

(2) He shall be the head of the Academy and be responsible for its relations with the Government of Ghana.

28. (1) The Vice-Presidents shall generally assist the President in the discharge of his duties. Vice-President.

(2) In the absence of the President from a General Meeting or a meeting of the Praesidium, one of the Vice-Presidents, if present, shall be elected by the meeting to preside.

(3) Each Vice-President shall be responsible for the general direction of the division of the Academy for which he has been designated and shall preside at meetings of the committee concerned with that division.

29. (1) The Praesidium may appoint any person to be Secretary of the Academy for such period and on such terms as the Praesidium may determine. Secretary.

(2) The Secretary shall be the Chief Administrative Officer of the Academy.

30. The Secretary shall -

- (a) be responsible for -
 - i) recording the proceedings of the Praesidium and of General Meetings of Fellows,
 - ii) the conduct of the Academy's correspondence,
 - iii) the custody of its records,
 - iv) the publications of the Academy or any of its

- organizations,
- v) the receipt, and payments into a banking account of the Academy, of all monies of the Academy,
 - vi) the keeping of proper accounts of such receipt and payment, and
 - vii) the custody of the books of account, securities and other property of the Academy;
- (b) prepare the annual estimates of the Academy for the consideration of the Praesidium once a year at a time and in a form determined by the Praesidium;
- (c) prepare a statement of the Academy's financial position once a year at a time and in form determined by the Praesidium;
- (d) prepare once each year at a time to be determined by the Praesidium a report of the Academy's activities during the preceding year and a statement of its programme of work for the ensuing year; and
- (e) ensure the proper execution of all projects sponsored or undertaken by the Academy and the co-ordination of its activities with outside persons.

31. (1) The Praesidium shall, subject to subparagraph (2), appoint such number of Assistant Secretaries as it may think desirable and determine their remuneration and conditions of service.

(2) No Fellow, Honorary Fellow, or Associate of the Academy shall be appointed to the position of Assistant Secretary.

(3) The Assistant Secretaries shall assist the Secretary in the discharge of his duties. They shall be responsible to the Secretary in all matters.

(4) The Praesidium may appoint any other persons to the staff of the Academy or any of its institutions for such periods and on such terms as the Praesidium may determine.

32. (1) The Praesidium may appoint advisors or consultants with or without remuneration and may pay to such advisors or consultants travelling, subsistence and other allowances as shall be determined by the Praesidium.

(2) Where the work of such advisers or consultants falls within the scope of the functions of the Sections or the Research Division, they shall only be appointed with the prior consent of the Sectional Co-ordinating Committee or the Research committee, as the case may be, or if the

Praesidium so think fit, of both Committees.

33. (1) The Praesidium shall have power to make such other appointments within the Academy itself or to any of the organizations under its control as it may think desirable for such periods and on such terms as it may determine.

Other appointments.

(2) In all such cases the appointments shall only be made with the concurrence of the committee responsible for the division of the Academy in which the appointment in question is to be held, that is to say, the Sections or the Research Division, as the case may be.

34. The Academy shall not without the consent in writing of the President or other person or persons appointed by the Praesidium to act on his behalf dispose of or charge any of its land or buildings.

Disposal of assets.

35. It shall be lawful for the President of the Republic of Ghana acting on the request of the Praesidium of the Academy to declare that the offices of the Secretary, Assistant Secretary or any other office under the Academy shall be a pensionable office for the purposes of the Pensions Ordinance (Cap. 30).

Pensionable officers.

APPENDIX I-contd.

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH DECREE, 1968

In pursuance of the Proclamation entitled "Proclamation for the constitution of a National Liberation Council for the administration of Ghana and for other matters connected therewith," published in Gazette No. 11 of 28th February 1966, this Decree is hereby made:-

I-ESTABLISHMENT OF COUNCIL

Council for
Scientific
and
Industrial
Research

1. (1) There shall be established a council to be known as the Council for Scientific and Industrial Research (hereinafter referred to as "the Council)."

(2) The Council shall be a body corporate and shall have perpetual succession and a common seal and may sue and be sued in its corporate name.

Member-
ship of the
Council

2. (1) The members of the Council shall be as follows:-

(a) a Chairman appointed by the Government after consultation with the Ghana Academy of Arts and Sciences established by the Ghana Academy of Arts and Sciences Decree 1968 (N.L.C.D.291) (hereinafter referred to as "the Ghana Academy of Arts and Sciences") for such period and upon such terms and conditions as the Government may determine;

(b) a representative of the National Council for Higher Education appointed by the members of the Council;

- (c) a representative of the Ghana Atomic Energy Commission appointed by the members of the Commission;
- (d) six persons representing between them the biological, physical and social sciences, technology, medicine and agriculture, appointed by the Government after consultation with the Ghana Academy of Arts and Sciences;
- (e) two directors of research institutes elected by the directors of the research institutes of the Council from among themselves;
- (f) one officer appointed by the Government from each of the departments or ministries responsible for agriculture, forestry, health, industries and economic planning to represent the technical and scientific interests of his respective department or ministry;
- (g) one representative to be appointed by each university institution in Ghana associating in research with any institutes of the Council;
- (h) two representatives of industrial and commercial interests in the country who shall be appointed in accordance with a procedure to be jointly determined by the Commissioners responsible for industries and trade.

(2) Any member holding office under any provision of the preceding subparagraph shall be ineligible to hold office at the same time under any other provision of the said subparagraph.

Secretary
of the
Council

3. The Council shall appoint a suitable person, not being a member of the Council, to be Secretary to the Council upon such terms and conditions as the Council may determine.

Functions of
the Council

4. The functions of the Council shall be:-

- (a) to advise the Government on scientific and technological advances likely to be of importance to national development and in particular to advise the Government or other agencies of Government on scientific and technological matters affecting the utilisation and conservation of the natural resources of Ghana and on how best scientific research may be co-ordinated and employed in the interests of such utilisation and conservation;
- (b) to encourage scientific and industrial research of importance to the development in the national interest of industry, technology, agriculture and medicine;
- (c) to establish where it thinks it necessary research institutes, units and projects;
- (d) to exercise control over all or any of the research institutes, units and projects of the Council and to have power to dissolve or reconstitute as the Council considers necessary any such institute, unit or project;
- (e) to co-ordinate research in all its aspects in the country; and in particular to provide machinery which will ensure that the Council, the

research institutes of the Council, the Universities of Ghana and other institutions engaged in research in Ghana co-ordinate their research efforts and co-operate in research;

- (f) to encourage and assist in their research efforts individuals and organizations engaged in research in Ghana;
- (g) to co-operate and liaise with national and international organizations in any part of the world on matters of research;
- (h) to undertake or collaborate in the collation, publication and dissemination of the results of research and of other useful technical information;
- (i) to encourage the training of scientific personnel and research workers through the provision of grants, fellowships, studentship and bursaries;
- (j) to arrange and organise such central and common services as may be required by organizations engaged in national research;
- (k) to ensure uniformity of standards in the selection, grading and promotion of all persons working for national research organizations;
- (l) to perform such other functions as the Government may assign to the Council or as are incidental or conducive to the exercise by the Council of all or any of the foregoing functions.

Functions
of Council
in relation
to Standards
Board and
amendment
of N.L.C.D
199.

5. (1) The Council shall in all cases be consulted by the Standards Board with respect to the promotion by the Standards Board of any research which the Council or any institute of the Council is engaged in or is proposing to engage in relation to specifications and with respect to the establishment by the said Board of research laboratories and facilities; and accordingly the Standards Decree, 1967 (N.L.C.D. 199) is hereby amended in paragraph 7 thereof by the substitution for subparagraphs (2)(a) and (2)(b) of that paragraph of the following new subparagraphs:

"(2) Without prejudice to the generality of the powers of the Board under subparagraph (1) of this paragraph and in accordance with such rules as may be made under paragraph 5 of this Decree, the Board may-

- (a) prepare, frame, modify or amend specifications and promulgate standard specifications; and
- (b) after consultation in all cases with the Council for Scientific and Industrial Research Decree, 1968 (N.L.C.D. 293), promote research which the said Council or any institute of the Council is engaged in or is proposing to engage in relation to specifications, and provide for the examination and testing of goods commodities, processes, and practices; and for those purposes the Board may (and in relation to research after consultation as aforesaid with the said Council) establish such laboratories and other facilities as the Board thinks fit."

(2) The said Standard Board shall have regard to the views expressed by the Council under this paragraph or under paragraph 7 of the said Standards Decree, 1967, and shall as far as practicable give effect to those views.

Terms of
Office of
members

6. (1) Subject to any other provision of this Decree, a member of the Council other than the Chairman or an ex officio member shall hold office for a term not exceeding three years but shall be eligible for re-appointment or re-election (as the case may be).

(2) Half the number of members appointed or elected under paragraph 2(d) to 2(h) of this Decree shall retire at the end of their second year in office but shall be immediately eligible for re-appointment or re-election (as the case may be) for another term of three years. The number of members of the Council in the case of an odd number shall, for the purposes of this subparagraph, be deemed to be such odd number less one.

(3) A member other than an ex officio member may at any time by a notice in writing addressed to the Chairman resign his office.

(4) The office of a member absent from Ghana for a continuous period of twelve months or more shall become vacant at the end of such period.

Filling of
vacancies

7. In the event of the death or resignation of a member or where the office of a member becomes vacant under paragraph 6(4) of this Decree, a replacement shall be appointed or elected (as the case may be) for the remainder of his term in

accordance with the procedure of appointment or election laid down in paragraph 2 of this Decree in respect of such member.

8. (1) No member of the Council, other than the Chairman, shall be entitled to any remuneration in respect of his membership.

(2) The Council may however pay to members of the Council and to other persons attending meetings of the Council such travelling and other allowances out of the funds of the Council as the Council may determine.

(3) The Chairman shall be paid such remuneration as the Council may determine.

II-MEETINGS AND COMMITTEES OF COUNCIL

Meetings of
the Council

9. (1) The Council shall ordinarily meet for the despatch of business at such times and places as the Council may decide but shall meet at least once in every four months.

(2) The Chairman may, and shall on the request in writing of not less than seven members of the Council, call an extraordinary meeting of the Council at such time and place as he may determine.

(3) The Chairman, if present, shall preside at every meeting of the Council, and in his absence any member of the Council elected by the members present shall preside at the meeting.

(4) The quorum at every meeting of the Council shall be eight or such greater number as the Council may determine.

(5) Subject to any other provisions of this Decree or any bye-laws of the Council, all

questions proposed at a meeting of the Council shall be determined by a simple majority of the members present and voting and where the votes are equal the Chairman or the person presiding shall have a second or casting vote.

(6) The Council may request the attendance of any person to act as adviser at any meeting of the Council and that person while so attending shall have all the powers of a member except that he is not to vote on any question and his presence at the meeting is not to count towards the constitution of a quorum.

(7) The validity of any act or proceedings of the Council shall not be affected by any vacancy among its members or any defect in the appointment of a member thereof.

(8) Subject to the preceding provisions of this paragraph the Council may regulate its own procedure.

Committees
of the
Council

10. (1) The Council may appoint such committees of such numbers of persons, whether members of the Council or not, as it thinks fit to exercise or advise the Council on the exercise of any of its functions under this Decree.

(2) The Chairman of every such committee shall be a member of the Council.

III ADMINISTRATION AND STAFF MATTERS

Secretariat
of the
Council

11. (1) There shall be established a Secretariat headed by the Secretary to the Council which shall be responsible for the day-to-day administration of the Council.

(2) The Council may employ, upon such terms and conditions as the Council thinks fit, such persons as may be required for the proper and efficient discharge of the Council's functions.

(3) The Chairman shall exercise a general supervision over the work of the Secretariat and a general authority over the employees of the Council and be generally responsible for the maintenance of discipline among the employees.

Provision of Pensions, etc., for Council's employees

12. (1) The Council may grant, subject to the provisions of the Social Security Act, 1965 (Act 279) and in accordance with rules made in that behalf by the Council, pensions, allowances, gratuities or retiring awards to such employees of the Council as the Council may after consultation with the Government determine, being employees to whom the Pensions Ordinance (Cap. 30) does not apply.

(2) The Council may require any such employees to contribute to any pension, provident fund or superannuation scheme.

Research institutes units and projects

13. (1) The Council may establish such research institutes, units and projects as it thinks fit for the carrying out of its functions under this Decree.

(2) With effect from the coming into force of this Decree, the following research institutes, units and projects which had been under the Ghana Academy of Sciences established by the Ghana Academy of Sciences Instrument, 1963 (E.I. 5) (hereafter referred to as "the Ghana Academy of Sciences") shall be deemed to be research institutes, units and projects established by the

Council under subparagraph (1) of this paragraph:-

- (a) Animal Research Institute
- (b) Building and Road Research Institute
- (c) Cocoa Research Institute
- (d) Crops Research Institute
- (e) Food Research Institute
- (f) Forest Products Research Institute
- (g) Institute of Aquatic Biology
- (h) Institute of Standards and Industrial Research
- (i) Soil Research Institute
- (j) National Atlas Project, and
- (k) Herbs of Ghana Project.

(3) All the property, rights and liabilities (including obligations) of the Secretariat of the Council and of the institutes, units and projects mentioned in subparagraph (2) of this paragraph shall, subject to any other provisions of this Decree and without any further authority than this paragraph, vest in the Council.

(4) The Council may request any management board appointed under this Decree, or such other person or body as the Council thinks fit, to manage on behalf of the Council any such property.

Management of Institute 14. (1) The Council shall appoint a management board consisting of such number of persons as the Council thinks fit to manage each institute of the Council and the Council shall prescribe for such board such terms of reference as the Council may determine.

(2) Every such institute shall be in the charge of a suitable person to be appointed by the Council upon such terms and conditions as the

Council may determine.

(3) Subject to the policy laid down by the Council and the need to obtain the Council's approval of any decision on programmes, budget and management of an institute, the person in charge of an institute shall be responsible for the day-to-day management of this institute.

IV FINANCIAL PROVISIONS

Funds of the Council 15. (1) The funds of the Council shall include:-

- (a) any grants received from the Government or any banking institution;
- (b) any loans granted to the Council by the Government or banking institution;
- (c) any moneys accruing to the Council in the course of the performance of its functions under this Decree; and
- (d) gifts.

Provisions relating to gifts 16. (1) Every gift intended by any person for the Council or for any institute, unit or project of the Council shall in all cases be made directly to the Council which shall utilise any such gift in furtherance of any of its objects under this Decree:

Provided that in deciding to what use to put any gift the Council shall have particular regard to such of the expressed wishes of the donor of the gift as are not inconsistent with the said objects of the Council:

Provided further that in the case of any inconsistency arising between the expressed wishes of the donor of any gift and the said objects of the Council, the Council may utilise the gift in

furtherance of such of the said objects of the Council as the Council thinks fit.

(2) The decision of the Council as to whether or not any inconsistency arises as aforesaid shall in all cases be final and conclusive.

**Estimates of
Expenditure**

17. (1) The Council shall receive estimates of expenditure for each financial year from the management boards of its institutes and shall process such estimates and submit them through the Commissioner responsible for Economic Affairs (hereinafter called "the Commissioner") for approval by the Government.

(2) The Council shall for each financial year prepare estimates of expenditure in respect of the Council's Secretariat and the research units and projects under the Council's direct supervision and shall submit such estimates through the Commissioner for approval by the Government.

(3) The Commissioner shall approve, amend or recommend such changes in the estimates submitted to him under the foregoing subparagraphs of this paragraph as the Commissioner thinks fit.

(4) The Council shall ensure that any funds approved by the Government in pursuance of the provisions of this paragraph shall be employed solely for the purposes for which they were approved and in accordance with financial regulations of the Council.

**Accounts and
Audit**

18. (1) The Council shall keep proper books of records in relation thereto.

(2) Subject to such directions as to form as the Commissioner may give, the Council shall prepare, in respect of each financial year, a statement of account which shall include:-

- (a) a balance sheet, a statement of income and expenditure and a statement of surplus containing such information as, had the Council been a company registered under the Companies Code, 1963 (Act 179), would be required to be laid before the company by the directors at an annual meeting; and
- (b) such other information in respect of the financial affairs of the Council as the Commissioner may require.

(3) The Council shall submit to the Commissioner such report of the Council's financial affairs as the Council may at any time require.

(4) The books and accounts of the Council shall be submitted for audit to the Auditor-General within three months after the end of the financial year.

(5) The Auditor-General or an auditor appointed by him shall, not later than four months after the end of the financial year, forward to the Commissioner a copy of the audited accounts of the Council for the financial year immediately preceding and his report thereon.

(6) The Auditor-General shall report annually to the Commissioner the results of his examination of the accounts and financial statements of the Council, and shall state therein whether in his opinion -

- (a) proper books of accounts have been kept

by the Council;

- (b) the financial statement of the Council,
 - i) was prepared on a basis consistent with the books of accounts,
 - ii) in the case of the balance sheet, gives a true and fair view of the income and expenditure of the Council for the financial year;

and the Auditor-General shall call the attention of the Commissioner to any other matter within the scope of his examination which in his opinion should be brought to the attention of the Government.

(7) The Auditor-General shall make to the Council or to the Commissioner such other reports as he may consider necessary or as the Commissioner may require.

(8) For the purposes of this paragraph:-

- (a) the period extending from the commencement of this Decree to the 30th of June, 1969 shall be deemed to be a financial year;
- (b) The expression "Auditor-General" shall be construed so as to include any other person appointed by the Auditor-General.

Annual
Report

19. (1) The Council shall, not later than six months, after the end of each financial year, submit an annual report to the Commissioner in such form as the Commissioner may prescribe which shall include the statement of account specified in paragraph 18 (2) of this Decree and the Commissioner shall as soon as practicable lay the report before the Government.

(2) The audit report of the Auditor-General shall be included in the annual report of the Council and the annual report of the Council shall be published in such manner as the Commissioner may determine.

Com-
missioner's
powers

20. The Commissioner responsible for economic planning shall be generally responsible for the Council, subject to the provision of this Decree.

V - MISCELLANEOUS

General
powers
the
Council

21. (1) The Council shall, subject to any other provision of this Decree, have power for any purpose which in the Council's opinion is necessary or expedient for or in connection with the proper exercise of the functions of the Council, to acquire and hold any movable or immovable property, to sell, lease, mortgage or otherwise alienate or dispose of any such property, and to enter into any other transaction.

(2) Where the Council has resolved that it is necessary or expedient to acquire any property under the preceding subparagraph the property which the Council seeks to acquire may be treated as property required for the Public Service and the State Property and Contracts Act, 1960 (C.A.6) shall apply accordingly, so however that the provisions of that Act shall apply with such modifications as are necessary to provide for the vesting of property acquired thereunder in the Council and for the cost of acquisition to be defrayed by the Council.

(3) No person shall charge or dispose of any land or building of the Council without the

consent in writing of the Council; such consent may be signified under the hand of the Chairman or of any other person duly authorised by the Council to act in that behalf.

22. (1) The Council may, with the approval of the Commissioner, make bye-laws or other instruments not inconsistent with this Decree for the purpose of regulating the Council's business or any matter falling within the scope of the Council's functions.
- (2) The Council may in particular make bye-laws to -
- (a) regulate the selection, grading, appointment, promotions, conditions of service, termination of appointment, and retirement benefits for the Council's employees;
 - (b) regulate the appointment and functions of any management boards of institutes appointed under this Decree;
 - (c) determine the persons authorised to sign contracts, cheques and other documents on behalf of the Council and otherwise regulate the procedure to be applied to transactions entered into by the Council; and
 - (d) ensure the proper custody and use of the Council's Seal.
- (3) A bye-law shall be taken to be made if, and only if -
- By-laws
and regu-
lations of
the
Council

- (a) a draft of the bye-law has been circulated to members of the Council at least 14 days before the meeting at which it is to be considered;
- (b) after consideration by the Council the draft has been provisionally approved either without amendment or only with amendments of which notice in writing was circulated to members not later than three days before the meeting;
- (c) the bye-law as provisionally approved has been circulated to the members of the Council, and (where in the opinion of the Council it affects research matters) to the members of the appropriate committee of the Council concerned with such matters whose report thereon shall be circulated to members of the Council not later than seven days before the meeting at which it is proposed to confirm the bye-law; and
- (d) the bye-law is confirmed without amendment at a meeting of the Council held not less than one month nor more than two months after the meeting at which it was provisionally approved.

(23) The Council shall not propose to the Government any amendment to this Decree unless

Council's powers of

- (a) such amendment is contained in a resolution passed at a meeting of the Council by the affirmative votes of not less than three-quarters of the total number of members of the Council present and voting; and
- (b) the resolution so passed is later confirmed by the same number of members present and voting at a second meeting of the Council held not earlier than one month nor later than four months after the meeting as aforesaid of the Council

Transfer to Council of Assets and Liabilities of the Academy of Sciences

24. All the property, rights and liabilities (including obligations) of the Ghana Academy of Sciences shall, with effect from the commencement of this Decree, be transferred to and (as the case may require) vest in the Council without any further authority than this paragraph.

Tax and rates exemption

25. The Council shall be exempted from any tax imposed under the Income Tax Decree, 1966 (N.L.C.D. 78) and from any rates imposed under the Local Government Act, 1961 (Act 54).

Employees of the Academy of Sciences to be employees Council.

26. Every member of staff or other employee of the Ghana Academy of Sciences shall, with effect from the commencement of this Decree, be deemed to be a member of staff and an employee of the Council on the same terms and conditions on which he was employed by the Ghana Academy of Sciences immediately before the dissolution of the Ghana Academy of Sciences.

Repeal,
revocation
and transi-
tional
provisions.

27. (1) The Ghana Academy of Science (Amendment) Decree, 1966 (N.L.C.D. 118) is hereby repealed and the Board of Governors constituted under the said Decree is, subject to the following provisions of this paragraph, hereby dissolved .

(2) Subparagraph (1) of this paragraph shall not have effect with respect to the dissolution of the said Board of Governors until immediately before the first meeting of the Council under this Decree and until that time the said Board of Governors as reconstituted under subparagraph (3) of this paragraph shall exercise all or any of the powers exercisable by the Council under this Decree.

(3) With effect from the 8th day of May, 1968 the said Board of Governors shall be deemed to have been reconstituted by the replacement of Professor J.A.K. Qaurtey (who has resigned from the Board of Governors) by Dr. Ebenezer Laing.

(4) With effect from the 15th day of March, 1967 Dr. K.M. Sape, Acting General Secretary of the Ghana Academy of Sciences, shall be deemed to have been appointed Secretary of the said Board of Governors; and paragraph 1 (3) of the said Ghana Academy of Sciences (Amendment) Decree, 1966 shall be deemed to have been accordingly amended by the substitution for the name "Dr. Yanney Ewusie" of the name "K.M. Sape" in the said paragraph.

(5) The Instrument of Incorporation of the Food Research Institute (L.I. 438) is hereby revised.

(6) Every reference to the Ghana Academy of Sciences in the Statute Law Revision Act, 1963 (Act 215) and in any other enactment shall be deemed to be a reference to the Council.

28. In this Decree - Interpreta-
tion
"financial year" means the
financial year of the Government;
"scientific research" includes
social sciences research;
"university institution" means an
institution of higher education
designated as such by the
Government or a body or person
authorised in that behalf by the
Government.
29. This Decree shall be deemed to Commence-
ment
have come into force immediately
after the commencement of the
Academy of Arts and Sciences
Decree, (N.L.C.D. 291).

Made this 10th day of October, 1968.

LT.GEN. J.A. ANKRAH
Chairman of the National Liberation Council

Date of Gazette notification: 12th October, 1968.

APPENDIX 2
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL
RESEARCH (AMENDMENT) DECREE, 1969

In pursuance of the Proclamation entitled "Proclamation for the constitution of a National Liberation Council for the administration of Ghana and for other matters connected therewith", published in Gazette No.11 of 28th February, 1966, this Decree is hereby made:-

N.L.C.D.
293
amended

1. The Council for Scientific Research Decree, 1968 (N.L.C.D. 29) is hereby amended as follows:-

(i) by the substitution for paragraph 2 thereof, of the following new paragraph:-

Member-
ship
of the
Council

2. (1) The members of the Council shall be as follows:-

- (a) a Chairman appointed by the Government after consultation with the Ghana Academy of Arts and Sciences established by the Ghana Academy of Arts and Sciences Decree, 1968 (N.L.C.D. 291) (hereinafter referred to as the "Ghana Academy of Arts and Sciences") for such period and up on such terms and conditions as the Government may determine;
- (b) a representative of the National Council for Higher Education appointed by the members of the Council;
- (c) a representative of the Ghana Atomic Energy Commission appointed by the members of the Commission;
- (d) six persons representing between them the biological, physical and social sciences, technology, medicine and agriculture, appointed by the Government after

consultation with the Ghana Academy of Arts and Sciences;

(e) two directors of research institutes elected by the directors of the research institutes of the Council from among themselves;

(f) one officer appointed by the Government from each of the departments or ministries responsible for agriculture, forestry, health, works, industries and economic planning to represent the technical and scientific interests of his respective department or ministry;

(g) one representative to be appointed by each university institution in Ghana associating in research with any institutes of the Council;

(h) two representatives of industrial and commercial interests in the country who shall be appointed in accordance with a procedure to be jointly determined by the Commissioners responsible for industries and trade;

(i) the Director of the National Standards Board;

(j) the Secretary of the Ghana Academy of Arts and Sciences; and

(k) two other persons appointed by the Government being persons appearing to the Government to have proven ability in respect of any subject falling within or relating to the functions of the Council.

(2) Any member holding office under any provision of the preceding subparagraph shall be ineligible to hold office at the same time under any provision of the said subparagraph.

(ii) by the substitution for subparagraph (4) of paragraph 9 thereof, of the following new subparagraph:-

"(4) The quorum at every meeting of the Council shall be ten or such greater number as the Council may determine;"

(iii) in subparagraph (2) of paragraph 13 by the insertion at the end thereof, the following:-

"(e) Water Resources Unit."

~~Commence-~~
~~ment~~

2. This Decree shall be deemed to have come into force at the same time as the Council for Scientific and Industrial Research Decree, 1968 (N.L.C.D. 293).

Made this 7th day of February, 1969.

LIT.GEN. J.A. ANKRAH

Chairman of the National Liberation Council

Date of Gazette notification: 17th February, 1969.

PART II

**PERFORMANCE REVIEW OF NIGERIA'S INSTITUTIONS
FOR SCIENCE AND TECHNOLOGY POLICY**

**Dr. Oserheimen A. Osunbor
Department of Commercial & Industrial
Law, University of Lagos**

EXECUTIVE SUMMARY

Preface

Nigeria has an estimated population of 100 million (the highest in Africa). At an annual growth rate of 2.5%, it is expected to rise to about 157 million by the year 2,000. With about 7 million hectares of the total land area being suitable for agriculture, the present per capita arable land is 0.75 hectares; but this is likely to fall below 0.5 hectares by the year 2,000, owing mainly to a combination of desertification in the North and flood, gully and sea erosion in the South.

With the upsurge in oil revenue in the 1970's, agriculture, hitherto the country's main economic base, fell into neglect. Over-dependence on oil for foreign exchange earning made the economy highly vulnerable to the glut in the crude oil market and other external influences, with deleterious consequences. With no foreign exchange to finance foreign imports, Nigerian authorities have now realized that the country has to go back to agriculture and harness her abundant natural resources for national development. The current necessity has brought to the fore the need to utilize Science and Technology (S & T) to enhance the socio-economic conditions of the people.

Nigeria's first S & T establishment came into existence as early as 1899 and many more were established in the 1950's. But it was not until 1963/64, with the support of United Nation's agencies, such as UNESCO, that the basis of a consistent and comprehensive national policy was laid. Initial efforts led to the establishment of the Nigerian Council for Scientific and Industrial Research in 1966. This was replaced by the Nigerian Council of Science and Technology in 1970 which operated alongside sectoral research councils. In 1977, all research institutes were centralized under a National Science and

Technology Development Agency, which thus became the first S & T organ of Government to be vested with executive powers. In 1980, a National Science and Technology Act was passed to replace the NSTDA with a Federal Ministry of Science and Technology (FMST) as the main Institution for Science and Technology Policy (ISTP) in Nigeria.

(a) Goals and Functions

The 1980 Act conferred on the FMST the responsibility to mobilize the nation's S & T capabilities for development. It also gave it policy-making functions with power to establish research institutes and regulate their activities. By having a Ministry of the Federal Government as the main ISTP, Science and Technology was elevated to the highest status in the Government power structure.

In the discharge of its policy-making responsibility, the FMST in 1986 produced a document conceptualizing the nation's S & T policy. This is extensive and embraces virtually every aspect of national life. The over-all idea was to attain the goals set in the 4th National Development Plan, 1980-85, of building, inter alia, a united, strong and self-reliant nation and a great and dynamic economy.

The National Policy has set out specific policies and the strategies for their implementation in nine spheres covering the following areas:

1. Manpower
2. Capital goods
3. Materials
4. Energy
5. Technology
6. Military Science

7. Environment
8. International Exchange and Co-operation in Science and Technology, and
9. National System of Science and Technology.

While this list is vast and laudable, the ability of the FMST to accomplish its objectives remains questionable, considering the low level of human, material and financial resources at its disposal. Moreover, the absence of a time-frame for attaining any of the policy goals makes it difficult to assess the rate of achievement.

(b) Organization

The principal organs of the FMST are the Minister, Director-General, Sectoral Directors and Assistant Directors in that order of precedence. While basic research takes place at the universities, applied research is mostly undertaken at the research institutes of which there are 23 now operating. Each research institute has a governing board and an executive director. All are expected to maintain close links with one another and with S & T centres in the universities and other Government ministries or departments on the one hand and the productive sector on the other.

(c) Activities

The activities of the ISTEP are set out in the statutes or mandate that establish them. By and large, the FMST and the research institutes are satisfied with the present range of activities and would rather consolidate than seek an extension of their scope.

(d) Goal Attainment

The absence of a time-frame for attaining set targets makes it difficult to assess the rate of goal attainment. There is scope for improvement of policy implementation, co-ordination and execution of programmed S & T activities.

(e) Achievements and Weaknesses

With the active support of the Government, several achievements have been recorded such as the establishment of the Raw Materials Research and Development Council, the National Council for S & T, the National Science and Technology Fund and the Science and Technology Village. The research institutes have also recorded many innovations. However, a poor human, material and financial resources base remains the major handicap in policy implementation.

(f) Recommendations

To improve performance, it is suggested that the following measures be taken:

1. Goals and Functions:

- (i) intensify the efforts towards manpower development and training, including the supervision and co-ordination of S & T activities;
- (ii) put greater emphasis on industrial attachment for S & T students;
- (iii) effect the prompt and regular publication of annual reports and journals and a wider dissemination of information;

(iv) strengthen the laws dealing with patents and the transfer of technology.

2. Organization

(i) reduce the problem of bureaucracy by allowing research institutes more freedom;

(ii) involve the States and Local Governments in S & T; and

(iii) enhance the status of the FMST.

3. Composition

There is a need for maintaining more stability in the system by minimizing changes in the leadership.

4. Linkages

(i) strengthen the linkages between the research institutes and the productive sector as well as the other S & T institutions.

(ii) give the Government's highest consideration to the FMST input in formulating major socio-economic policies.

5. Resources

The resources, especially financial, to S & T should be increased.

Conclusion

Although the nation's S & T policy has now been placed on a sound pedestal, all those involved in its implementation do recognize that there is scope for improvement in the system. The FMST itself leads in this process of introspection, which gives room for optimism. It is hoped that the Government will continue to understand the special nature of investment in S & T as one having a long gestation period and the fact that upon it depend the hopes of accelerated national development.

PREFACE

Objectives of the Review

The aim of this project is to review the performance of Institutions for Science and Technology Policy (ISTP) in Nigeria. It was embarked upon as part of a continent-wide project to evaluate the performance of Science and Technology (S & T) policy institutions in African countries during the decade or so that most of them have been in existence within this period. Six countries, including Nigeria, were selected for the purpose—Kenya, Sudan and Tanzania in East Africa and Guinea, Ghana and Nigeria in West Africa.

In particular it was intended:

1. to ascertain the statutory characteristics of selected institutions for S & T policy in regard to their stated aims and functions, prescribed organizational structures, composition of their Councils or Boards, links with other institutions, promised legal powers and resource allocations;
2. 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, account for disparities, if any, and relate these to the institutions' past and present performance;
3. 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 have spawned rivalries or encouraged co-operation between them;

4. to study the nature and working of decision-making machineries with respect to institutions for S & T policy in the country, especially with regard to the allocation of resources thereto; and
5. from the emerging conclusions and the comparisons with successful institutions for S & T 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 in promoting and utilizing science and technology for development.

This report is confined to Nigeria and is intended to be both diagnostic and prescriptive. It is hoped that the empirical information provided will help in deciding whether the underlying assumptions in the initial establishment of Africa's S & T policy institutions can continue to be justified; whether these institutions have performed effectively or new arrangements are required. It is also hoped that those factors which promote achievement and the improved performance of S & T policy institutions may be adapted and applied to redress the poor performance of other public institutions in African countries generally.

The idea for this kind of evaluation emanates from the fact that although ISTPs have been in existence in many African countries for at least a decade or two now, they have by and large made very little impact within the individual countries, a state of affairs lamented in the Lagos Plan of Action - the

declaration of intentions adopted when African Heads of State and Governments met in Lagos in 1980. Despite the laudable measures and strategies prescribed under that plan and nearly a decade since then, it has been generally perceived that these institutions in many of the countries have become even less relevant in the national scheme of things than they were in 1980. Until now, no systematic attempt has been made to evaluate their performance.

The Institutions for Science and Technology Policy in Nigeria comprise primarily the Federal Ministry of Science and Technology and the Research Institutes which come under it. The full list numbers 25, of which 23 are functional. There is also a Centre for Genetic Resources and Biotechnology under the Ministry as well as Centres of Excellence in 4 Federal Universities, which, though not coming directly under the aegis of the FMST, carry out functions of relevance to it.

Questionnaires were administered to all the Institutes in the course of this research, but only 8 returned theirs at various levels of completion. Logistical factors did not permit a visit to a majority of them, since they are spread across the country. Except for the FMST itself and a few of the institutes, personal interviews were not possible due to the Directors' inability to arrange appointments as they were either hastily preparing for, attending council meetings or otherwise unavailable during the period the field work was conducted. Very often the junior officials when available were unwilling on their own to grant an interview without their Directors' prior authorization. Nevertheless, the writer has tried to extrapolate from information provided by the respondents in the Questionnaires which form the basis of this report.

Acknowledgement

At the commencement of this study, the researcher wrote to acquaint the Honourable Minister of Science and Technology, Professor E.U. Emovon, with the project and to seek his permission for access to all the relevant sources of information connected with his Ministry. This he very kindly granted. I, therefore, wish to express my profound gratitude to the Honourable Minister for his valuable co-operation. Much assistance was also received from various people in the Ministry, but special mention must be made of the following: Professor E.E. Okon, (Director-General of the Ministry), Dr. T.I. Obiaga (Director of Industrial Technology), Dr. A.A. Abiola (Publications), Mr. Olaniyi Akande and Dr. S.A. Adegoke, (Planning Research and Statistics).

My thanks also go to those Research Institutes which responded promptly to the Questionnaires and all those I came across in the course of my field-work whom, for obvious constraints, I cannot mention by name, but who rendered one form of assistance or another.

I must thank especially, Dr. A.M. Goka, Study Leader for the West African end of this project for guiding me in a most helpful manner in the conduct of this study and for supplying, or otherwise drawing my attention to, very useful literature and Prof. Adebayo Adedeji whose timely contact with the Hon. Minister of Science and Technology no doubt eased my difficulties.

Finally, my special thanks to Ussieh and our children for bearing with me in many ways as I became preoccupied with yet another research.

CHAPTER 1

BACKGROUND

1.1 Rationale for the Establishment of Nigeria's Institutions for S & T Policy

Nigeria gained independence from Britain on 1 October, 1960 and attained Republican status exactly three years later. At independence, the country operated a three-states regional Federal Government structure, but the number rose to four in 1963. It changed to a 12 states structure in 1967, 19 in 1976 and 21 in 1987. There has been a separate government structure at the ministerial level for the Federal Capital Territory, Abuja, since 1979.

Nigeria occupies an estimated land area of 930,000 square kilometres. It is bordered in the South by the Bights of Benin and Bonny in the Atlantic Ocean and shares extensive common borders with the Republics of Benin, Niger, Chad and Cameroon. The country's population is estimated to be about 100 million with an annual growth rate of 2.5%. By the year 2000, it is expected to be about 157 million.

Only 75% of the total land area (i.e. 71 million hectares) is considered suitable for agriculture - arable farming, animal husbandry and fisheries. However, two opposing factors have in recent years affected this estimate. First, the establishment of River Basin Development Authorities and the extensive use of irrigation in many parts of the country, especially in the North, have transformed areas of low fertility and the semi-arid into rich arable land. At the opposite end, sea erosion in the coastal area (accounting for the washing-off of 3 metres of coastal areas annually, the flooding of low lying areas, particularly along the banks of the River Niger and gully

erosion, especially in the Eastern states coupled with the encroachment of the Sahara desert on the Northern frontier, which accounts for an annual loss of 12 metres of arable land, have perhaps more than off-set the gains from irrigation. It is feared, therefore, that the present per capita arable land of 0.75 hectares may fall below 0.5 hectares by the year 2100, when a forecast equilibrium population of about 435 million will be attained. If this is allowed to happen, the present food crises is bound to worsen and the country's dependence on food imports will compound the Government's indebtedness, leading to an even lower quality of life for the people.

1.2 Trade and Industry

In Nigeria, trade has traditionally centred around agriculture, especially cash crops. Indeed, by deliberate policy, the colonial administration favoured and encouraged this with the primary aim of securing raw materials to feed British industries. Even their marketing was the exclusive preserve of foreigners, since they alone had access to credit from the early financial institutions. This laid the foundation for an alien-dominated economy in which the indigenous people were kept on the land as peasants, whereas the distributive trade and other major sectors were dominated by foreigners - essentially multinational companies. It is this pattern that provided the fervour for economic nationalism resulting in the indigenisation policy that now underlies Government practice in trade and the overall socio-economy of the country. It entails the transfer to or vesting of ownership (and possibly control) of enterprises upon Nigerian citizens so that the economy is substantially in their hands.

Although the country's economic base at independence was agriculture, the advent of oil and the subsequent boom in the crude oil market in the early '60s to mid '70s resulted in a total neglect of agriculture. With the major urban centres

virtually awash with oil revenue, the country witnessed an unprecedented rural - urban migration. Nigeria's thus became a mono-product economy whose fortunes were inexorably tied to oil. Come the oil glut and the subsequent collapse of the global market for crude and the nation's foreign exchange earnings fell drastically. This adversely affected the economy in terms of the ability to fund foreign imports, complete on-going projects and execute programmes envisaged under the 4th National Development Plan of 1980-85.

On the positive side, the collapse awakened the nation to the dangers of over-reliance on a single product for foreign exchange earnings and, therefore, on the need to apply local material and manpower resources for national development.

Since 1972, when the Nigerian Enterprises Promotion Act of that year introduced the programme of indigenisation, the country has witnessed an increase in the level of local participation in various sectors of industry, including manufacturing. Starting from the manufacture of products like paper and paper products, toiletries and the assemblage of products such as television and Hi-Fi, bicycles etc, industrial activities have now advanced to more complex manufacturing processes, comprising fertilizer production, food processing and packaging, pharmaceuticals and iron and steel. Regrettably, however, the production processes are still characterized by high production costs, low value-added and installed production capacity. The location of most of the industries in the urban centres has compounded the problems associated with rural - urban migration. It is notable, however, that recent Government policy which emphasizes dispersal to areas of low concentration in the location of new industries has attempted to stem this tide.

1.3 Basic Infrastructures

A major constraint in this and other measures by the Government is the lack of a basic infrastructure such as water, electricity and transport and communication. The most common means of communication in Nigeria is road transportation; but, although several thousand kilometres of modern roads were built in the 70s, most of them have fallen into disrepair in recent years. The railways have remained largely undeveloped beyond the time when they were established by the colonial administration to link the sources of raw materials with the sea ports and, although the sea ports have, in turn, grown in number and have been modernized within the past decade, they have remained under-utilized because of the poor connection with the rail and road network.

With all these constraints, the problem of wants persists as agricultural products cannot be evacuated to markets and the nation's abundant non-oil mineral resources cannot be exploited. Thus the nation experiences poverty in the midst of plenty. When these problems are considered against the backdrop of the escalating population and the widening rich - poor gap, the indicators point to grave socio-political upheavals in the future, unless the situation is remedied soon. This is the great challenge that faces Science and Technology.

1.3.1 Health

The population growth rate owes much to Western medicine. However, belief in and resort to traditional medicine are still strong. Indeed, the Government recognizes the relevance of traditional medicine in the Health care delivery system and its usefulness in those areas where it excels Western medicine. At a time when funds to finance Western medicine are either unaffordable or very scarce, the challenge of Science and

Technology is to facilitate the introduction of scientific methods that will enhance the effectiveness of traditional medicine.

1.3.2 Education

The entire national educational system also has an important role to play in this by introducing scientific and technological methods into the training of students. Indeed, this policy already underlies the 6-3-3-4 system of education and the 60:40 ratio in favour of science in admissions to tertiary institutions.

Conclusion

From the foregoing account, it will be obvious that Nigeria has to make an optimum use of her human and material resources if she is to be able to cater for the various needs of her fast growing population. In the face of dwindling financial resources and more difficult climatic and ecological circumstances, she must apply science and technology to ameliorate these conditions and to ensure a better quality of life for her citizens. In other words, consistent with the Vienna Programme on the Application of Science and Technology for Development and the Lagos Plan of Action, Nigeria has no choice but to apply science and technology to national development. That this is imperative has long been recognized in this country, but how far and how well she has gone in attaining this objective will gradually emerge from the rest of this report.

1.4 History of the Institutions for Science and Technology Policy in Nigeria¹

The early period in the process of development of Nigeria's institutions of science and technology policy witnessed a number of events affecting the said institutions in an atmosphere devoid of any deliberate or comprehensive national policy on S & T. The first was the establishment of agricultural research stations whose purpose, as we have already seen, was to ensure a steady supply of raw materials of good quality to British industries as determined by the colonial administration. The earliest of such research stations was the Moor Plantation which was established in Ibadan, long before the creation of Nigeria, in 1899. Similar stations were later set up in Samaru in Zaria and at Umudike, near Umuahia. Within the British West African colonies, a number of sub-regional research agencies were created some of which were based in Nigeria. These included the West African Cocoa Research Institute at Ibadan, the West African Institute for Oil Palm Research near Benin City, the West African Council for Medical Research at Yaba, Lagos, and the West African Institute for Trypanosomiasis Research, Kaduna.

Other research institutes to which Nigeria belonged were the West African Road Research Institute, the West African Rice Research Station and the West African Timber Research Unit. All the activities of these agencies were under the co-ordination of a West African Research Office located in the Gold Coast (now Ghana). After her independence in 1957, Ghana withdrew from these sub-regional agencies. Those institutions located in Nigeria then became national and, shedding the appellation West Africa became the Cocoa Research Institute of Nigerian Institute of Trypanosomiasis Research, Nigeria Institute for Oil Palm Research, etc. To this end, the Agricultural Research Institute Act was passed in 1964 for the purpose of co-ordinating the activities of the research institutes in this country.

Hitherto the Federal Institute of Industrial Research had been established in 1956 as a division of the Ministry of Commerce and Industries. This was a notable extension of the Government's efforts, pioneered in S & T service establishments like the Railways, to encourage various government departments (e.g. Agriculture, Forestry Geology, Survey) to set up research units and associated schools for training middle level technical manpower.

The efforts to develop a National Science and Technology Policy in the years immediately following independence received a boost first from the United Nations conference on the application of S & T for the benefit of developing countries in 1963 and secondly, from UNESCO at an international conference in Lagos in 1964 on the Organization of Research and Training in Africa. There subsequently developed a greater awareness of the need to focus more on this aspect of the nation's development programme.

In December 1966, the Federal Military Government promulgated the Nigeria Council for Scientific and Industrial Research Decree No. 83. The major functions of the Council were to co-ordinate and encourage scientific activities, including scientific research at all levels. It was the highest national body on scientific policy and was authorized to maintain contacts with foreign organizations and foundations interested in research. The Council was essentially an advisory organ with little or no executive powers and the decree setting it up was considered too narrow in scope as it excluded research in agriculture, medicine and the basic sciences. These shortcomings, coupled with the fact that the Council came into existence at a most turbulent period (the on-set of the 30 months old civil war) militated against its effectiveness.

In 1967, the Government secured the services of a UNESCO science policy adviser to review the S & T position and assist in

the involvement of an appropriate policy. On the basis of this exercise, the Government promulgated the Nigerian Council of Science and Technology Decree in February 1970, thus repealing the NCSIR Decree of 1966. Its scope was wider than that of its predecessor and embraced agricultural sciences, experimental sciences, industrial sciences, engineering and technology, medical sciences, environmental sciences and social sciences. It also ensured state representation in the Council. However, the NGST was still essentially an advisory body with little or no executive power over the Research Institutes. Moreover, its membership, which comprised 35 ex-officio and appointed members, was rather unwieldy and hindered effectiveness.

In order to facilitate and support the functions of the NCST, Sectoral Research Councils were established by various Federal Ministries between 1971 and 1973. These included the Agricultural Research Council of Nigeria, the Medical Research Council and the Natural Science Research Council. Working with these Councils, the NCST helped to establish a framework for Science and Technology policy formulation, priority-setting, promotion and co-ordination of scientific and technological activities.

In 1976, the new military administration which came to power the previous year set up a committee to review the S & T situation and to make recommendations for a more effective organ. In the event, it recommended two alternatives:

1. a Ministry of Science and Technology with all the research institutes coming under it, or
2. an executive agency.

The Government chose the second option and, in January 1977, promulgated the National Science and Technology Development

Agency Decree establishing the National Science and Technology Development Agency (NSTDA) in place of the NCST and its Sectoral Councils.

The NSTDA had a Governing Council of 14 members under the Chairmanship of the Chief of Staff, Supreme Headquarters - a member of both the Federal Executive Council and the Supreme Military Council. Unlike its predecessor, it had both funds and the executive powers which, it was hoped, would allow it more flexibility, autonomy and freedom from bureaucratic delays to which its predecessors and government departments generally were subject. It functioned through five departments, viz - Research, Planning, Agricultural Sciences, Industrial Sciences and Biological Sciences. During the period of its existence (1977-79), the number of research institutes under it increased from 11 to 22, 18 of which were agro-based, 3 industrial and 1 medical. Its interests went beyond projects coming directly under the ambit of the Agency in that it also funded by way of grants research projects of national importance being undertaken in the universities and other tertiary institutions. Its weakness may have been due to the fact that the leadership did not recognise its potentials or, if they did, they could not make out how to use it. The Chief of Staff as Chairman was probably too busy with other aspects of national governance to give it much attention.

The NSTDA had a very short existence and was replaced by the Federal Ministry of Science and Technology in January, 1980 by the new civilian administration that came to power on 1 October, 1979. The Government thus reverted to the choice it had rejected when it opted for the NSTDA in 1977.

With the overthrow of the civilian government on 31 December 1983, the new military regime merged this Ministry with that of Education to form a Federal Ministry of Education, Science and

Technology. This action was widely perceived as a reversal of some sort to the efforts over the years to project Science and Technology as an area of high priority to which due recognition ought to be accorded by the Government. Apparently realizing the retrogressive implications of the merger, it reverted again to a Federal Ministry of Science and Technology in September 1985 and this position has remained unchanged to-date.

CHAPTER 2

GOALS AND FUNCTIONS

2.0 Mission of the Federal Ministry of Science and Technology

The statutory goals, powers and functions of the Federal Ministry of Science and Technology (FMST) are to be found in the National Science and Technology Act 1980, which dissolved the NSTDA and transferred its functions, staff, assets and liabilities to the Ministry of Science and Technology. It was the very first Act passed into law by the civilian Government in the Second Republic, but it did not expressly incorporate the functions or powers of the Ministry, although it is clear from the preamble to the Act that the FMST was intended to take-over and exercise the functions of the NSTDA as contained in the repealed decree. Prior to it and as part of the re-organization of Ministries under the new civilian administration, the Federal Government had published, in October 1979, Government Notice, No. 1205 titled Assignment of Responsibilities to Ministries wherein the FMST was charged with the following major responsibilities:-

1. formulation of a national policy on Science and Technology;
2. promotion and administration of scientific and technological research and development;
3. promotion and administration of technology transfer programmes;
4. liaison with universities and polytechnics on scientific and technological activities, especially as regards manpower development and training;

5. encouragement and popularization of science and technology generally and
6. supervision and co-ordination of the activities of the nation's science and technology research institutes.

These and the other functions stated clearly derive from and are based on the statutory functions of the defunct NSTDA. Strictly speaking, therefore, the statutory functions of the FMST are still to be found in the 1977 Decree incorporated by implication into the 1980 Act and the decree must be deemed to have extended and defined more clearly the responsibilities of the Ministry as contained in the Government Notice. By section 2 of that Decree, the NSTDA was charged with the executive responsibility for promoting and developing science and technology, including the initiation of policy relating to scientific research and technology. Specifically, it was to:

1. advise the Government on national science policies and priorities and on scientific and technological activities generally;
2. prepare periodic master plans for the development of science and technology and advise the government on financial requirements for the implementation of same;
3. prepare annual budgets for scientific research development and receive grants for allocation to research institutions and special research projects conducted by universities under the aegis of the Agency;

4. advise the government on the creation of new research institutes and centres and the reorganization of existing ones to meet national needs;
5. supervise and co-ordinate the activities of research institutes and centres established by the government;
6. allocate special research projects to the universities after consultation with the National Universities Commission;
7. take such steps as it may deem necessary to facilitate the application of the results of scientific and technological research by Federal and State Ministries and their agencies;
8. advise on the scientific and technical manpower requirements of Nigeria and promote manpower training for research;
9. advise on science education not only at the advanced level in respect of scientific manpower in training, but also at lower levels in respect of science education for the public;
10. establish and maintain a National Science and Technology Library, Documentation and Conference Centre;
11. publish or sponsor the publication of scientific research journals;
12. channel external aid meant for the development of science and technology to governmental research establishments;

13. promote co-operation in science and technology with similar bodies in other countries and with international bodies connected with science and technology; and
14. carry out such other activities as are necessary or expedient for the full discharge of any of the functions of the Agency.

2.1 Analysis & Commentary

The transfer of the above functions from the Agency to a full-fledged Ministry did not involve any expansion in their scope; it was hoped rather that the enhanced institutional level for the implementation of the S & T policy would ensure a more effective execution of programmes and policies. This arrangement has, in fact, given more prominence to S & T in the governmental power structure.

2.2 Operationalization of Mission

2.2.1 Perceived Goals and Functions

Although several refinements and improvements on Science and Technology development generally have taken place, especially since 1964, there has been no conceptualization in policy form. Indeed, the frequency of change witnessed was symptomatic of the operational weakness of an S & T programme devoid of a consistent policy. In realization of this, the Minister of Education Science and Technology in August 1984 constituted a panel for Science and Technology Policy Formulation and Implementation. The terms of reference were:

1. to develop guidelines for a national science and technology policy;
2. to advise on a possible organ of Government;
3. to advise on functions of such an organ and the implementation policy of science and technology; and
4. to advise on any other issues related to the above.

Based on the panel's report², the FMST published in October 1986 a blueprint on Science and Technology titled National Policy on Science and Technology.³ This document now guides all aspects of the implementation of the national S & T policy.

The idea behind the national S & T policy derives from the overall national objectives as defined by the 4th National Development Plan which was conceived with the hope of building:-

1. a united, strong and self-reliant nation;
2. a great and dynamic economy;
3. a just and egalitarian society;
4. a land of bright and full opportunities for all citizens and
5. a free and democratic society.

With these objectives in mind, a national S & T policy was evolved with the following goals

1. to maintain a well-fed, healthy, well-informed and happy citizenry by providing adequate and suitable food, shelter, education, sanitary environment, basic social amenities and improved health care delivery for all citizens;

2. to develop and use wisely all its resources; human, forest, land, animal, water, mineral, financial and air space;
3. to ensure a fair and equitable distribution of resources, amenities and opportunities among all citizens;
4. to provide the necessary environment for the growth and sustenance of a buoyant and vigorous economy; possess enough technical know-how, skills and materials to defend the integrity and security of the nation;
5. to be technologically self-reliant in the production of capital, consumer goods and raw materials;
6. to maintain a flourishing national export capability of goods and services.

These have been the guiding principles in the organization and implementation of the Science and Technology policy.

In order to ensure that the stated objectives are met, the FMST has set for itself a number of specific goals, namely to:

1. increase public awareness in S & T and the vital role which it can play in national development and well-being;
2. direct S & T efforts along identified national goals;
3. promote and translate S & T results into actual goods and services;

4. create, increase and maintain an endogenous S & T base through R & D;
5. motivate creative output in S & T;
6. increase and strengthen a theoretical and practical scientific base in the country; and
7. increase and strengthen the technological base of the nation.

In pursuance of these objectives, specific policy guidelines and strategies are being pursued for the development of S & T in all sectors and spheres of national life and activities. The policies in the various sphere, their individual objectives and strategies for implementation as contained in the National Policy are as follows:

1. **Manpower**

- (a) **Educational System:**

The policy here is to emphasise science at all levels in the educational system with the objective of re-orienting the entire society towards scientific thinking in order to develop new technologies and adapt existing ones. The major strategies for implementing this include encouraging and promoting scientific and technological talents, making it possible for every child to have early contact with the concepts of, and materials relating to, science and technology and ensuring a sound science foundation during the first lap of the new 6-3-3-4 educational system. A target ratio of 70:30 in University admission in favour of science is to be aimed at.

(b) Mass Movement

The policy is to have a mass movement for S & T development throughout the country in order to orient society towards S & T within the framework of its customs and traditions. Implementation of this will involve giving prominence to S & T through the mass media and providing well-equipped laboratories and workshops as well as opportunities for industrial attachment for science-based technical and professional courses.

(c) Motivation

Special incentives and/or remunerations are to be paid to people engaged in S & T development endeavours to attract and retain a substantial proportion of the society in the mainstream of S & T activities. This is to be attained by preferential remuneration of workers employed in S & T undertaking over their non-science and technical counterparts, provision of scholarships, bursaries and grants to students pursuing science-based courses in tertiary institutions and promoting and projecting innovations, inventions and new technologies at exhibitions, fairs and museums.

2. Capital Goods

(a) Machinery and Equipment

The policy is to ensure that the production of machinery, equipment and their spare parts is as far as possible, locally-based to ensure a solid and stable technological foundation for a self-sustaining industrialization process. This is to be attained primarily by initiating and promoting the widespread development of foundries, associated refractory materials and technology, accelerating the development in material science and engineering and developing copy-technology activities in the area of machineries and tools with a view to expanding available

capacity and thus localizing the production of heavy engineering machinery, tools and spare parts.

(b) Financial Inducement

Financial incentives are to be created to encourage the growth of machine tools and heavy engineering equipment industry so as to attract and channel capital into the engineering industry for its growth locally. The strategy is to provide loans and loan guarantees, grants and subsidies for firms engaged in heavy engineering industries, providing tax incentives to such firms and requiring banks to set aside a fixed percentage of their loan funds for industries in this sector.

3. Materials

The policy is to ensure that the exploitation, processing and utilization of the nation's material resources are programmed in such a manner as to promote self-reliance and enhance export. This will help provide and guarantee a steady and assured source of raw materials for the productive sector of the economy. The strategy is first to undertake comprehensive geological and exploration mapping of the nation's mineral resources and maintaining an inventory of all agricultural resources, initiating and developing programmes that promote the use of local materials as substitutes in existing industrial processes, improvement of locally available materials for use in the petrochemical, pharmaceutical and food processing industries, developing new and alternative materials for evolving new technologies. All these efforts are to be geared first to meet local needs and then export requirements in future.

4. Energy

The policy is to develop, protect and optimally harness the nation's energy resources in the overall interest of the nation at all times. This is to ensure the availability and adequacy of energy supplies for national development as well as a balanced exploitation of all energy sources with due regard to environmental protection. To this end, an inventory of all energy resources has to be established and followed by evolving and promoting measures for more efficient energy conversion, fabricating and manufacturing equipment for the utilization and conversion of energy sources, especially in the rural areas so as to conserve forest resources and the promotion of research and development in conventional and non-conventional energy sources such as solar and nuclear energy.

5. Technology

The policy is to see that advantage is taken of technological development in all aspects of daily activities; that major government projects involving imported technology are procured in an unpackaged form, that strategic capital goods industries are controlled by Nigerians; that organizations which maintain locally - based R & D activities receive special incentives and that national development projects are not based on unproven foreign technologies. The objective is to ensure the continuous and sustained upliftment of the general quality of life and national security, through self-reliance in the shortest possible time compatible with the nation's cultural patterns and the optimal utilization of resources. The strategies for implementation include technology generation from local research activities, technology acquisition and development, technology transfer and diffusion, research and development, standardization and legislation. It is necessary to strengthen the inspectorate functions and the drafting of licensing and technology transfer

agreements by competent legal experts to eliminate contractual terms inimical to the national interests.

The priority areas in the policy on technology fall within three main sectors:

(a) Agriculture, Food Production and Agro-Allied Industries

The strategy involves inter alia increasing crop production through new techniques, diversification of food sources, ensuring the availability and adequacy of food throughout the year through improved preservation and storage techniques, increasing the production and productivity of livestock, raising fish production and enhancing the nation's forest products potentials.

(b) Health and Health - Care Delivery

This involves ensuring support for health-care delivery systems for all by engaging in purposeful medical research and development; developing the local capability for production of medical equipment and devices; increasing productivity in the local drug industry by developing medicine and other biological products through a combination of genetic engineering, microbial fermentation and chemical engineering; improving and integrating traditional medicine into the national health-care delivery system and improving the efficacy of local medicinal herbs and plants.

(c) Industry

Technology policies and strategies will be made to permeate all areas of industry - construction, communication, transportation, etc, with special emphasis on the development of hard and softwares in computer and micro-electronics technology, bio-engineering, space, laser and information technologies.

6. Military Science

The policy is to have a fully developed military science and technology complex so as to enhance the scientific and technological competence of the Armed Forces. This is to be achieved by emphasizing related subjects in all aspects of military training and establishing an R & D division in the Federal Ministry of Defence.

7. Environment

All activities in the country are to be conducted in a manner that ensures a sound environmental management culture. The objective is to protect the environment against the harmful effects of human and animal activities, to preserve the nation's ecological setting and ensure the protection of the health and well-being of the people as well as fauna and flora. The strategy for implementation involves evolving clear guidelines for resource use and development; articulating long and short-term objectives and regulations for environmental protection and incorporating environmental considerations into all project planning, review and implementation.

8. International Exchange and Co-operation in Science and Technology

Efforts are to be made to engage actively in bilateral and multilateral exchanges and co-operation in S & T, international collaborative research and participation in international scientific and technical information network, etc. This will help compensate for inadequacies within the over-all objective of self-reliance.

9. National System of Science and Technology

The stability of the system in terms of sustained commitment, continuity and momentum in the development of S & T generally will be best ensured by setting up an organ, presently the FMST itself, to implement the development of S & T in the country and encourage State and Local Government involvement in S & T in the performance of their functions. A meeting point has been considered necessary for the various interests. To this end, a National Council for Science and Technology consisting of representatives from each state and the Federal Capital Territory was thought necessary. Under the chairmanship of the Minister, the Council will be expected to help in the effective infusion of S & T into and derivation from the States and to afford a platform for regular consultation among scientists.

Analysis and Commentary

1. Manpower

(a) The policy of emphasizing science has been pursued with sincerity by governments. A major constraint, however, has been and continues to be the shortage of laboratories and equipment in most schools as a result of which science teaching in many of them has had to be more theoretical than practical. Thus the idea of an early exposure of children to S & T materials inherent in the 6-3-3-4 system has not been widely attained. Consequently, the present minimum of 60:40 ratio in favour of science in university enrollments has yet to be realized.

(b) The policy efforts on mass movement continue to intensify and the level of consciousness of the average citizen in S & T is definitely higher now than it was a few years back. However, many people still consider new inventions as the white man's magic⁴ and even indigenous enterprises do not consider it worth-while to invest in R & D, preferring instead to buy packaged foreign technologies. Service organizations in the public and private

sectors also seem to lack appreciation of the role of science and technology in their operations.⁵

(c) Preferential remuneration which has long been advocated as a means of motivating interest in science and technology has not been widely accepted. However, the transfer of the salary structure of staff in ISTP from the general civil service to the higher Universities Salary Structure (USS) and conditions of service operated by the nation's universities has helped to attract and retain the best hands in S & T activities. The Government has also approved recently the USS pay structure for polytechnics and colleges of technology. The current high level of unemployment which affects science and technology graduates (along with others) may, however, constitute a temporary set-back in these efforts. This has to do with the urgent need to modify the educational curriculum in order to make these graduates job creators rather than job seekers.

2. Capital Goods

Some success has been recorded in the development, design and fabrication of local machinery and foundries. A major constraint, however, is the continued preference by consumers for imported products on the popular belief that they are of a better quality.

The system of financial arrangements envisaged to encourage local industries by way of loans and grants is well conceived; but the banks and other financial institutions that will be involved in the scheme need to give their maximum co-operation, if it is to succeed. In any case, the Government is yet to work out the necessary guidelines for such a scheme.

The policy on local material resources has gained utmost relevance in the prevailing economic conditions which have made

it not only wise but imperative to convert to local materials as imports become very expensive and in some cases impossible due to customs prohibition. However, local substitution will not succeed unless the necessary modifications are made to existing plants and machinery to accommodate new and alternative materials that are developed.

The rapid south-ward advance of the Sahara desert has brought to the fore the need to conserve our energy resources which, for most of the people, means firewood. As the forests and woodland are depleted, it has become imperative to devise measures for the more efficient energy conversion of firewood by using locally fabricated burners. The use of kerosine and liquefied petroleum gas (of which the nation has an abundance) is being widely encouraged, especially among the urban dwellers; but the high cost of stoves, burners and gas cookers has inhibited conversion from using firewood to gas. The research into and the use of non-conventional energy sources are yet to make a significant impact on the populace.

The policy on technology is multi-faceted and runs across many sectors with various levels of effectiveness. In the area of technology transfer and diffusion, much success has been recorded through the screening of technology transfer contracts, although loopholes still exist and have to be plugged through further legislation and inspection.⁶ In the area of technology generation from local research, not much impact has been felt because most of the new technology is normally not taken up and commercialized by the private sector. Nor do most businesses undertake any significant research and development, preferring instead to rely on what is generated from abroad. This is especially true of local affiliates or subsidiaries of multinational corporations which continue to hold sway over the major sectors of the economy.

Also, because of the absence of any regulation, machines and equipment of different makes, brands and specifications have found their way into the country. The absence of standardization often makes it difficult to maintain or procure spare parts for them. This has become a major problem in the Government's efforts to inculcate the maintenance culture in the people and discard the old habit of discarding machines after a few years of use and procuring new ones.

National security underlines the S & T policy in the military. Success in the military S & T complex has relevance to national development as it enhances national capability and minimizes dependence on imports, thus releasing money for the other sectors. This is most relevant for Nigeria where currently the military accounts for the highest proportion of the national budget.

Environmental protection is not under the direct responsibilities of the FMST but of the Federal Ministry of Works and Housing. At the moment, the nation lacks a clear policy or any law at all on environmental protection, although the recent dumping of toxic waste in Koko by an Italian in collaboration with some Nigerians has given urgency to the need to formulate an up-to-date policy and legislation on this. Such legislation will build upon the S & T policy and strategies.

The importance of international exchange cannot be over-emphasized as no area binds mankind more together and calls for greater co-operation than the need to apply science and technology to harness the bounties of nature to make the world a better place for all to live in. It is interesting to note that Nigeria's stand on the importance of international co-operation, especially by African ISTP, was widely accepted and adopted at CASTAFRICA II. At the regional and sub-regional levels, Nigeria has been involved in the establishment of the African Regional

Centre for Engineering Design and Manufacture (ARCEDEM) at Ibadan, Nigeria; the African Regional Centre for Technology (ARCT), Dakar, Senegal; the African Regional Aquaculture Centre (ARAC), Port Harcourt, Nigeria and the West African Rice Development Association (WARDA) Monrovia, Liberia. She maintains bilateral scientific co-operation agreements with some developing countries like Cuba, India, Korea and Brazil and developed countries like the U.S.A., USSR and Britain. Multilateral co-operation is maintained in the Commonwealth Science Council, for example.

The need for a national platform for integration by representatives of the various sections of the community underlies the need for a National Council of Science and Technology. It was felt that all the States and sections of the community that are directly involved in the S & T programme should have such a common platform where ideas could be exchanged and areas needing priority attention identified. Various shades of interests were thus expected to be reflected. Though similar in name to the now defunct Nigerian Council of Science and Technology, the present Council is different and will operate under the FMST.

CHAPTER 3

ORGANIZATION

Structure

3.1 The Institutions for Science and Technology Policy's Position in Government Structure

On its creation by the National Science and Technology Act, 1980, the FMST started off with six departments, namely:

1. Administration
2. Science & Technology Planning, Programming and Evaluation
3. Agricultural Sciences
4. Industrial Sciences
5. Medical and Natural Sciences and
6. Technology Transfer and Education

Twenty-two research institutes came under the direct supervision of the Ministry. In addition, the National Office of Industrial Property was transferred to it from the Federal Ministry of Industries.

During the period from January 1984 to August 1985, when the FMST was merged with the Federal Ministry of Education, the number of Departments/Division increased from six to nine; but following re-organizations, this number now stands at eight (see below).

The Federal Ministry of Science and Technology is headed by a Minister of Cabinet rank who is appointed by the President. Since its creation in 1980, four different persons have served as Ministers. The present incumbent was appointed in 1985. Under

the new Civil Service reforms introduced early in 1988, the Minister has become the chief executive and chief accounting officer of each Ministry. He is a member of the National Council of Ministers which comprises the President, the Chief of General Staff (who ranks next to the President), the Attorney-General of the Federation and Minister of Justice. It is charged with executing the general policies of the government within the framework determined by the Armed Forces Ruling Council.

There is a Director-General for the Ministry (formerly known as the Permanent Secretary) who is a political appointee and the bureaucratic head of the Ministry. He oversees the overall implementation of all policies of the Government to whom he owes total allegiance.

Immediately below the Director-General are eight Sectoral Directors (See Organigram)

3.2 Sectoral Articulation

The list of the incumbent directors and their departments is as follows:

1. Dr. S.A. Adetunji, Director, Agricultural Sciences.
2. Dr. O. Ogunye, Director, Medical and Pharmaceutical Sciences.
3. Dr. T.I. Obiaga, Director, Industrial Technology.
4. Mr. V.O. Sagua, Director, Science and Technology Information.
5. Dr. A.J. Coker, Ag. Director, Energy Research and Natural Sciences.
6. Mr. S. Abdullahi, Ag. Director, Planning Research and Statistics.
7. Mrs. B. Okunsanya, Director, Finance and Supplies.
8. Mr. M.O. Asielue, Director, Personnel Management.

Altogether there are 23 functional Research Institutes under the FMST. They are:

1. Agricultural Extension and Liaison Services (AELS), Ahmadu Bello University, Zaria,
2. Cocoa Research Institute of Nigeria (CRIN), Ibadan,
3. Federal Institute of Industrial Research (FIRRO), Oshodi, Lagos,
4. Forestry Research Institute of Nigeria (FRIN), Ibadan,
5. Institute for Agricultural Research (IAR) A.B.U. - Zaria.
6. Institute for Agricultural Research and Training (IAR & T), University of Ife, Moor Plantation, Ibadan,
7. National Institute for Freshwater Fisheries Research, (NIFFR), New Bussa,
8. Lake Chad Research Institute (LCRI), Maiduguri,
9. National Research Institute for Chemical Technology (NRICT), Zaria,
10. National Animal Production Research Institute (NAPRI), Shika Zaria,
11. National Cereals Research Institute (NCRI), Badeggi, Niger State,
12. National Horticultural Research Institute (NIHORT), Ibadan,
13. National Institute for Medical Research, (NIMR), Yaba, Lagos,
14. National Office of Industrial Property (NOIP), Lagos,
15. National Root Crop Research Institute (NRCRI), Umudike, Umuahia,
16. National Veterinary Research Institute (NVRI), Vom, Near Jos,
17. Nigerian Building and Road Research Institute (NBRI), Lagos,
18. Nigeria Institute for Oceanography & Marine Research (NIOMR), Victoria Island, Lagos,
19. Nigerian Institute for Oil Palm Research (NIFOR), Benin City,

20. Nigerian Institute for Trypanosomiasis Research (NITR), Kaduna,
21. Nigerian Stored Products Research Institute (NSPRI), Ilorin,
22. Projects Development Agency (PRODA), Enugu.
23. Rubber Research Institute of Nigeria (RRIN), Iyanomo, Benin City.

In addition, there is a National Institute for Pharmaceutical Research and Development at Abuja, but this has not become fully operational. There is one centre for Genetic Resources and Biotechnology under the Ministry. The Minister may, with the approval of the President, establish more research institutes. FMST also co-ordinates the work programmes of four University Centres of Excellence in energy research (two each for solar energy and nuclear energy), but the universities and the researches undertaken therein fall within the main auspices of the National Universities Commission and the Federal Ministry of Education.

Analysis and Commentary

The organization of the Research Institutes whereby they all fall within FMST has the potential to facilitate the proper co-ordination of their activities and avoids the situation in the past in which some of them operated under different Ministries thus making co-ordination at the national level somewhat complicated. At any rate, it is neither possible nor desirable to completely place all S & T endeavours under one umbrella; but unless there is proper and effective co-ordination, collaboration and linkages between those concerned, there is a danger that efforts will be dissipated and researches duplicated leading to unnecessary rivalry and waste at a time when prudence is called for. The present structure appears to have introduced safeguards against this.

One area in which inter-ministerial and extra-ministerial co-operation has been most marked is in energy research where recently an elaborate body, the National Energy Commission, was constituted to advise the Government and to plan and co-ordinate all aspects of the nation's energy policy. FMST is represented on the Commission, but it is to report directly to the President. (See Organigram).

3.4 Policy-Making Body

The structure of FMST has been described. In the execution of policies and programmes, the Minister is assisted by the Director-General and the Directors who meet regularly as a Board.

A Committee of Directors of Research Institutes (CODRI) also meets regularly with the Minister to brief him on the state of affairs and the programmes of the respective institutes and to offer suggestions on policy matters. Reports of development, inventions and progress on the institutes' research are reviewed and the possibilities of linkages and collaboration and further affiliation with other institutes considered. This organ though recognised by the government is purely informal and has no policy-making powers.

At the Research Institute level, the policy-making body is the Governing Board whose duty is to determine: (a) the broad policy for the medium-term plan of the institutes in line with their mandates; (b) the mechanism for monitoring and reviewing research programmes in order to keep them on course and (c) how resources are to be efficiently utilized. In order to achieve this, each Governing Board is expected to:

1. prepare a programme of research for its institute;
2. review the programmes for each year together with the

- expenditure estimates;
3. submit the programme and estimates of expenditure for the approval of FMST;
 4. carry out the programme of research approved by the Ministry;
 5. arrange the preparation of annual reports and accounts to the Ministry;
 6. make suitable arrangements for the application of the results of the work of the Institute.

Governing Boards are also expected to explore alternative sources of income for their institutes and collaborate with other institutes in any way considered relevant to theirs.

The day to day management of the affairs of the institute is the responsibility of the Executive Director, acting in accordance with the policies of the Institute. He/she is appointed by the Minister and must have a wide experience relevant to the Institute. Most institutes have an Assistant Director. Communications to and from the institute go through the Director, while those to and from the Board are routed through the Chairman. Members of the Governing Boards are appointed by the Minister with the President's approval.

3.4.1 Committees

Like all Federal Ministries, FMST has a Senior Management Committee which is statutory and is required to meet every Monday morning. Its membership comprises all officers on Grade Level 14 and above. The Ministry operates with several ad hoc Committees as the need arises. An example is the Task Force Group on Techno-Economic Classification of Foundries which was constituted in 1986 and is required to prepare a feasibility study on different classes of foundries in Nigeria, following the

submission to FMST of the report of the National Committee on Foundry Development.

The use of committees, though authorised by statute, is not mandatory for all research institutes, NOIP for instance, has no standing committees, but many of them operate with one or more standing committees. All the research institutes that responded reported using an ad hoc committee whenever the need arose.

3.4.2 Departments

There is no uniform structure in the departmentalization of research institutes. Typically, however, there are Departments of Administration and Planning, Library Services and Finance. Departments may be created according to the peculiarities and need of each institute. In the case of the Nigerian Institute of Oceanography and Marine Research, for instance, there are separate Departments of Marine Biology, Fishing Technology, Fish Technology, Marine Geology and Geophysics, Physical and Chemical Oceanography, Fisheries Statistics and Economics, the Federal Fisheries School and Aquaculture.

3.4.3 Personnel

The total estimated number of personnel employed in FMST in 1988 was 667 (up by 2 from the 1987 figure) of which 43 were in the salary grade level 14 - 17; that is, Senior Management Cadre.

It is not possible to ascertain how many of those employed in the Ministry are professionals. Although the details of the approved budget for each year show the number of persons in the various salary grade levels, this information is not helpful to determine what professional qualifications are held by persons within a given salary level even within the same department.

The Governing Board of each Research Institute is empowered by the National Science and Technology Act to employ staff as may be necessary for the effective discharge of the functions of the institute. The board also exercises disciplinary power over the staff. It was not possible to ascertain the personnel level in all the research institutes, but a list of professionals supplied by the respondent institutes is contained in Appendix 1.

3.5 Analysis and Commentary

The composition of the entire ISTP structure has been in a state of flux in the recent past. This is not surprising in view of the fact that the components have been subject to a series of reorganizations to enhance performance. This is true of the structure of FMST itself and of the research institutes, especially their Governing Boards, which were dissolved in August 1983. The absence of Governing Boards has, without doubt, hindered performance and made recruitment and staff discipline difficult. Now that this important machinery in the ISTP structure has been put in place, it will no doubt have an impact on their performance. It is remarkable in this regard to note that competence and individual merit were the criteria for selecting board members - a departure from the erstwhile appointments which were made on political grounds.

3.6 Linkages

3.6.1 (a) Links with other S & T Institutions

The forms of affiliation between institutions are not clearly defined, although links exist between the various research institutes and research centres in the universities. In fact, the Minister has endorsed such affiliations right from the board level in order that the various institutes may be able to share experiences, solve common problems, collaborate on inter-related

activities to ensure that constraints are removed timely and activities engaged on are those approved.⁷ The nation's research institutes, he charged, must work as a family.

Some research institutes are affiliated or otherwise informally linked to the universities. Typical of this arrangement is the relationship between Ahmadu Bello University, Zaria, and the research institutes affiliated to it. This form of integration facilitates the mobility of research staff either way. However, the funding of the research institutes remains the responsibility of FMST.

In the case of NIOMR, there is an affiliation with the Rivers State University of Science and Technology such that the post-graduate training of staff and long-term joint research programmes can be maintained without any administrative links between them.

3.6.2 Links with the Productive Sectors

The FMST supports the exploitation of local raw materials and the development of indigenous technology through targeted research and development programmes for various sectors of industry such as agro-allied (wood, leather, textiles, rubber and paper) chemicals, food and beverages, building materials, metal work and engineering. The productive sector is encouraged to seek information and the necessary assistance in these areas from the relevant research institutes. In order to foster this link between research institutes and the private sector, the Government in November, 1987 established by Decree 9 a Raw Materials Research and Development Council whose duty was and is to co-ordinate research efforts in raw materials acquisition, exploitation, conservation and development. The Council was formally inaugurated in February, 1988.

In the agricultural sector, the State Ministries of Agriculture have been encouraged to maintain strong links with research institutes as a way of revitalizing their agricultural extension services to the local farmers.

3.7 Analysis and Commentary

Collaboration and linkages are crucial for the optimization of research efforts at the various institutes. At the moment, the linkages which exist are weak and tenuous both amongst the research institutes themselves and between them and the productive sector. No formal structure has been established to enhance this vital element in the organizational system. The existence of informal opportunities for mutual consultation helps to avoid unnecessary rivalry. The linkages between the research institutes and the productive sector are particularly necessary because they are the major channel through which the benefit of research output can be put into the practical realisation of the needs of the nation and so ensure that the aspect of the national policy which stresses the exploitation, processing and utilization of the nation's material resources for self-reliance and sustained growth is attained.

3.8 Powers

3.8.1 (a) Statutory Powers

The statutory power of FMST to exercise its functions and enforce S & T policies derive from section 1 of the National Science and Technology Act 1980 and as contained in schedule 1 thereto. Clause 13 of the schedule vests in each research institute the power to take such decision and enter into such transactions as, in its opinion, are necessary for the proper discharge of its functions. This is in addition to such additional specific powers as may be conferred by the mandate of each research institute. Other clauses in the schedule deal with

matters such as establishment, functions, the governing board, committees, director, employees and financial provisions.

The power of FMST over the research institutes derives from the fact that the Hon. Minister constitutes their governing boards, approves their work programmes and controls their funding.

3.8.2 Perceived Powers

FMST does not seek extra power beyond those it now enjoys. It does not suffer any serious rivalry from other agencies or departments of Government. The research institutes are also content with their general powers, which allow for flexibility and the exercise of discretion.

3.9 Commentary

FMST's position in the structure of the Government enables it to command the requisite powers to ensure the execution of the nation's S & T policy. This situation is likely to remain, unless the basic organizational structure is changed.

CHAPTER 4

ACTIVITIES

Planning

4.1 Policy Development

The development of policy on S & T is the responsibility of the Government acting through the appropriate agency - in this case FMST. Indeed, as noted above, the nation's S & T programme was for many years operated without any well articulated and formulated policy until 1986 when amends were made. They found expression in a 34 page publication covering four broad headings:

1. National S & T objectives and policies
2. Financing of S & T activities
3. Research and Development and
4. Application.

In an effort to ensure consistency between the programme of activities of the research institutes and the national policy, FMST recently embarked on a re-organization exercise of the institutes.

The research institutes covered in this project were established by separate instruments, status or mandates which defined the type and range of their activities. Some of them are actually older than FMST although now reorganized and moved to the Ministry. The programme of activities of the research institutes is required by statute to be conducted consistently with and in furtherance of the objectives and directives of the FMST. It must, consequently, be approved by the Minister.

Responses to Questionnaires indicate that no policy development takes place beyond the mandate or instrument setting up each institute. However, since each institute was established in order to satisfy specific local needs, the policies and programmes undertaken by each are usually geared towards meeting the identified need for an S & T input. For instance, the research institutes in the health sector are involved in the development of human vaccine and research into traditional medicines, while those in the industrial sector are engaged in the processing of baby foods, drinks and beverages, bread and confectionaries from composite flour derived from the local root crops, grains and cereals such as cassava, corn, sorghum and soyabeans

4.1 Programming

The programming of the activities of each institute is usually influenced by the level of funds received from the parent Ministry. The activities are heavily dependent on FMST funding and this is exacerbated by the fact that most of the institutes do not receive funds from external sources. Notable exceptions are the National Veterinary Research Institute, Vom, which has received funds from FAO and the Directorate for Food Roads and Rural Infrastructure (DIFRRI), an agency of the Federal Military Government. The National Office of Industrial Property also has received funds from UNIDO. In both cases, the actual amounts received could not be ascertained. NIOMR has also received a large amount of equipment and facilities from the Japanese Government.

4.2 Co-ordination among S & T Institutions

Since research institutes are autonomous and separate from one another, their activities are pursued without any formal linkage or collaboration. Nevertheless, and as has been mentioned

elsewhere in the report, collaboration at a local and informal level does occur. For instance, the NRCRI Umudike, maintains some collaboration with PRODA with respect to the fabrication of processing machines and with FIRRO on the processing of root crops. The NVRI and Vom also indicated that they collaborate with related institutes, but these were not specified.

4.3 Reconciliation and Harmonization of S & T Activities with the National Policy

Apart from the very limited degree of collaborative activities between institutes, there appears to be very little overlap between their functions. Each institute confines its activities to its specific mandate, while the reconciliation and harmonization of S & T activities with the national policy is left to FMST. Over the years, some modifications, extensions or variations have been made to the mandate of some of the institutes, the most recent of which involved the re-organization and change of name of the former Kainji Lake Research Institute and the Leather Research Institute of Nigeria into the National Institute for Freshwater Fisheries Research and the National Research Institute for Chemical Technology respectively. Also, a new national mandate on agricultural extension was given to AELS, Zaria. These changes were effected in order to streamline the activities of the affected institutes so as to ensure greater effectiveness and productivity consistent with the national policy.

4.4 Programme Implementation

The programmes of the institutes are of a continuous or long-term nature. There are, in some instances, ad hoc programmes, but the institutes have a free hand in setting the time-table for completing their projects. This often depends on the level of requisite manpower, funds and facilities at their disposal.

4.4.1 Monitoring and Evaluation

The institutes' governing boards have a primary responsibility for monitoring and evaluating the programmes of their charges. The director serves as a useful link between the research staff and the board of each institute.

The committee system which is utilized by many of the institutes covered appears to play an important role in ensuring the execution of the institute's programmes. Examples of committees used by more than one of the institutes are the Research Committee, the Staff and General Purpose Committee, the production and Management Committee and the Job and Manpower Appraisal Committee. There are various ad hoc committees relating specifically to the needs of the institutes (e.g. Price Verification Committee (LCRI), Pets and Animal Control (NIFFR) and Staff and General Purpose Committee (NVRID)).

The system of filing annual reports to FMST is intended to ensure that the Ministry is apprised continuously of the activities of the institutes. However, it is observed that such reports are not produced regularly by most of the institutes and that, even when published, they are usually several years late. Incidentally, FMST itself is under statutory duty to produce an annual report; but this is not done, which may explain its moral difficulty in compelling the institutes' compliance on this score.

4.4.2 Advice

The research institutes are statutorily required to publish scientific and technical journals and annual reports. The annual report is an especially important means of disseminating information on the activities, achievements, and difficulties of

organizations, particularly for research institutes which are expected to reach out to the widest possible number of people. When it is considered that inadequate dissemination of S & T achievements is seen by many as a major weakness in the S & T policy, the necessity for these publications cannot be over-emphasized.

Currently, there are plans to develop data banks and information centres on all aspects of S & T, including the use and application of new and emerging technologies. Such facilities can be helpful to the Government in formulating policy and in its effort to prohibit the import of those products and technologies that are locally available or otherwise monitor and supervise the importation of foreign technology. In this connection, NOIP is by statute conferred with the powers to screen and register contracts for the transfer of foreign technology which is consistent with the national interests. It issues guidelines on the terms and conditions which have to be satisfied by the parties to the transfer of technology agreements in order to qualify for registration. To ensure compliance with these conditions, the National Office of Industrial Property Act 1979 provides that foreign exchange remittances will not be approved in respect of contracts unless they have been registered by the National Office. The law has, however, failed to ensure compliance by all for lack of compulsion.

4.4.3 Advocacy

Programming research activities especially on a long-term basis is difficult and often impracticable because of the constraints of manpower, finance and equipment. On the other hand, research institutes enjoy much discretion and do not appear to be too hampered by bureaucratization (at least in the actual research process), although related problems cannot be totally eliminated so long as the institutes continue to operate within the civil

service structure. Bureaucracy was cited as a handicap in enforcing discipline and ensuring staff dedication in some of the institutes.

4.5 Commentary

The institutes seem generally satisfied with their mandates and the execution of their programmes of activities. The concern of many of them is that they could have recorded a higher degree of achievement if they had not been handicapped by such problems as a high turn-over among highly skilled top-level personnel, low morale and low funding consequent upon the lean financial position of the country. Although much has been achieved, there is a need to give greater publicity to research results that can be put to use by the productive sector.

CHAPTER 5

GOAL ATTAINMENT

5.1 Planning

5.1.1 Policy Development

The year 1986 which saw the formal adoption of the National Policy is a crucial point from which to assess the development of Nigeria's S & T policy. Since then, there have been many official speeches elucidating one aspect of the policy or the other. Understandably, the Hon. Minister has played an important role in this regard by articulating the Government's stand on and its seriousness about S & T at conferences, symposia and workshops. Some of these platforms were and continue to be organized by FMST solely or in collaboration with interested professional bodies and organizations such as the Science Association of Nigeria, the Nigerian Academy of Sciences, the Nigerian Society of Engineers, Chambers of Commerce and Industry and tertiary educational institutions. This happens very frequently, averaging twice a week. Important S & T delivery speeches have also been made at the inauguration of the various bodies and councils established under the Ministry.

The number of official publications are few. Apart from the National Policy itself, the only other regular publication is the FMST Newsletter, a monthly publication of the Ministry. The coverage of the Newsletter includes selected events involving the Minister, papers or speeches delivered at such events as well as highlights of events concerning S & T such as technical seminars, national and international conferences on S & T and recent publications on the same.

The number of policy recommendations from the S & T institutions across the country are few. Many of these institutions see their roles as being primarily to execute the functions set out in the instruments establishing them. They consider their mandates to be adequate for the time being. It is thought by them unnecessary at this point to recommend new policies.

The institutes do not consider it in their place to recommend new policies. Even FMST does not see any need at the moment to extend the scope of the present S & T policy. If and when the need does arise, there is no doubt (judging from present attitudes) that its recommendations will be given the highest consideration by the Government.

Official speeches emanating from the Minister, the Director-General and the Sectoral Directors are authoritative and represent Government thinking and intentions. They serve primarily as an elaboration of the overall national policy and are, for this reason, deemed very significant in content.

5.1.2 Programming

The official document in which statements on strategies for achieving the S & T objectives can be found is the National Policy. Its contents as well as of the earlier document titled, 'Guidelines on Science and Technology Policy Formulation and Implementation' can be described as significant in the over-all scheme of things in that practically no S & T business is undertaken by the Government now which does not fall within the blue print they established.

There are, however, no set calendars (annual or short-term) as to which S & T activities are programmed. What exists is an

annual calendar of events like conferences, seminars, exhibitions and fairs. The purpose of the calendar, therefore, is not to programme the execution of specific activities or projects but to aid in the logistics and preparation of annual or periodic events.

5.1.3 Co-ordination

Considered against their functions, the overlap between S & T institutions is small. The affairs of research institutes are conducted in such a manner that the spheres of activities are specialised and peculiar to each institute. Where, however, overlaps exist, the Ministry has moved to restructure and re-organize. In a few cases, overlap is deliberate in order to allow for mutual collaboration. This is especially true of research institutes in the agricultural sector, which are in the majority.

5.2 Execution of Programme of S & T Activities

In terms of quantity, the output from S & T institutions is significant in the area of experimental development (i.e. testing, adaptation and refinement of products and processes towards a practical application); it is of some significance in the areas of innovation and scientific research and scientific and technological sources.

In terms of quality, the output of experimental development is again significant; that of innovations is equally of some significance while that of scientific research and scientific and technological sources is insignificant.

The role of FMST in providing resources to the S & T institutions for their activities is very important as most of them are totally dependent on the Ministry for this. Even those

institutions which receive support from external sources still depend for their annual recurrent and capital expenditure and occasional grants on FMST.

As a result of this dependence, FMST plays a very important role in ensuring that the institutions conform to the national S & T programme. Indeed, it is as difficult as it is unwise for any institution to do otherwise than carry out the national policy. Any deviation would be a clear violation of the governing statute and carry unpleasant consequences.

5.2.1 Advice

The number of publications by FMST is small. No option paper on specific S & T issues has ever been released. There is a need to publish and make easily accessible to members of the public the proceedings of conferences where highly constructive ideas on S & T are aired. Such publications would be helpful towards meeting some of the objectives FMST has set for itself of increasing, through its mass movement policy, public awareness of S & T and the vital role it plays in national development and well being.

It is instructive to note that the National Policy which is available to the public at a very moderate price is very important. The Newsletter published by the Ministry is important too in helping to generate interest in the development and direction of S & T efforts. The presentation of the Newsletter appeals to a wide section of the public but the quality would be enhanced if it was printed rather than cyclostyled as of now.

5.2.2 Advocacy

The effective execution of some of the S & T activities has been hampered by inadequate funding. It is important to note too that in the extended 4th National Development Plan (1980-85), Science

and Technology was not accorded the right degree of priority, obviously because FMST was not yet in existence at the time. Nonetheless, it is regrettable that the Plan has not yet been replaced; but the government has now acknowledged that most of the targets set under that and previous N.D.Ps had been over-ambitious and hence could not be attained. It has, therefore, been decided to replace the 5 Year Development Plan with a 3 Year National Development Plan which it is hoped will incorporate more realistic targets. The first of the new Plans is still expected, but at the moment it is not certain what are the contributions of FMST to it. Certain official speeches, however, express optimism for an enhancement in the status of S & T under the new Plan when it comes into effect.

CHAPTER 6

STRENGTHS AND WEAKNESSES

6.1 Goals and Functions

A number of measures have been taken by the Government in recent years to ensure the realisation of the S & T goals of the nation and the effective discharge of the statutory functions of FMST. They include:

1. The establishment of a National Science and Technology Fund by Decree in November 1987, which was intended to encourage innovative scientific and technological activities and develop research results for commercialization by both the public and the private sectors.
2. The establishment of a Raw Materials Research and Development Council to co-ordinate efforts in raw materials acquisition, exploitation, conservation and development.
3. The increased allocation of resources to technological manpower development.
4. Tax incentives for R & D and deduction for contributions to the National Science and Technology Fund.
5. The provision of alternative sources for financing R & D activities.
6. The establishment of the National Council for Science and Technology which will ensure the effective diffusion of science and technology in all States of

the Federation and act as a forum for considering policy issues that affect the overall development and utilization of science and technology in all facets of life in the country.⁸

8. The establishment of a National Science and Technology Complex in the new Federal Capital Territory, Abuja, which is expected to form the hub of the nation's S & T establishments.

The various research institutes have developed new products and processes, and designed and fabricated new machines (See Appendix 2). What is lacking is the means to bring the benefits of these S & T advances to the citizenry in such a way as to enhance their conditions of living. The private sector that ought to commercialize these products and ideas does not seem to have been acculturated towards the local S & T and prefers instead to import technologies. A major weakness, therefore, is the failure of the national policy so far to acculturate the entire society towards S & T to ensure that it permeates all aspects of life.

The S & T efforts have been concentrated in agriculture and agro-related areas to the neglect of high-technology, for example. While this is understandable in view of our priority needs and comparative advantage, it is hoped that more emphasis will be put on hard-core areas of engineering and technology.

The absence of any time frame for specific targets in the national policy makes it difficult to correctly assess ISTP's success. It is hoped that future revisions of the policy will set definite targets and be less general in the selection of policy programmes.

6.2 Organization

6.2.1 Structure

Considering the different structures which ISTP may take, FMST is closest to the horizontally-integrated structure. In other words, the Ministry has an across-the-board responsibility for S & T policy in all sectors and is responsible through the Minister to the President.

The present structure has evolved through a long process spanning several decades (see History) and has been informed by the experience garnered up from each stage of the development of the institutional arrangements leading up to the re-instatement of the FMST in 1985.

The existing structure facilitates to a great extent the performance of the statutory functions of FMST in its executive responsibility of promoting and developing science and technology and the initiation or formulation of a policy relating to research in those areas. With the primary ISTP structure being at Ministerial level, direct access to the President is assured and the fact that the Minister is a member of the National Council of Ministers ensures S & T a place on the highest pedestal in the national affairs. In turn, this ensures that such statutory functions as advising the Government on national science policies and priorities and on scientific and technological activities generally are carried out. It also means that the Ministry is able, without the need for further assurance or authority from any outside body, and by virtue of its control of the funding, to carry out other statutory functions like supervising and co-ordinating the activities of research institutes and to take steps to facilitate the application of the results of scientific and technological research by the Government and its agencies at both the Federal and State levels.

It is to be noted that such weaknesses to which we have already referred as the FMST's inability to carry out statutory functions like publishing annual reports, deciding on its programme in the National Development Plan and determining its vote in the National budget, are not a result of the statutory structure of the Ministry. Rather they are a common characteristic of government departments generally.

6.2.2 Composition

The present internal organization of FMST is, generally speaking, satisfactory. Recently, a reorganization exercise was carried out in the structure of the sectoral directorships of the Ministry and involved the separation of Natural Sciences from Medical Science resulting in two new departments: a Department of Medical and Pharmaceutical Science and a Department of Energy Research and Natural Sciences. In all, there are now eight sectoral directors.

Also, a number of research institutes have been re-organized and streamlined resulting in the redesignation of many of them. Their priority now is to consolidate the existing internal arrangements in order to make a success of the various challenges posed to them.

The rather large number of research institutes involved in S & T has not gone without criticism. However, the choice is between concentrating all aspects of S & T under one body or decentralising under the present arrangement. There is little doubt that, considering the present level of our infrastructures and given the tendency in large public institutions in developing countries generally, over-centralisation would be counter-productive. However, if decentralisation is to succeed, monitoring the units must be taken seriously.

6.3 Linkages

The links between FMST and the research institutes are not merely statutory but practical. They have enhanced the degree of co-operation and collaboration amongst the major organs in the implementation of the S & T policy. However, linkages with the productive sector remain weak, with the result that the various achievements of the research institutes have had a very little impact on the lives of the people. Mention has to be made of the linkages between the universities which, together with the research institutes, constitute the repository of knowledge in S & T in the country.

The other Federal and State Ministries' involvement is also important in the entire national endeavour. Through such a wide linkage, research results can be passed on to the public for utilization. It is interesting to note that new discoveries in the field of agriculture at the universities or research institutes are now passed on to States Ministries of Agriculture who disseminate the information amongst the farmers. In Bendel State, for instance, a series of pamphlets in folder form on new farming techniques is distributed free of charge to peasants and farmers. Public response to these new ideas is enthusiastic and already the results are manifest in the increased yield per hectare for various crops. A high yield variety of crops is also distributed to the farmers.

The linkage between the research centres and manufacturing industries especially remains weak. It is hoped that the various incentives and new national economic policies which emphasise the use of local materials and resources will lead to greater collaboration between the research institutes and industry.

6.4 Powers

The statutory powers of FMST are vast. The executive capacity to discharge its functions without reference to an intermediary authority virtually guarantees effective implementation of the nation's S & T policy.

The arrangement whereby FMST funds the research institutes enables it to enforce accountability on them. Its control is also strengthened by the fact that the Minister appoints the directors and constitutes the Governing Boards.

In all, the wide statutory powers ensure that the FMST is able to implement all aspects of the national policy. However, since S & T activities also take place in other ministries and establishments outside FMST, it cannot be said to have total control of them in Nigeria. Although FMST can count on the co-operation of other ministries in this regard, it has neither incentives nor disincentives of its own to offer to modify their behaviour or attitude, especially where those others consider the matter as falling within their responsibilities. It is in this regard that the National Council on Science and Technology will play the useful role of providing a platform for all those involved at various levels in ensuring the application of science and technology for development in Nigeria. FMST is nevertheless well represented in NCST since the Minister is the Chairman.

With respect to the private sector, FMST has no direct power to compel compliance but can exert influence in the formulation of Government policy affecting them. This relationship is best illustrated by recent happenings in the brewery industry. In an effort to conserve the huge foreign exchange that is spent on malt and barley imports, FMST pioneered, through FIRRO, the use of local cereals (maize and sorghum) for beer brewing, but the industry refused to accept the new technology until the

Government banned the importation of barley. Now they brew beer from local materials and the adverse consequences such as consumer rejection and the astronomical costs which they had anticipated have not been realized.

6.5 Resources and their Utilization

6.5.1 Human

The number of institutions involved in developing and training the nation's human resources in Science and Technology is sizeable. It consists of about 24 universities, 36 polytechnics and 227 technical and vocational colleges. Another 24 research institutes and about 34 other establishments render scientific and technological services, including training.

Although the rate of growth in recent years has accelerated, there is no data on the country's actual potentials. However, it is believed that the target of 200 scientists and engineers in R & D activities per million people adopted by UNACAST in its World Plan of Action and recommended at CASTAFRICA 1 is yet to be achieved in Nigeria.

The dearth of scientists and technologists has thus affected the manpower base of research institutes and weakened their ability to execute their programmes. It exacerbates the problem of high staff turn-over which afflicts the research institutes.

As FMST does not publish any annual report, it is not possible to know the number of professionals in its service in each year. Although the details of the approved budget for each year show the number of persons in the various salary grades, they do not help to determine what professional qualifications are held by them.

However, a survey of the existing manpower in FMST itself at the time of this research revealed the following number of professionals and categories:

| | |
|------------------------------------|-------|
| (a) Doctorate degree or equivalent | 17 |
| (b) M.Sc. | 12 |
| (c) B.Sc. | 8 |
| | <hr/> |
| | 37 |
| | <hr/> |

The figures received from the various research institutes are contained in Appendix 1.

There has been a high turn-over of staff at the research institutes, but it was impossible to establish the number of years each staff had served the institute or FMST before they left the employment.

Since FMST is about 9 years old, the oldest staff would have served the Ministry for that number of years at most. No doubt many of the staff joined from other ministries, government departments, research institutes, universities and other tertiary institutions.

The high turn-over of staff has been a thing of concern to the research institutes, especially at the time when the staff of the ministry and the research institutes were on the Unified General Salary Structure operated by the Civil Service. When the higher University Salary Structure was approved in 1982, there

was a drift from the research institutes to the universities. In 1987, the Government approved that research institutes and FMST should enjoy the same conditions of service as the universities. This has come as an inducement to staff and is bound to reduce the high turn-over rate, although migration to the private sector is likely to continue as salaries there are higher than those of the universities.

The massive devaluation of the national currency (Naira) and the fall in the working conditions and standard of living has given rise to a negative phenomenon - brain drain. Within the past three years or so, many Nigerian scientists and medical doctors have left the country to take up appointments in North America, Europe and Saudi Arabia. This phenomenon will have serious destabilizing effects on the nation's S & T policy programme unless it is halted. A Brain Drain Panel recently set up by the Government is currently studying the problem with a view to finding a solution.

6.5.2 Material

Much of the material resources which the S & T programme received in the formative years, 1963-64, came by way of support from UNESCO. Over the years, the Government has become the main provider of these resources. Owing to the serious economic problems that have prevailed in the last eight years or so, it has become more and more difficult to procure essential material inputs. For instance, it is very expensive to build new laboratories, expand existing ones or procure equipment and reagents most of which are imported. Since the research institutes (like other government departments and parastatals) do not receive any special foreign exchange allocations from the government but are required to compete for their needs in the

foreign exchange market, they can hardly get enough to purchase these essential materials. The result, therefore, is that research has to be highly selective. In many instances, researches cannot be completed due to lack of re-agents and equipment.

6.5.3 Financial

The financing of S & T has been virtually the sole responsibility of the government. The statutory allocation for FMST in the annual budget for 1988 was N102,326,780 as against N54,344,690 in 1987 for Recurrent Expenditure. Allocation for Capital Expenditure for both years was N32,245,00 and N6,954,532 respectively. (See Appendix 3 for a comparative Table of annual allocation to FMST).

The substantial increase in the 1988 budget over the previous year's may suggest a big rise in the proportion of allocation to S & T in the total sectoral allocations. This is not so, however, as the proportion of the FMST vote in 1988 remained 0.5% as against 0.3% the previous year. It represented a net increase of only 0.2%. The increase in the amount of money allocated was achieved by a deliberate government attempt to 'reflate' the economy by deficit budgeting, which put more money into all areas of the government.

Definitely, with more money available in 1988, the Ministry and research institutes have been able to complete long-standing projects and to develop some vital undertakings.

The private sector has contributed very little to the funding of research as indicated already. It is not surprising, therefore, that the financial base of the nation's S & T policy

is weak. The Lagos Plan of Action recognising the need for adequate funding of S & T recommended that each Member State spend at least 1% of their GDP annually on S & T activities. Even though this figure is modest compared to those of countries like the U.S.S.R., U.S.A. Japan and West Germany amongst the developed countries and India, Brazil and the Democratic Peoples Republic of Korea, amongst the developing countries, it is yet to be attained in Nigeria.

The national policy provides for a tripartite system of funding with the Federal Government and its agencies contributing 2.5% - 5% of the nation's total annual budget, the State governments 1% of their annual budgets and the private sector through in-house contractual research, import tax, levies on turnover and donations. The idea of a super tax on after tax profits of subsidiaries of multinationals in Nigeria has also been mooted.

Renewed emphasis is now being given to seeking contributions and various forms of financial assistance from foreign governments and through bilateral and international agencies for science and technology development activities.

6.6 Analysis and Commentary

6.6.1 Organization

The achievements of the various research institutes evidences a good sense of priority in that researches are geared towards areas of immediate relevance to the citizenry; principally, food, health and shelter. However, many of the benefits of these achievements have not been realised because of the weak link between the institutes and the populace, especially the private industries. Two reasons can be advanced for this situation. Firstly, the productive sector lacks interest and commitment to research programmes in the research institutes that are of unquestionable relevance to them because they are not involved in the project formulation. They are likely to feel less alienated and uninterested if they are involved right from the moment of conception of such projects to completion and application in industry.

Secondly, research innovations need to be sufficiently diffused to all S & T service establishments and the private and public sectors. In this connection, it is interesting to observe that, amongst the institutes, CODRI provides a platform which minimises the problem of communicating inventions and discoveries. Communicating these to the rest of the public and to industry has, however, been less successful. It is hoped that the practice of organizing public lectures, seminars and especially exhibitions (in view of the poor reading habits and low literacy levels) will help to eliminate this gap in communication.

The problem of human, material and financial resources is first and foremost a problem of attitude and priority and, secondly, one deriving from the present state of the economy. The history of ISTP in Nigeria is a catalogue of struggles to lift S & T from the back-burners to the fore; but the political

will to do this has often been lacking. There are clear indications, however, that the present military government has realized that S & T has to be brought to the fore in order that the nation's human and natural resource potentials can be exploited to develop the country. The process of re-orientating public attitudes towards S & T and introducing them into the thinking process of the populace has begun. The most serious constraint now is finance.

Statutorily, FMST is empowered to liaise with the universities and the federal polytechnics in their educational programmes. This is to ensure that the training of scientists and technologists emphasizes relevance to the nation's S & T priorities as identified and underlined in the national policy. However, the government has the power to create the right kind of financial and career incentives to attract students into science and technology. This may indeed be necessary if the admission quota of 60:40 in favour of science is to be fulfilled in the institutions of higher learning. An essential component of such an incentive package would be the creation of more employment opportunities for scientists and technologists or the provision of enough financial assistance to those of them with an entrepreneurial drive.

6.6.2 Finance

A UNESCO report on the Estimated World Resources for Research and Experimental Development 1970-1980,⁹ ranked Nigeria in the group spending 0.2 to 0.49% of GNP on R & D. It is a sad commentary on the state of financing S & T that the country has not been able

to fare much better nearly a decade afterwards. The financial weakness of ISTP is not surprising in view of its dependence on the Federal Government for virtually all the funds. In contrast,

in Australia, for example, industry funds half of the total R & D and in Sweden such funding is eight times that of the Government. There is very little that FMST can do to increase the size of its allocation in the national budget since it competes for funds with the other sectors of the economy. However, as the National Science and Technology Fund (to which about N10 million had been contributed by November, 1988)¹⁰ grows and as the private sector takes more interest in R & D, it is hoped that FMST will be relieved of this over-dependence as well as the financial constraints in bearing all the burden of implementing the national policy. A useful means of overcoming this handicap is to appeal to international agencies and the Government for assistance in the form of materials and equipment. Indeed, this strategy was endorsed at CASTAFRICA II as a useful line for African ISTP to pursue.¹¹

CHAPTER 7

RECOMMENDATIONS

7.1 Goals and Functions

If Science and Technology are to be effectively applied to the development of society, they must permeate every aspect of the lives of the people. Nigeria's S & T policy appears to have recognized this and it can be truly said that no aspect of national life has been neglected in the formulation of the national policy. Accordingly, the statutory goals and functions which ISTP set out to accomplish are vast and encompass every conceivable area that would affect national development. Despite some commendable achievements in the policy implementation so far, major weaknesses exist in the aspects regarding manpower development and training and the supervision of S & T activities.

Manpower development and training is very crucial because the primary responsibility for applying S & T to development must be that of Nigeria, not foreigners, and unless the indigenous manpower base is strengthened, an important component of the system will be lacking and the goals of S & T as a whole threatened. The government has recognized this and has sought to encourage the growth in S & T manpower through an admission policy into higher institutions which is biased in favour of science and technology and through the establishment of many Universities of Technology and two Universities of Agriculture. The increased manpower will, hopefully, begin to be felt sooner than later. It has been observed, however, that the opportunities for S & T education have not been fully utilized perhaps due to a lack of interest or motivation by students, considering the career opportunities or rewards. It is, therefore, recommended that preferential financial inducements or salaries be paid to scientists and technologists, although

details of such a system would have to be carefully worked out by the Government in order that it does not have negative impacts on other sections of the community.

Industrial attachment in relevant establishments should be made an important aspect of the training for science, technology and engineering for a sufficiently long period of time for students to acquire the relevant skills. Where this programme already exists, it should be intensified. This would provide young graduates with enough confidence and experience to generate their own employment (as the government now constantly admonishes them) and to be less dependent on the public sector for employment. A lower rate of unemployment amongst S & T graduates will, in the light of current economic difficulties, serve to attract many students into these areas.

More efforts should be made to publish annual reports regularly and on time both by FMST and the research institutes. Annual reports can provide a veritable source of information to local and international users. Indeed, the entire information network of the nation's S & T needs to be invigorated. It is interesting to note that FMST is now handling, as a matter of priority, the building of a national S & T data bank and a central library to be headquartered at the National Science and Technology Village at Abuja. Through such a facility, international exposure can be given to our S & T experts and their accomplishments, just as they will be able to benefit from a mutual information exchange with the other countries' agencies and information centres that are linked to ours.

The patent system and legislation regulating the transfer of foreign technology should be strengthened in areas that may directly or indirectly discourage local efforts in order to eliminate the loopholes already identified.

7.2 Organization

7.2.1 Structure

The present structure whereby the primary responsibility for the nation's S & T policy is under a Ministry (FMST) is not without its drawbacks and has indeed been criticised in some quarters (including the Nigerian Society of Engineers¹²) with calls for its abrogation and replacement by an Agency under the Presidency. This structure would be similar to the defunct NSTDA whose Chairman was the Chief of Staff, Supreme Headquarters; but is no guarantee that the same problems of neglect as befell the NSTDA will not recur.

As has been indicated in this report, part of the bane of ISTP in Nigeria has been the very frequent rate of change. Although changes have been motivated by the desire to correct identified deficiencies in existing institutions, there is no doubt that a greater stability in the system would have resulted in more success. It is, therefore, recommended that the present structure should be allowed to remain and to stabilize, although certain changes need to be made within it. Firstly, whereas bureaucratic problems cannot be completely eliminated so long as it remains within the Civil Service structure, a greater degree of freedom of action should be allowed FMST and especially the research institutes.

Secondly, the States Government should be more involved in the S & T policy (now perceived as an essentially Federal Government affair) by strengthening the S & T departments in their ministries, co-operating with and maintaining closer links with the research institutes and helping to disseminate S & T and diffuse the outputs of research institutes through their information machinery. More should be made of their closer contact with the majority of the population. The Local

Government Councils being closest to the grassroots in the rural areas should also be actively involved in the S & T policy. They do not play any significant role at the moment.

Thirdly, FMST should be seen in the over-all government structure as a powerful ministry. It is not necessary to bring it directly under the Presidency as is done in some countries like China, in order to achieve this. There are already too many agencies or departments under the Presidency competing for attention. The South Korean variant in which the S & T Ministry exists as a kind of Super Ministry would be sufficient in Nigeria.

To conclude, it has to be emphasized that ISTP will be more productive by giving it stability, not structural change.

7.2.2 Composition

The frequent changes in the ISTP structure have also affected its composition. The turn-over of Ministers and Permanent Secretaries (now Directors-General) at FMST and of Directors and top-level manpower at the research institutes has been very high. This definitely has not made for consistency. It is, therefore, recommended that changes in these positions should be as infrequent as possible, although whenever there is a change in the political leadership (which is a common occurrence in Nigeria) changes in political appointments such as those of Minister and Director-General cannot be avoided completely. However, directors of research institutes and members of the governing boards who are appointed on the basis of their individual merit and professional competence should, at least, be allowed a more permanent tenure.

7.2.3 Linkages

There is a need to intensify the linkages in the S & T policy implementation on two fronts:

- (i) between research institutes and the productive sector and
- (ii) between the research institutes and tertiary institutions.

At the moment, a new body, the National Committee on Industrial Research and Development, has been established by FMST to effect this linkage function. The membership comprises representatives from the research institutes, financial institutions, academia and government. This body should be given every encouragement so as to provide a bridge across which problems affecting all the participants can be discussed, resolved and useful information disseminated to the benefit of all.

While it is right to criticize the low involvement of local entrepreneurs in R & D, this should not be carried too far as the Nigerian case is not peculiar. As a result, R & D is more a function of multinationals than of local entrepreneurs due to a number of reasons. Multinationals alone command the financial resources, a 'global' market and a competitive advantage that can justify huge investments in R & D. Local entrepreneurs can contribute best by adapting foreign technology and applying the results of applied research in local institutes (of which there is now an abundance) in industry.¹³

Monitoring the activities at the research institutes needs to be improved upon without necessarily restricting their freedom of action or interfering in their day-to-day affairs. At the moment, the monitoring exercise is one-directional - that is,

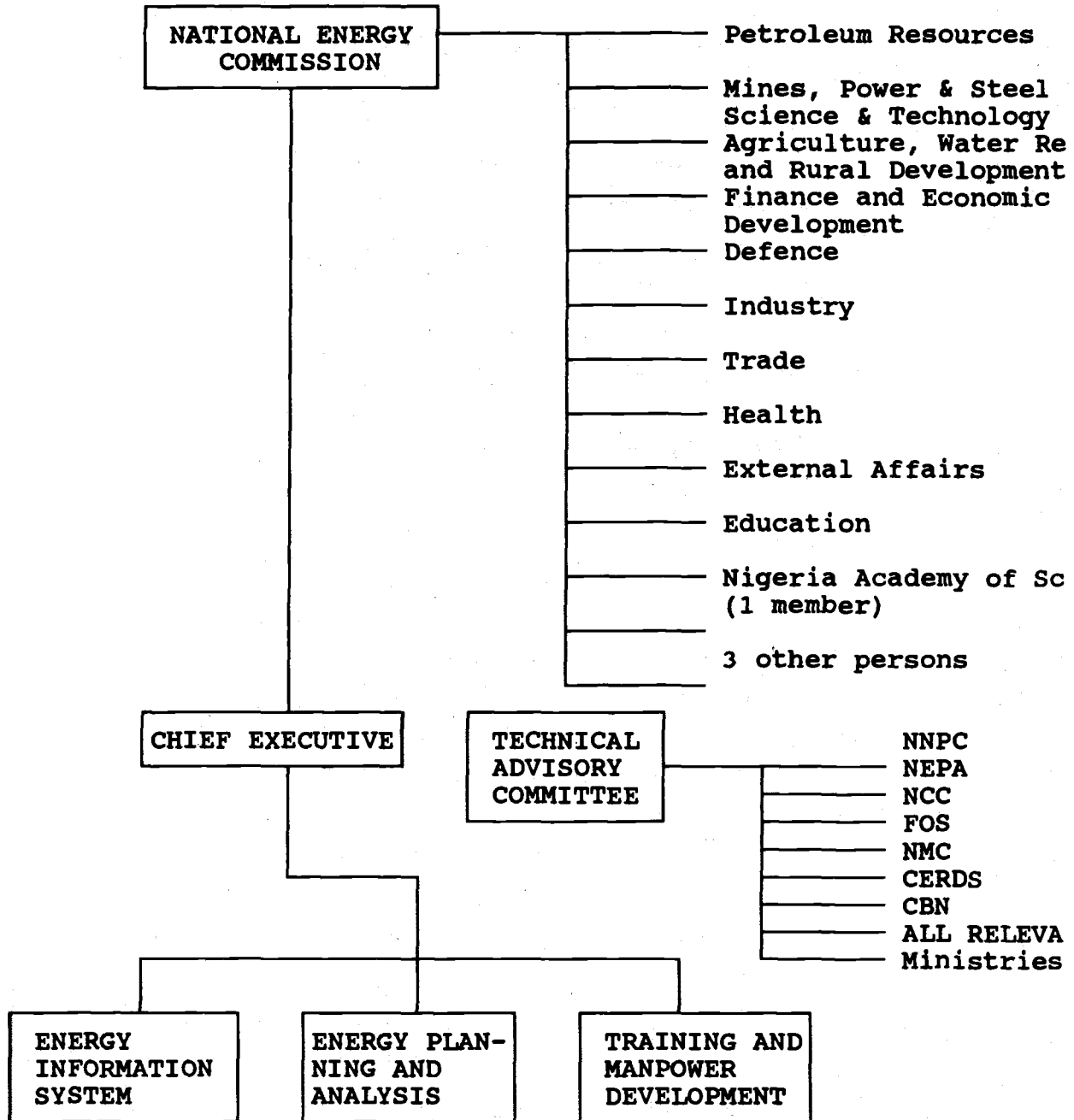
based on information flowing from the research institutions to FMST. It is necessary for FMST to establish a monitoring unit that will exercise greater initiative in this role.

Research institutes should also acquaint themselves with advances in the productive sector in order to avoid dissipating their energy and resources on products and innovations which are already locally produced. A case in point is the porcelain dishes (electric insulators made from local clay) said to have been manufactured as a major break-through by FIRRO recently but which a local manufacturer has been producing on a commercial scale from the same process for many years.

**Organizational Structure for Coordinated
Energy Planning in Nigeria**

M E M B E R S H I P

**President and C-in-C
(Chairman)**



7.2.4 Powers

There is no doubt that the productive sector has not co-operated fully with FMST in its drive to minimize excessive dependence on imports and to encourage greater use of local resources. The Government has all too often yielded to strong lobby and pressure from the organized private sector. It is recommended that the Government should have more faith in the views of ISTP as to the level of national self-sufficiency in those import items that we can do without. Once such items are identified and banned, the Government should resist pressure either to lift the prohibition or to embark on a new policy which negates the essence of the prohibition, as happened in 1988 when, having banned the importation of wheat to encourage the use of local grains, the Government followed this up immediately with huge investments in local wheat production thus not only negating the initial objectives but also giving rise to smuggling wheat flour from across the borders.

7.3 Resources

Given the number of research institutions coming under FMST, the tertiary institutions under the Federal Ministry of Education and S & T establishments like the Railways, National Electricity Power Authority and Petro-Chemicals, it can be truly said the nation's human and material resources in S & T is satisfactory and that there is room for optimism in the future. However, the brain drain which has assumed an alarming dimension in the last two years seems to cast grave doubts on this optimism. It is gratifying to note that the Government has recognized the gravity of the situation and has indicated its readiness to halt the trend. The major reasons for this trend are well-known. It is hoped that the Government will provide the necessary basic facilities in the work places that will provide the experts with job satisfaction and also give enough financial inducements and

recognition to make it less tempting to move overseas. Much of this demands a strong political will on the part of the leadership.

The financial resources provided for S & T over the years has been very meagre as we have seen. In the spirit of self-sustenance, it is recommended that research institutes be permitted, if not obliged, to market their products and services so as to generate part of their funds. This will lessen their dependence on the Government. Already, institutions of higher learning have established a precedent by operating consultancy units with the government's active support and encouragement. Such independent revenue generation is consistent with the government's policy of reduced public spending through partial or complete withdrawal of subsidy from parastatals, privatization and commercialization which are major components of the present Structural Adjustment Programme. However, commercial operations by research institutes (as indeed public corporations) must be handled with extreme caution and a proper balance maintained in order that their primary purpose is not lost at this critical period.

CONCLUSION

The experiences of Europe, North America, Japan and nearly developed countries like South Korea and Taiwan have brought into full consciousness in developing countries the imperative to judiciously apply science and technology to harness the resources with which nature has endowed mankind within their respective territories. In Nigeria, it has been recognized that in science and technology lie the answers to the myriad of problems which have to be overcome in order to enhance the socio-economic conditions of the people. After several decades of groping for

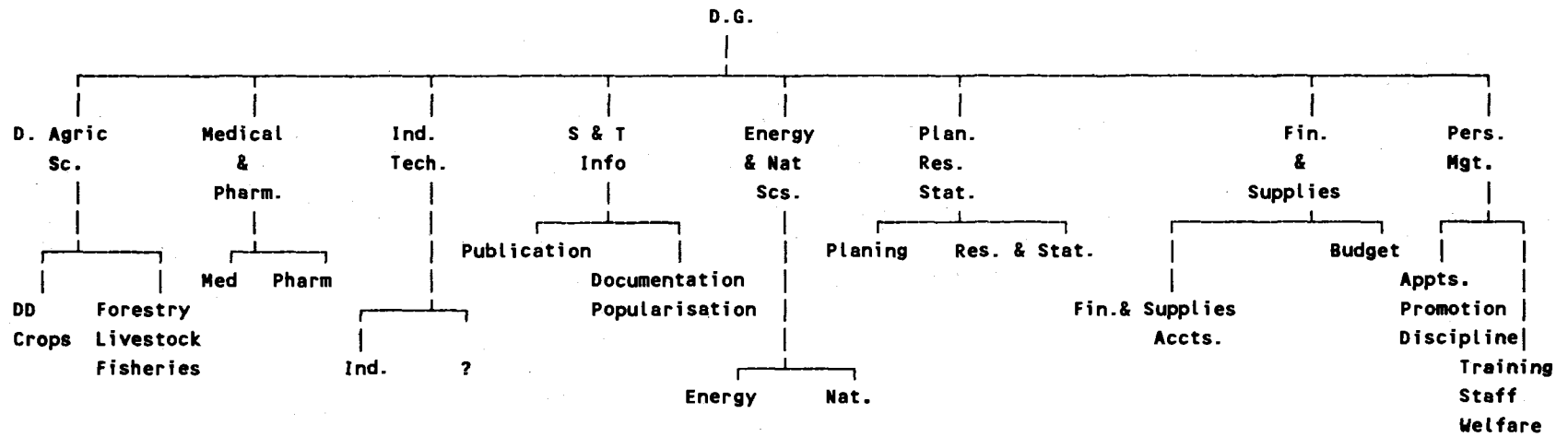
an appropriate modality for the development of the nation's S & T, FMST was established in 1980. Despite a number of set-backs, it has been able to conceptualize a national policy which can be fairly described as comprehensive. It touches every conceivable aspect of the national life and there is little doubt that, if the goals set out therein are fully attained, the standard of living of Nigerians will be enhanced and the country's status in the international community raised.

That FMST, as the primary ISTP in the country, has carried out the policy implementation with sincerity and dedication is beyond dispute. The research institutes have recorded many achievements, while FMST has been able to give prominence to S & T in national affairs so much so that hardly a day passes without a major news item in the media about one S & T event, invention or break-through or the other. On the contrary, major weaknesses exist in the areas of linkages, monitoring and funding of S & T. This report has made recommendations on how these problems can be remedied. There are no easy solutions and there is little the Government can do in the face of competing demands by other sectors. However, if the priorities are set right, more attention can be given to S & T than is now the case. An example of misplaced priorities is the fact that Defence continues to get a higher allocation in the national budget every year, whereas the country can do with a smaller military. It must be said that the present Government has made bold efforts to systematically reduce the Defence budget in the past few years. Nevertheless, more savings can be made from this source alone, if the political will is present. Indeed, more than anything else, the future of S & T in Nigeria will depend on the readiness of the leadership to exercise political judgement in favour of S & T in the national life. Investment in S & T should be seen as an investment in the future well-being of our people.

It is encouraging to note that FMST is aware of the immense challenges before it and is under no illusion that the current national S & T policy framework is perfect. On its own initiative, it set up an internal panel in 1987 to review the structure and operation of ISTP. The panel submitted its report¹⁴ in July, 1988; but this is still restricted and no policy statement has been issued yet about it. The interest which was shown by the Honourable Minister and top officials of the Ministry in this project also attests to their receptiveness to ideas which will enhance the implementation of the national S & T policy. If this report does make any contribution in this direction, all the efforts put into it will have been worthwhile.

Finally, I wish to thank most heartily, the United Nations Economic Commission for Africa and the International Development Research Centre, Canada, for giving me the opportunity to make this contribution to the national efforts.

FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY



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Note

D - Director
DD- Deputy Director

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CASTAFRICA II p. 14 (Report of the Minister).

6. The defects in the statutory framework for screening transfer contracts have been highlighted by this writer in "Law and Policy on the Registration of Technology Transfer in Nigeria" Vol.21 No.5 J.W.T.L. 13 (1987)
7. Lagos Plan of Action (1980).
8. See the Address by the Hon. Minister of Science and Technology, Prof. E.U. Emovon, delivered at the first meeting of the National Council for Science and Technology, in Benin City, 26 November, 1987.
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Appendix 1

Number of Professionals and Staff in Research Institutes

| Name | Ph.D | MS.c | Bachelors | Other Profes- sionals | Total No |
|----------|----------------|------|-----------|-----------------------------|----------|
| Staff | | | | | |
| 1. NRICT | 4 | 14 | 7 | 202 | N/A |
| 2. NIFFR | 1 | 20 | 5 | 19 | 430 |
| 3. NVRI | 9 | 46 | 18 | 175 | 822 |
| 4. LCRI | 1 | 16 | 7 | 109 | 318 |
| 5. NAPRI | 21 | 26 | 30 | 23 | 590 |
| 6. NOIP | - | 5 | 8 | 5 | 104 |
| 7. NIOMR | 9 | 32 | 18 | 20 | N/A |
| 8. NRCRI | No Information | | | | |

Appendix 2

Selected List of Achievements of Research Institutes.

1. Development of high yielding varieties of commonly grown crops and improved production practices including disease and pest control, weed control and use of fertilizer;
2. Development of vaccines, such as, Rinderpest vaccine for cattle and Gumboro vaccine for poultry and balanced poultry and animal feed formulation using local raw materials;
3. Development of a fortified breakfast cereals (Soy - ogi) for infants weaning; beer brewing from malted locally grown sorghum, palm wine bottling and pasteurization and wine from kola nuts;
4. Development of inert gas grain silos and adaptation of traditional storage systems for food storage;
5. Development of prototype machines and mechanical components for local needs (e.g. cassava peeler, crop threshers/sheller, fire clay bricks machinery and science laboratory wares.
6. Development of human vaccines and drugs from local plants and herbs; adaptation of medical equipment and new techniques and strategies to control communicable diseases;
7. Development of improved production of fishery products and mass production of fish fingerlings for distribution to fish farmers.

Appendix 3

Statutory Allocation to the Federal Ministry of Science and Technology (Capital and Recurrent Expenditure)

| Year | Amount | Percentage of Total Budget |
|------|-----------------|----------------------------|
| 1985 | N256,226,650 | 2.02% |
| 1986 | N75,910,880 | 0.5% |
| 1987 | N10,829,493,300 | 0.3% |
| 1988 | N13,809,020,790 | 0.5% |

ACKNOWLEDGEMENT

This report is part of a bigger and broader study on national institutions for science and technology policy in six African countries. It was initiated by the United Nations Commission for Africa and funded by the International Development Research Centre of Canada. The size or content of this national report on Tanzania may not be quite reflective of the invaluable contributions made by various institutions and individuals in its preparation. This compels me to mention some of these, although the list is inexhaustible.

Starting with institutions, I would like to thank the International Development Research Centre for its grant which has enabled this project to produce reports such as this one and whose future support in similar endeavours has the potential of reawakening awareness on issues of development importance. Secondly, I would like to thank the United Nations Commission for Africa for four main things. First for initiating this vital study; second for selecting Tanzania as one of the initial case studies; third, for appointing me team leader for the Eastern African case studies and as a national researcher for Tanzania; fourth and last, but by no means least, for its smooth coordination of the whole project.

In addition to institutions, I would like to mention some of the people who represent, in this context, many others whose time, intellectual and other types of contribution have made the report stronger than it would otherwise have been. The Minister for Planning and Economic Affairs, Dr. Dismas Mbogoro, and the Deputy Minister for Industries and Trade, Dr. Nicas Mahinda, gave me part of their scarce and valuable time and greatly influenced my understanding of the Tanzanian science and technology system. The Director General of the National Scientific Research Council, Prof. A.S. Msanyi, and one of his immediate auxiliaries, Dr. H.F. Bitanyi, were kind enough to allow me access to their documents of a non-confidential nature and made a big

contribution to my research effort. Others include heads of various science and technology services and policy institutions whose candid responses to my questions and questionnaires were very instrumental in shaping my conception of the problems and prospects of the Tanzania national science and technology regime. To all those mentioned and unmentioned, I express my appreciation and acknowledgment of support.

Needless to mention, however, I remain solely responsible for misrepresentations, misconceptions, errors of fact or law and any distortions in my presentation of what is otherwise an encouraging profile of the National Scientific Research Council.

THE OBJECTIVES OF THE REVIEW

The Tanzania National Scientific Research Council was formed in 1968 by an Act of Parliament (no. 51 of 1968) and began operating in 1972. The original idea was conceived at a UNESCO conference on scientific research held in Lagos in 1964. At that time, Tanzania was going through its third year as an independent sovereign state. It had fewer than 600 scientists and had a total of not more than 1500 university graduates. "Scientific research" then was not only a new concept to grasp but was difficult to implement, because of the limited scientific personnel, scarce science equipment and other essential inputs. Four years after the UNESCO conference, the said Act was passed legalizing the formation and commencement of operations of the National Scientific Research Council. Due to financial and other problems, the council was not officially launched until June, 1972.

Between 1972 and 1988, the Tanzania National Scientific Research Council played a significant and dynamic role in Tanzania's economy: it helped in the formation of a good number of research and development institutions; it financed research by individuals and institutions in various fields and areas of a

social and scientific nature; it set up a good number of research projects in important areas of national socio-economic importance, especially in energy; it launched a journal and small bulletins which became very useful in the dissemination of research findings; it organized conferences, workshops and symposia and thereby provided a forum for interaction between researchers, policy makers and operational staff. Most important and significant, it worked out a very ambitious and somewhat comprehensive science and technology policy for the whole country whose projected implementation goes very far into the next century.

Alongside, and in spite of these achievements, the Council has had some set-backs. It has retained most of its operational staff but changed the top leadership several times. It has also suffered a drop in popularity and its influence over the scientific community and smaller research and development institutions which have had a more dynamic influence on the productive sector in recent years. Furthermore, it has not been very successful in coordinating research and providing a forum for researchers and technology developers. On the contrary, a clear gap has developed between the Council and major R&D institutions such as the University, the Tanzania Industrial Services and Consultancy Organization, the Tanzania Industrial Research Organization and others. In actual fact, the Council has become 'just another' R&D institution. As a result, science and technology research has greatly suffered.

Organizationally, the Council has eleven specialized committees, including the Executive Committee. Between 1972 and 1978, these met regularly and operated very well. In the last decade, however, their role has declined; the number of their meetings has been reduced; their role in advising the Council and the government has decreased; they have remained occasional and been relegated to the function of allocating research funds.

Furthermore, solidarity and cohesion between the committees and the committee members have decreased. In addition, the Council has failed to grow. Although it has had a director general, it has not developed directorates.

There has practically not been any organizational change in the leadership structure between 1975 and 1988. The impact of this static model has been that the Council has failed to develop its own dynamic ways of operating, has gradually resembled a government department and has come under increased government control and direction. It has lost some of the dynamism which arises out of an autonomous existence.

The Council has noted most of these changes and problems. It has identified their causes and suggested fundamental changes in its own structure. One of these changes is that it should be given wider powers, more autonomy and supervisory and control functions over other R&D institutions. For these changes to be effective, it was suggested that the Council should be transformed into a National Commission for Science and Technology.

All these recommendations have been accepted by the government and by Act of Parliament no 1 of 1986, the legislature authorized the Council's transformation into a commission. The qualitative difference between its status in the two forms will be examined later. The transition from Council to commission has been delayed due to financial and administrative difficulties. But as the Council changes its status and structure, it is not improper that a study of its past performance be carried out so that it can use it to perfect the future. This in fact is the major objective of the study.

It derives its force from the deliberations of a meeting of the Ministers of African Member States responsible for the application of Science and Technology for Development

(Castafrica) held in Dakar from 21st to 30th January 1974. Recommendation no 4 of that meeting was that 'Member states that have established their science policy planning machinery should keep it under constant review with a view to effecting the necessary changes at appropriate time so as to ensure the effective functioning of the machinery.'

At the Vienna Conference on Science and Technology for Development organized by the UN, 20th-30st August 1979, a programme of action was adopted and one of the commitments made was that Member States should formulate national policies for science and technology and carry out responsibilities such as planning, budgeting, management, coordination, stimulation, promotion and execution of scientific and technological activities relevant to defined development objectives (para 18 of the Vienna Programme of Action). The Vienna Programme of Action was emphasized at the special OAU meeting of the Heads of State in Lagos a year later. This meeting, which launched the Lagos Plan of Action, committed every Member State to take all the necessary measures to enhance the development of science and technology.

Tanzania's response to CASTAFRICA, the Vienna Programme of Action and the Lagos Plan of Action has been commendable. Between 1983 and 1985, it worked on and later launched a national science and technology policy. As the Council prepares to enter the second phase of its transformation and operations as a commission, it may be important that the government, in line with Recommendation 4 of CASTAFRICA I, looks back at the activities of the Council, its weaknesses and strengths, its failures and achievements in order to ensure that the future does not become a new version of the past. It is hoped that this study will provide the Tanzanian government with a basis for a deeper and even better study.

CHAPTER ONE
BACKGROUND TO THE FORMATION OF THE
TANZANIA NATIONAL SCIENTIFIC RESEARCH COUNCIL

1.1 The Rationale for its Establishment

The Tanzania National Scientific Research Council was formed in 1968 as a statutory body, four years after the UNESCO organized conference in Lagos (28th July to 6th August 1964) to discuss the 'Organization of Research and Training in Africa in Relation to the Study, Conservation and Utilization of Natural Resources.' At that time, there was no national body concerned with the central coordination of scientific research. Most of the research institutions that existed were of a specialized nature and were organized under the auspices of the then East African Community. Because this was much more of an economic organization, most of the activities carried out under it were administrative and operational and were not intended to influence policy. The Council was, therefore, formed both as a policy-generating and as policy-implementing institution.

1.2 A Brief History of the Council

The Tanzania National Scientific Research Council is the oldest science and technology policy institution in Eastern Africa. When it was formed in 1968, it legally came into existence seven years before the Science and Technology Commission of Ethiopia was established (Proclamation no 62 of 1975), nine years before the formation of the National Council for Research of Sudan (Order no 26 of 1977), eleven years before the formation of the National Council for Science and Technology in Kenya and more than ten years before the Ugandan National Council for Science and Technology.

As mentioned earlier on, the initial idea of forming a body to coordinate research at the national level was introduced, discussed and adopted at a UNESCO conference on scientific research and training in Africa held in Lagos (Nigeria) in July 1964. The broad recommendation at that conference was that such

bodies which it was agreed would be referred to as Research Councils would be mainly responsible for the coordination of all scientific research and formulate and work out research priorities in their respective countries.

After the 1964 Lagos Conference, three important bodies took interest in the formation of such a body in Tanzania: the Ministry of Education (as it then was) and the Ministry of Agriculture in which most of the research institutions were based, on the one hand, and the University of Dar es Salaam on the other. The three, all engaged in the coordination of research activities, began working together, under the guidance and coordination of UNESCO, to devise the structure, policy and orientation of the intended central coordinating body. At the same time and without the knowledge of UNESCO and the three local institutions, the Ministry of Development Planning and Economic Affairs (as it then was) in collaboration with UNIDO began planning and working towards the setting up of a similar institution. At that time, UNESCO, the two ministries and the University of Dar es Salaam had made written proposals for the formation of the Tanzania National Scientific Research Council.

In June 1967, the Ministry of Development Planning and Economic Affairs (DEVPLAN) decided that it was not going to interfere with the proposals of the other three institutions respecting the Council, but that it was going to establish a Science and Technology Unit which would monitor the activities of the Council and act as its secretariat. This would have the effect of making the Council part of the government structure with its secretariat in the Ministry. In such a structure, the Council would be composed of directors of various research institutes and units, themselves civil servants and under the control of their respective ministries. It would make the Council a purely and exclusively advisory body and DEVPLAN the coordinator of all research activity. On this basis, the research to be coordinated would be conducted by government

departments under and through governmental financial and administrative redtape.

After discussing these and other possible disadvantages, DEVPLAN agreed with the recommendations of the other three parties that the Council should be set up as an autonomous statutory body with very little ministerial control and that it should be free to perform its statutory duties without being subjected to any bureaucratic procedures. In 1968, therefore, the Council was formed along this proposed structure.

1.3 General Observations

The apparent confusion in planning which surfaced during the period of the Council formation has a lot of significance for the past and future of the activities of the Council and its successor, the Commission. It lies in three main observations. The first is the very strange spectre of donor agencies within the same UN system or indeed any other system working at cross purposes and causing confusion by approaching different institutions of the same government with aid and advice. It is clear that UNESCO had its own approach on institutions of science and technology policy as also did UNIDO.

In such circumstances, it is necessary that agencies from the same institution should approach the governments of Member States through only one contact. Secondly, internal institutions involved in the assimilation of ideas from donor agencies and other advisers may further complicate this problem by allowing themselves to be involved in conflict and parallel pieces of advice on the same subject matter.

Thirdly and specifically in the case of the Council, it is not in the interest of the third world governments to allow themselves to be swayed by a variety of institutions. The Council, for example, took about five years between its formation by legislation in 1968 and its official inauguration on 25th June 1972. This was due to the fact that immediately after the Act was passed and after DEVPLAN had given up the idea of acting as the secretariat, the latter introduced a third element in the

whole process. It invited an expert from the Danish Institute for Development Research to discuss the need and the means to establish a National Research Plan. A working party was set up under the leadership of Prof. Eric Svendsen from that Institute and started working on the proposed plan. This took one year and eight months (April 1969 to December 1970).

The working party submitted its report to the Council in June 1972. The main thrust of the report was to revive the issue of the role of the Science and Technology Unit based on DEVPLAN. It also recommended that there should be eighteen specialized sub-committees of the Council. The Council discussed it and decided that in order to give the Act its proper interpretation, the Council secretariat should remain independent of the government structure and that the Unit for Science and Technology should be exclusively established in the Ministry without any powers over the Council. The Unit was so established in 1980.

Apart from unnecessarily delaying the inauguration of the Council, the prolonged debate over the role of the Unit very much affected the relationship between the Council and the Unit. From personal observation, the top leadership of the Council has always been suspicious of the directorate of Science and Technology based in the Ministry. This has made the members of the Unit very cautious in the way they deal with the Council leadership. In fact all the control powers the Minister of Planning has have to be exercised through the Unit. Unfortunately this is not the case as there has been an element of withdrawal on the part of the Unit and cooperation between it and the Council is very low. Furthermore, this has made it difficult for the Minister in charge of planning to exercise full control over the Council without leave of the overall Minister for Finance and Planning and Economic Affairs. Just as this factor delayed the launching of the Council, it also prolonged the transition from Council to Commission.

1.4 Recommendations

The following recommendations should be considered:

- (1) The inauguration of the Commission should not be further delayed since the activities of the Council have almost come to a standstill as its workers and leaders as well as interested outsiders wait for the next move.
- (2) As further delays in the inauguration of the Commission further postpone the implementation of some items on the national science and technology policy, a short transition is clearly in the interests of economy.
- (3) The role of the Science and Technology Unit in the Ministry of Planning should be made clearer and be given the necessary control powers in the new Act e.g. it should receive annual returns from all R&D institutions, including the Commission, on manpower reports and quarterly performance reports. The Council/Commission should be required to submit an annual report on the performance of science and technology institutions to the Minister of State Planning and Economic Affairs who will cause it to be transmitted and tabled before Parliament as required by the Act.
- (4) The Minister of State Planning and Economic Affairs should be put exclusively in charge of and be made answerable for issues of science and technology policy.
- (5) The Ministry of Planning and Economic Affairs should, as a matter of routine and in accordance with Recommendation 4 of CASTAFRICA (Dakar 21st-30th January 1974), review the performance of all national science and technology policy or service institutions at least every four years.

CHAPTER TWO

THE GOALS AND FUNCTIONS OF THE TANZANIA NATIONAL SCIENTIFIC RESEARCH COUNCIL

2.0 Introduction

This chapter examines the functions of the Council as provided by the statute which established it and as interpreted by the leadership of the Council. The difference between the two is that, while in the statute the broad goals of the Council are spelled out, the other aspect seeks to show how these goals are understood by their implementors and the best methods they think could be used to attain the statutory objectives. The chapter therefore, is divided into two sections each of which is concluded by a short commentary based mainly on personal views.

2.1 THE MISSION OF THE COUNCIL

The broad framework of the functions and objectives of the Council and its sister institutions in other countries was worked out at the Lagos meeting of 1964 mentioned earlier. The functions were outlined as being to stimulate activities and interest in science and technology for socio-economic development and to coordinate scientific research at the national level. These broad objectives have been given efficacy and amplification both in the statute governing the Council and in the statements and documents given by the Council leaders and members of the public. Some of these will be discussed separately below.

2.1.1 Statutory Goals and Functions

The statutory goals and functions of the Council can be divided into three categories. The first is that of advisory functions; the second that of executive functions and the third that of powers.

Under the establishing Act (no 51 of 1968), the advisory functions of the Council are five. The first is to establish research priorities in scientific research and advise the government on national or international matters relating to

scientific research. This function involves membership in international scientific research associations and representation at international conferences. The second is to advise the government on national or international matters relating to scientific research. The third is to advise on matters related to training and recruiting scientific personnel. The fourth is to advise on instruction on scientific subjects in educational institutions in the country, while the fifth is the initiation, formulation and implementation of research and programmes.

Executive functions include a mandate to act on behalf of the government in the area of scientific research and development, to coordinate all types of scientific research carried out in the whole country, to promote the documentation and dissemination of information on all research and to collaborate with people or institutions or organizations within the country or elsewhere in matters concerning and related to scientific research.

In order to finance local and international research, it has power to raise funds from local and international donors within limits set by the Minister. In the performance of the research function, it has powers to undertake research in commerce, agriculture, industry, mining, national economy, communication, education, public health, labour productivity, industrial and commercial management, utilization of materials and equipment in use and other matters related to the United Republic of Tanzania and its people.

Another power it has relates to the dissemination of scientific information. The Council has been empowered to collect, compile, analyse, abstract and publish any newspaper, journal or periodical or 'do any act or thing designed to promote interest in science and its achievements.' In this respect, it has power to organize seminars, workshops, symposia or conferences.

2.1.2 Analysis and Commentary

Most of the statutory functions which the Council is supposed to carry out reflect both the spirit of the UNESCO (1964), Dakar (1974) and Vienna (1979) Conferences mentioned earlier on. They have so far been implemented without serious problems. But, as we shall see later, their nature has been a cause of implementational problems. This is due to several main reasons.

The first is that there is no statutory correlation between some of the functions and the powers bestowed upon the Council. For example, while in the dissemination of scientific information the Council has statutory power to publish by way of journals or conferences and related media, there is no statutory guidance about the powers the Council has in trying to establish research priorities for R&D institutions or individual researchers or the mechanisms for ensuring these priorities are observed. Similarly, the function of coordinating scientific research all over the country is not accompanied by coordinating powers such as the requirement that the R&D institutions should submit detailed research plans and reports to the Council for approval and transmission to higher authorities or the authority to evaluate ongoing research and advise on measures to be taken if the research is not beneficial to the country or violates the laws, policy or research priorities of the country.

The second is that, while most of the functions are executive in that they give a semblance of the power to act, they are not accompanied by executive powers to do so. There is no executive power for the Council or the Commission, for example, (Act 7 of 1986) to control and regulate the policies, behaviour and activities of smaller scientific institutions, although it has the duty to coordinate them. These institutions, as we shall see, are governed by their own Acts of Parliament which are much more recent (1976-1979) than the Act of Council (1968). Hence, where there is a conflict, by rules of statutory interpretation, the more recent Acts apply and override previous Acts.

The third is that the Council Act (1968) has a strong bias for scientific research and overemphasizes what are termed scientific standards. Although these are not statutorily defined, the Act tends to ignore issues of technological research and science and technology policy. This shortcoming has now been taken care of by Act No.7 of 1986 which established the Commission.

The fourth is that neither the Council nor the Commission Act mentions it as a statutory function that these institutions have a statutory duty of facilitating, evaluating and advising on the best methods for acquiring technology by local firms and personnel from foreign sources. The Kenyan Act establishing the National Council for Science and Technology requires it to advise on these matters.

The fifth is that, both in the Council Act of 1968 and the Commission Act of 1986 most of the functions are anticipatory and not mandatory. The two Acts expect the two bodies to Act but do not require them by force of law to do so. In contrast, the Kenyan Council Act requires the Council, for example, 'to ensure the application of the results of scientific activities to the development of agriculture, industry and social welfare' (section 2(1)c) and also 'to ensure cooperation and coordination between various agencies' (section 2(1)(f)).

The use of such phrases as to 'ensure' or to 'secure' or to 'see to it' give empowering legislation a greater force and provides the controlling agencies and members of the public with a means of measuring the failure or success of the Council.

The sixth and related problem is that there are no policy functions which can be used to determine the policy direction and orientation of the Council. The two Acts do not establish in this direction the criteria for measuring the performance of the Council. Such duties would include, for example, the duty to facilitate technical change, to bring about technological self-reliance in manpower, etc., to work out the means to reduce technology dependence and to enhance national policy objectives.

In Tanzania, it has been difficult in the past sixteen years of the Council and it may remain difficult during the existence of the Commission, to determine the extent to which the Council has operated within the expectations of the national policy. It is not mentioned anywhere that the Council or the Commission has to operate within the framework of national goals under the policy of socialism and self-reliance. This shortcoming makes it very difficult to determine the policy direction of the activities of the Council and the extent to which they abide by national policy goals and aspirations.

The seventh shortcoming is that the two Acts do not have a clear framework for the division of powers and functions. As we shall see later, the Council has about eleven statutory committees which are supposed to help it to perform its duties. But the two Acts create a centralized power structure under which every function revolves around the Council. The committees have no statutory status in the internal power structure. They have no separate and independent functions or mandate either separately or as a group. This centralized power structure creates a state of confusion as to the way the statutory functions and powers can be exercised, while at the same time laying the ground for the concentration of power within the secretariat and subsequent inefficiency and subordination of committees to the secretariat. This in turn tends to elevate the secretariat beyond the statutory organs of the Council and to create room for possible control of the Council by the secretariat.

It is worth noting that in the Kenyan Act, the position of the committees is very clearly spelled out. They have their own statutory functions and powers which include, among other things, the following duties:

- (a) to work out sectoral research programmes and priorities;
- (b) to work out sectoral budget requirements;

- (c) to encourage, promote and coordinate research in their respective areas;
- (d) to apply research results 'through the technical and development services of government';
- (e) to carry out surveys and register research programmes, scientific research facilities and personnel;
- (f) to disseminate information on research programmes;
- (g) to assess the value of sectoral research programmes in terms of their significance to the national economy and advise the Council and Ministries involved.

Such a decentralized power and functions structure has a big potential for making it easy for the Council to act efficiently through committees, while at the same time enabling it to evaluate its own efficiency through evaluating the efficiency of the committees. In a situation where the committees are operating directly under and on behalf of the Council, the Council cannot adequately control and evaluate them, because that will involve a biased self-evaluation. Below are a few recommendations on how the statutory functions and powers of the Council or Commission can be improved:

- (1) The powers of the Council or Commission must be more closely linked with its functions in that there should be guidelines on how each of the statutory functions can be carried out without violating the laws of the other institutions.
- (2) All the Acts of smaller or subordinate R&D institutions, including training institutions, should be adjusted to make room for the supervisory and coordinating functions and powers of the Council or Commission over research on science and technology issues.
- (3) The present conception of science and technology issues as being linked to the physical sciences which is reflected in the composition of the Council and the Commission as well as the functions of the Council should be minimized and recognition given to matters of science and technology

policy which go beyond physical science into the socio-cultural and political aspects of scientific knowledge and development.

- (4) The functions of the Council and later the Commission should be made more compulsive and forceful by clarifying the duty to act and the form of action to be taken.
- (5) In order to make the Council or Commission more accountable for its activities within the broad framework of the national policy, the broad policy objectives of the nation as embodied in the national science and technology policy which has now been adopted by the ruling party should be included in the Act. To be specific, these policy goals include:
 - (a) to formulate and implement policies which enhance the national policy objectives of socialism and self-reliance;
 - (b) to stimulate processes for the generation of local scientific and technological capability in the public, private and cooperative sectors of the economy;
 - (c) to organize and facilitate the development of local scientific research and technological capacity in order to accelerate the process of structural transformation and technological independence.
- (6) The objectives of the Council or later the Commission should be reviewed from time to time in order to keep them in line with developments in the local and international economy.

As mentioned at the beginning of this chapter, statutory goals and functions have another angle, which relates to the leaders' perception of the Council. In the next paragraph, these functions will be examined from this angle.

2.2 PERCEIVED GOALS AND FUNCTIONS

While discussing the need for a national science and technology policy, most of the Council leaders displayed a deep awareness of the problems constraining science and technology research in

general in Tanzania and the existing machinery for its coordination in particular. As regards general problems, four main ones were identified: the first was a lack of machinery and the capability to apply existing technological know-how efficiently; the second was a lack of a clear and informed political policy; the third a lack of adequate financial resources and the fourth a lack of a dynamic machinery capable of 'merging political pragmatism and expediency with scientific truth and realism' (Msangi, 1984).

Having identified these as the major problems, the leaders went on to explain what role, according to them, a national science and technology policy institution should play. Nine main functions were spelled out. The first was to bridge the gap between policy makers and administrators on the one hand and researchers and technologists on the other (Msangi, 1984:2). The second was to provide a link between scientists in various sectors to avoid the fragmentation of research efforts (Msangi, 1984:1). The third was to facilitate an exchange of technological information (Msangi, 1984:2). The fourth was to produce a common focus for scientific and technological workers in order to facilitate an exchange of ideas and avoid duplication and thereby make possible the economical use of resources allocated to scientific research and technological development (Msangi, 1984:2). The fifth, was to provide a mechanism for the dissemination of results of scientific research and technological innovation and facilitate their application in as wide an area of the national economy as possible (Msangi, 1984:3). The sixth was to centralize the planning of scientific research and to determine research priorities at the national level, in order to ensure that such research and technology development are relevant to the socio-economic needs of and consonant with the overall national development plans (Msangi, 1984:3). The seventh was to provide a basis for the formation of a national technology policy based on utilizing national science and technology resources and minimizing wastage in that area (Msangi, 1984:5). The eighth was

to facilitate the handling and management of foreign financial support in the area of science and technology research (Bitanyi, 1984:5) and the ninth the preservation of national cultural traditions by putting emphasis on indigenous resources (Meela 1984:1).

In order to advance these objectives, the Council initiated in June 1987 the formation of the Tanzania Association for Advancement of Science and Technology (TAAST). This body was launched by the leadership of the Council which was also involved in drafting the constitution. Although legally the association is neither affiliated to nor organizationally a part of the Council, its objectives bear the imprint of the Council's objectives as perceived by the leadership. There are four such among the eleven contained in the object clause which deserve special attention. The first is the objective of promoting and maintaining a coherent linkage between science and technology and social development 'with a view to harmonizing the judicious use of science and technology for human development' (TAAST Constitution V: 6). The second is to act as a consultative and advisory organization to the government and other governmental and private bodies on all matters pertaining to the development and application of science and technology (TAAST Constitution V:6). The third is to function 'as a reservoir and bank of scientific knowledge and technological expertise available for advisory, professional and consultative service to the Tanzanian government and to national and international private and public organizations, including the representation of Tanzania in international meetings of experts, conferences, seminars and other similar fora' (TAAST Constitution V:8). Finally there is TAAST's objective of promoting and safeguarding the professional interests and status of scientists and technologists in Tanzania (TAAST Constitution V:10).

2.2.1 Analysis and Commentary

The problems, goals and functions of the Council and later the Commission as perceived by the Council leadership reflect five

main problems. The first is that the leaders' outlook is too structuralistic. The problems of organizing science and technology are seen as stemming from a lack of proper institutions and as being capable of being solved by change of structure within these institutions. The outlook that the problem is not a lack of scientific knowledge and technological know-how but that the know-how is not being applied or is being misapplied may be true to some extent, but cannot form the basis of a feeling that this can be solved by an increase of powers or financial resources in some science and technology institutions or by the formation of a new machinery capable of merging 'political pragmatism and expediency with scientific truth and realism.'

Over the years, there has been an increase of financial resources by external and internal donors to research institutions and science and technology institutions, but there has been a similar increase in technological dependence. Between 1965 and 1975, there were less research institutions, less research funds, and less fora for the dissemination of research results. But there was more research output, more research input into policy and more technological advancement in the area of animal diseases. Between 1975 and 1985, there was increased financial support, more organizations for receiving and managing research funds, and more researchers but there were more problems of disparity between research findings and policy formulation. In the past decade, there has been less and less reliance on research findings in policy formulation, less exchange of research findings among researchers, less cooperation between researchers and technologists and these factors, together with others, have perpetuated technological dependence. Therefore, apart from structures, there is a need to try to understand the problem from a broader perspective.

The present technological problems should be seen as part of the existing socio-economic problems such as a low industrial output, low level of savings, poor infrastructure, which affect

the level of economic growth on the one hand, and a lack of a technological culture, lack of serious planning, refusal to subject institutions to strict supervision and accountability, corruption and the suppression of the market forces and other factors which suppress or affect the pace of technical change and technological innovation on the other.

The second problem is that most leaders, both in the Council and in government, see the lack of a science and technology policy as a problem and believe that the existence of such a policy would necessarily and substantially alter the existing situation. While it is true that 'practice without a theory is blind action', there is also the problem of working out a theory that is capable of being put into practice, because a theory that cannot be put into practice becomes a utopia. The major issue is, therefore, a policy by whom and for whom?

The majority of leaders in policy institutions tend to think that their main duty is to manufacture or produce a policy to be followed and be binding upon all those operating under them. A better approach would be for such institutions to treat themselves as initiators of the processes for policy formulation and as coordinators of the policies of various institutions. If this becomes the outlook, leaders may cease seeing the lack of a national policy as a problem and seek, instead, to identify the various policies of the institutions working under them, enrich those policies and try to harmonize them into a national policy. This is a realist view of a policy formulation which is based on the view that the best policy emanates from basic institutions and that the broader policy is a set of compromises, trade-offs and priorities derived from such policies. A positivist outlook that policy emanates from above and permeates basic institutions and has, therefore, to be implemented by subordinate institutions ignores the fact that a policy is like an architectural design which becomes valueless unless it has been translated into a structure. The architect is usually not the building contractor

and the latter matters a lot in the interpretation and perfection of the plan.

The third problem is that the leaders of the Council view the Council's role as regulatory and aimed at controlling by harmonizing and coordinating either scientists or science and technology institutions. Therefore, success or failure is measured in terms of the capability to control resources and institutions. This may be due to a positivist attitude that governments are meant to control and that, therefore, so are government agencies. On the contrary, the Council is a facilitating institution which is supposed to stimulate the growth of new ideas and processes. The main problem for it there is to find out the best medium for the popularization of ideas. Ideas arise out of production, consumption and exchange. The best outlook would be that the Council should enhance the production, consumption and marketability of new scientific ideas, inventions and other products. This involves providing facilities for that purpose rather than regulation and control. In actual fact, control and regulation would come in when the market was flooded with technological inventions, ideas or similar products.

The fourth problem is that the leaders tend to believe that there is a crisis of information due to a lack of the central coordinating institutions and that, given more financial support, and regulatory powers, the Council would be able to collect, store and disseminate a lot of technological information. Hence the suggestion that the Council should act as a forum for the dissemination of information. Again, this outlook ignores a lot of factors. First, it ignores the fact that in many research institutions, the problem is not a lack of forum but a lack of the market for the researched information. The University of Dar es Salaam has about seventeen international journals. These provide, by all international standards, adequate fora for its researchers and outsiders. But their consumption within the

country is limited to the University student body and a few training institutions.

Similarly, the University of Dar es Salaam organizes an average of two seminars every day. Apart from specialized teaching seminars in physics and law, or the economic policy seminars organized by the Economics Department, the rest are attended by a few teachers and many students. They become some form of extension services within the university community. Very few industrialists, policy-makers or public servants are keenly interested in attending research-based seminars or reading articles, papers or books. Public officials find it more rewarding to travel to distant places outside the country or far from research centres to attend seminars and workshops because this involves personal financial gain. Therefore, without over-emphasizing the absence of common fora, it is important to make a survey of the factors which have a bearing on the local market for science and technological information arising out of local research. An effort should also be made to overcome the factors that tend to constrain that market.

Finally, it is commendable that the Council has facilitated the formation of the Association for the Advancement of Science and Technology as a think-tank for the Council and the government. But it is noteworthy, at this stage, that, while the Association is likely to play a dynamic role in the popularization of science and technology, it has been given a unitary structure which tends to centralize the operations of its branches at zonal and regional levels. This centralism may not be conducive to the free and unfettered development of a science and technology organizational infrastructure. A federal structure which makes the Association accommodative of a variety of associations and clubs with different organizational structures and constitutions could, in the long-term, be more conducive to the development of the necessary science and technology infrastructure. The Council should, as a mission, encourage schools of all levels to form science and technology

clubs, industries to form production and technological associations, various professionals to form professional associations e.g. for physicists, chemists, bio-chemists and chemical engineers, agronomists, aeronautical engineers and technicians, civil, architectural and construction/building engineers and related professional associations.

It should also form research and development networks among individual researchers using either its own funds or funds from other sources and organize the networks along certain broad themes e.g. economic studies, production and engineering studies, science and technology policy studies, health and sanitation, agriculture and energy. Fortunately such research networks funded by donor agencies e.g. the International Development Research Centre, already exist in the Eastern African region and a link can be established with them and new networks encouraged at the national level. Such an infrastructure for science and technology research and development can make easy the attainment of a forum for science and technology information, can develop and make a big contribution to policy and provide the Council or Commission with something more tangible to coordinate, or even at a later stage when they become too many, to regulate.

2.2.2 Recommendations

- (1) The leaders and workers of the Council/Commission should organize, as a matter of annual routine, an out of workplace workshop for purposes of self-evaluation. On such occasions, they should have policy papers and reports and invite evaluation reports from the Ministry and outsiders. The purpose, apart from self-evaluation, should be self-criticism, joint planning and the formulation of new objectives, targets and ideas.
- (2) The Council, or later the Commission, should examine the organic factors within Tanzania's socio-economic system which tend to have a significant bearing on the development and absorption of science and technology. Structural and

institutional features should be examined in this broader context and outlook.

- (3) The formulation of science and technology policy should not be viewed as a one-time exercise or a specialization of one institution. Policy is about society which is fluid and always in transition. It has, therefore, to be reflective of society and be based on it and no set of policy guidelines should be expected to last for eternity. A review of policy based on input from basic institutions should be allowed to make existing policy more relevant, dynamic and progressive.
- (4) The role of the Council should be less regulatory and more facilitative. The Council should play more the role of a trader than of a court or church, going to the people rather than expecting them to come to it. It must struggle to understand the economy and go to the oasis instead of praying for the impossible to happen.
- (5) A national infrastructure for national science and technology should be established through professional organizations operating autonomously and linked together by TAAST and the Council or Commission. It is only such an infrastructure that can produce a lasting and workable policy, provide permanent and reliable fora for scientific information and also research for and secure a market for technological information.

CHAPTER THREE

THE ORGANIZATIONAL STRUCTURE OF THE TANZANIA NATIONAL SCIENTIFIC COUNCIL

3.0 Introduction

This chapter discusses four main things: first the structure of the Council and its articulation within the national policy-making structure; second the composition of the Council; Third the linkage with the other research institutions and the productive sector and finally its powers in relation to other institutions and the productive sector.

3.1.1 THE STRUCTURE OF THE COUNCIL IN CONTEXT

The supreme policy-making organ in Tanzania is the National Executive Committee of the ruling Chama Cha Mapinduzi (CCM) party. Immediately below it is the Party Central Committee which initiates and formulates most of the party policies and decisions. Below the party is the Parliament which, under the Constitution of 1977 as amended in 1984, comprises the National Assembly and the President. Parliament has no special body or unit for the formulation of science and technology. In the President's office, there is an Economic Affairs Unit headed by the Economic Advisor to the President and the Political Affairs Unit headed by the Political Advisor. Both these units are responsible for formulating, evaluating policies and advising the President on policy matters, including those on science and technology.

Below Parliament is the Cabinet which has a strong team of advisors based in the Cabinet Secretariat. The latter is a government think - tank composed of experienced policy advisors, researchers and administrators. It operates in collaboration with research institutions based mainly in training institutions. There are advisors on various issues and the secretariat is divided into various sector-oriented departments. Science and technology issues surface from time to time under the section dealing with energy matters.

Below the Cabinet is the Prime Minister's Office which houses several Ministries e.g. Youth and Culture, Rural Development and Regional Administration. It has supervisory powers over all the government ministries and controls policy formulation and implementation at government level. It has its own secretariat of professionals drawn from various disciplines who formulate and advise on policy. Administratively, it has a number of departments in charge of various sectors and their relevant ministries. Below the Prime Minister's Office comes the Planning Commission which involves all Ministers, appointed members of Parliament and appointed members of the National Executive Committee (NEC). This is the biggest planning body which usually meets before the budget session of Parliament and charts out the broad national development and investment plan of the whole country.

Below the Planning Commission comes the Ministry of Finance, Planning and Economic Affairs in which the National Scientific Research Council is based and the Commission for Science and Technology will be. This is charged with the task of coordinating national plans. The Council is based there to enable it to influence national planning by having an input in national policy formulation. The Ministry also runs several other institutions whose activities influence, and are influenced in turn or affect national science and technology development trends. These include the Bank of Tanzania which allocates foreign exchange, authorizes imports and exports as well as the recruitment of foreign personnel. It also controls the Tanzania Investment Bank which manages all foreign industrial loans on behalf of recipient institutions, including the government, authorizes foreign investments, as well as loans for investment by local enterprises. The National Bank of Commerce, the Rural and Cooperative Development Bank and Tanzania Housing Bank which deal with payments for imports and exports and which receive foreign loans and manage them on behalf of the government are also in this Ministry.

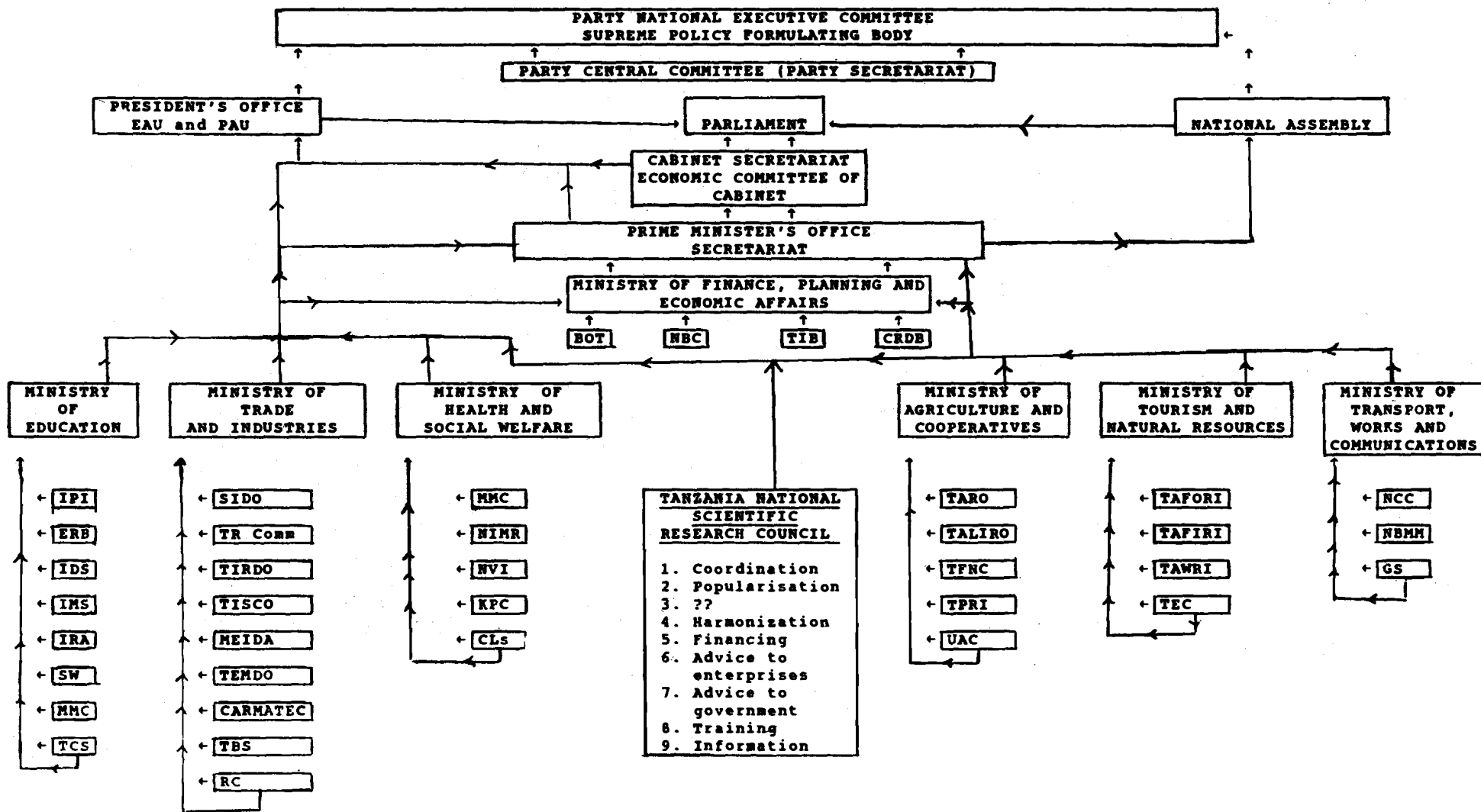
Below the Ministry of Finance, Planning and Economic Affairs come various ministries most of which have, under them, R&D institutions. The biggest number of these is based in the Ministry of Industries and Trade. There are among them, technology-generating institutions such as the Centre for Agricultural Mechanization and Rural Technology (CARMATEC), the Tanzania Industrial Research and Development Organization (TIRDO), the Small Industries Development Organization, the Tanzania Engineering and Manufacturing Design Organization (TEMDO), the Metal Engineering Industries Development Association (MEIDA) and the High Technology Precision Centre (HTPC). The other group consists of science and technology service institutions such as the Tanzania Industrial Service and Consultancy Organization (TISCO), the Tanzania Bureau of Standards (TBS), the Tanzania Radiation Commission (TRCOMA); and the Registrar of Companies, Trade Marks and Patents (RC).

The Ministry of Agriculture has the second biggest number of science and technology institutions. Most of them are science and technology generating and include: the Tanzania Agricultural Research Organization (TARO), the Tanzania Livestock Research Organization (TALIRO), the Tropical Pest Research Institute (TPRI), the Tanzania Food and Nutrition Centre (TFNC) and the Uyole Agricultural Centre (UAC). The Ministry of Health and Social Welfare runs several science and technology research institutions such as the National Institute for Medical Research (NIMAR); the Muhimbili Medical School under the Muhimbili Medical Centre (MMC), the National Vaccine Institute (NVI), the Keko Pharmaceutical Companies (KPC) and the Central Laboratories (CLs).

The Ministry of Tourism and Natural Resources runs and controls several research institutions, the most prominent of which are the Tanzania Forests Research Institute (TAFORI), the Tanzania Fisheries Institute (TAFIRI), the Tanzania Wildlife Research Institute (TWRI) and the Tanzania Environmental Commission (TEC). Under the Ministry of National Education is

the University of Dar es Salaam with seven key science and technology policy research institutions which are the Institute of Production Innovation (IPI), the Science Workshop (SW), the Economic Research Bureau (ERB), the Institute of Resources Assessment (IRA), Institute of Development Studies (IDS) and the Institute of Marine Science and Muhimbili Medical Centre. Under the same Ministry are also based the Sokoine University of Agriculture (SAU), all Technical Colleges (TCs). Under the Ministry of Transport, Works and Communications are the National Construction Council (NCC), the National Board for Materials Management (NBMM) and the Government Stores (GS). Below is a chart showing Tanzania's science and technology nomenclature within which the Council operates.

Fig 3.1 The Council's Context



Key

| | | | | | |
|------------|---|--|---------------|---|---|
| AI | - | Ardhi Institute | MMC | - | Muhimbili Medical Centre |
| AMREF | - | African Medical Research | NBC | - | National Bank of Commerce |
| BOT | - | Bank of Tanzania | NBQS | - | National Board of Quantity Surveys |
| BRI | - | Bilharzia Research Institute | NCC | - | National Construction Council |
| BRU | - | Building Research Unit | PHYSICS- | - | Physics Department, University of Dar es Salaam |
| CARMATECH- | - | Centre for Agricultural and Rural Machinery Technology | RWRI | - | Rwagaluria Water Resources Institute |
| CHAWATA | - | Chama Cha Waandishi Tanzania | STI(b)- | - | Saruji Training Institute |
| Chemistry- | - | Chemistry Department, University of Dar es Salaam | STI(b)- | - | Sugar Training Institute |
| CRDB | - | Cooperative and Rural Development Bank | SUA | - | Sokoina University of Agriculture |
| CUT | - | Press - Cooperative Union Press | TAFORI- | - | Tanzania Forests Research Institute |
| DUP | - | Dar es Salaam University Press | Tafiri- | - | Tanzania Fisheries Research Institute |
| EAP Ltd | - | Eastern Africa Publications Ltd. | TARO | - | Tanzania Agricultural Research Organization |
| ERB | - | Economic Research Bureau | TBS | - | Tanzania Bureau of Standards |
| Geology | - | Geology Department, University of Dar es Salaam | TEMDO | - | Tanzania Engineering and Metal Designs organizations |
| ICD | - | Institute of Curriculum Development | TI | - | Textiles Institute |
| IDM | - | Institute of Development Management | TIB | - | Tanzania Investment Bank |
| IDS | - | Institute of Development Studies both at the Sokoine University of Development Agriculture and University of Dar es Salaam | TPH | - | Tanzania Publishing House |
| IFM | - | Institute of Finance Management | TPRI | - | Tanzania Pesticides Research Institute |
| IMS | - | Institute of Marine Science | TIRDO | - | Tanzania Industrial Research and Development Organization |
| IPI | - | Institute of Production Innovation | TSB | - | Society for the Blind |
| IRA | - | Institute of Resource Assessment | TSD | - | Tanzania Society for the Deaf |
| IRP | - | Institute of Rural Planning | TSJ | - | Tanzania School of Journalism |
| JUWATA | - | JUWATA Press | TWLRI | - | Tanzania Wildlife Research Institute |
| KILIMO | - | Ministry of Agriculture 'Ukulima wa Kisas' Publishers | UNESCO-NC | - | UNESCO National Commission |
| KPC | - | Keko Pharmaceutical Companies | UN MIN-CENTRE | - | UNECA Mineral Centre |

3.1.2 The Sectoral Articulation of the Council

The Council was formed in 1972, six years after Tanzania had declared the policy of socialism and nationalized a substantial number of private enterprises. At the time it was formed, there were about 289 public enterprises in Tanzania, most of which were operating under big holding corporations which were exercising a lot of control powers over them. In addition to the holding corporations, there were specialized public enterprise policy control agencies and these included the Tanzania Audit Corporation, the Tanzania Legal Corporation, the Bank of Tanzania, the Presidential Standing Committee, the Permanent Labour Tribunal, the Productivity Council and several government departments directly in charge of various corporations.

The existence of numerous control agencies at the time of the formation of the Council may have had a very big impact on its sectoral placing. This is because in spite of being placed within the planning ministry, the Council, as we shall see, did not get exceptional powers of sectoral control and regulation. As stated in the previous chapter, it was given more advisory than executive powers and more anticipatory than mandatory functions. In addition, a few other factors it found in existence, which have continued to exist, have had a bearing on its capability to have an impact on the inter-sectoral and intra-sectoral science and technology policy formulation and implementation structure.

The first factor is that, while major policy decision-making takes place at enterprise, ministerial, parliamentary and finally party levels, at the time the Council was formed there were no science and technology policy advisory units or organs at enterprise, ministerial, parliamentary or party levels. This created an immediate lack of linkage problem for the Council. The science and technology directorate in the Ministry of Planning was formed in 1980 and it is the only unit for science and technology policy in the government machinery. The absence of science and technology policy units makes it difficult for the

Council to establish itself as a coordinating institution for the various sectors and science and technology policy institutions.

The second factor is the accountability structure within the science and technology institutions at the national level. As can be noted from the chart above, each science and technology institution is coordinated by and accountable to the parent ministry separately. Except for institutions under the University of Dar es Salaam, there are no organization or operational linkages between institutions within the same ministry or within different ministries doing the same thing. For example, there is no linkage between institutions dealing with industrial designs (CARMATEC, TEMDO and MEIDA) or those dealing with industrial research (TIRDO, TISCO AND TBS) in the same Ministry of Industries and Trade. Similarly, there are no organizational links between the Mihimbili Medical Centre, the National Institute for Medical Research, the Central Laboratories, the National Vaccine Institute and the Keko Pharmaceutical Companies. At the same time, there were and are no organic or operational linkages between the various research institutions in different sectors e.g. the Institute of Production Innovation and the Science Workshops on the one hand under the Ministry of Education and TEMDO, TIRDO and CARMATEC dealing with manufacture under the Ministry of Trade on the other.

The ascending nature of accountability patterns between institutions and the government and the accompanying lack of horizontal links between these institutions within and between the various sectors makes the role of the Council as a coordinator very difficult because it is expected to coordinate uncoordinated institutions. It is almost impracticable to expect the proper coordination of these institutions only at the top when at the bottom they are balkanized and their accountability based on a parallel ascending order.

The third and related problem that may have reduced the importance of the Council is a lack of organic relationship

between the Council and subordinate science and technology institutions. Although the 1968 Act gave the Council duties to coordinate these institutions, it did not incorporate them in its organizational or decision-making structures. As if this was not incapacitating enough, subsequent Acts of Parliament forming these institutions never mentioned the Council at all and gave absolute decision-making powers to the said institutions. Hence, the Acts establishing SIDO (1973), TBS (1975), TISCO (1976), TIRDO (1979), MEIDA (1979), TEMBO (1980), CARMATEC (1980), TARO (1980), do not only give no room to the Council to exert any influence over the activities of these institutions. They create a situation which would entitle them to treat any interference or advice or directive from the Council as either illegal or purely advisory.

An attempt has been made in the 1986 Commission Act, (section 12) to render most of these institutions affiliates of the Commission. This is a very positive step in giving sectoral and inter-sectoral coordination role to the Commission. The only problems are that first, the section does not give the statutory demarcations of this affiliation. In other words, it is not enough to say these institutions are affiliates of the Commission without changing their laws and requiring them to submit certain major policy decisions to the Commission's final say. Affiliation without subordination may end up being purely cosmetic.

Secondly, the Commission cannot easily exert an influence on these institutions unless it becomes an apex or an umbrella organization for them. Perhaps it is time that these institutions were allowed to operate autonomously but under policies agreed upon at the Commission level where they are adequately represented. Finally, the Commission structure may have to be planned in order to cater more for the sectoral coordination function. There have to be directorates specifically committed to particular sectoral institutions and the coordination of their activities. Without an internal

structure tailored to the sectoral coordination function, affiliation or closer operational links may never be attained.

The fourth factor is that the Council has no statutory role to play in the National Planning Commission. Although it is usually involved in planning due to its geographical location in the Ministry of Planning, it has no special representation or role to play in the national planning process. This Commission draws representation from government, Parliament and the party. It has a secretariat in the Ministry of Planning and Economic Affairs. The Council has had no special role in it. The Commission would have an impact if it were allowed or required to present its annual or other plans before this body so that they could be included in the annual plans and budgets of the whole country.

The fifth factor is that most of the science and technology activities take place in the area of industry and trade. The Ministry of Industry and Trade has several science and technology sections e.g. the Directorate of Metals and Engineering, the Office of the Chief Industries, Training and Technology Officer, and the High Technology Precision Centre. The Council is not required by any act to work in close cooperation with the Ministry of Industries and the key science and technology officials of these ministries have no statutory role to play in the decision-making structure of the Council and its activities. In the 1986 Commission Act, the Ministry has been given the right to be represented on the Commission, but its representation is equal with that of other ministries and does not in any way reflect its important role in the acquisition, use, assimilation and diffusion of foreign technology and its capability to develop and influence the development of local technology.

The sixth factor is the accountability of the Council to Parliament. The Commission accounts both to the National Assembly and the President through the parent Ministry. Much as this is in line with the traditional governmental business procedure, indirect accountability through annual reports tabled

by the Minister dilute the flow of information from the Council to Parliament and the input of Parliament in the policy and activities of the Council. When the Council Act was being launched, some members of Parliament had very high hopes about its possible role. Some thought it was meant to bring about 'an industrial revolution'; some that it was going to usher the nation into an era of 'space exploration' and still some hailed it for its potential for making Tanzania's socialism 'scientific' (meaning using science to hasten its accomplishment). For a country like Tanzania which is lagging behind technologically, the Council's annual reports to Parliament or a specialized committee thereof and a debate on them would not be extravagant at all. On the contrary, it would afford the Council or Commission an opportunity to get wider views and guidelines on its activities.

The seventh factor is that both the Council Act (1968) and the Commission Act (1986) ignore the private sector. The Council had no representation from the Chamber of Commerce which is an association of industrialists or any other groups involved in trade, industry or commerce. This was, and will be for quite some time, a very serious shortcoming because the private sector in Tanzania is not only responsible for over 50% of the country's GDP but includes in its operations some of the most successful industrial ventures e.g. Tanna Somaiya, IPP, MB Textiles, Tropical Foods, etc., and has a lot of links with foreign suppliers of inputs, machinery and know-how. Furthermore, there has been a higher level of technical change and industrial innovation in the private sector (Kanyilili, 1983; Komba: 1984). The notion prevailing among planners in Tanzania that the government and its agencies exist only for the public sector and that the private sector exists only as a source of revenue may not only be misguided but also injurious to the development goals of the country as a whole. The cooperative sector which encompasses most of the activities in the agricultural and

informal sectors also deserves not only representation but recognition and support.

3.2 COMPOSITION

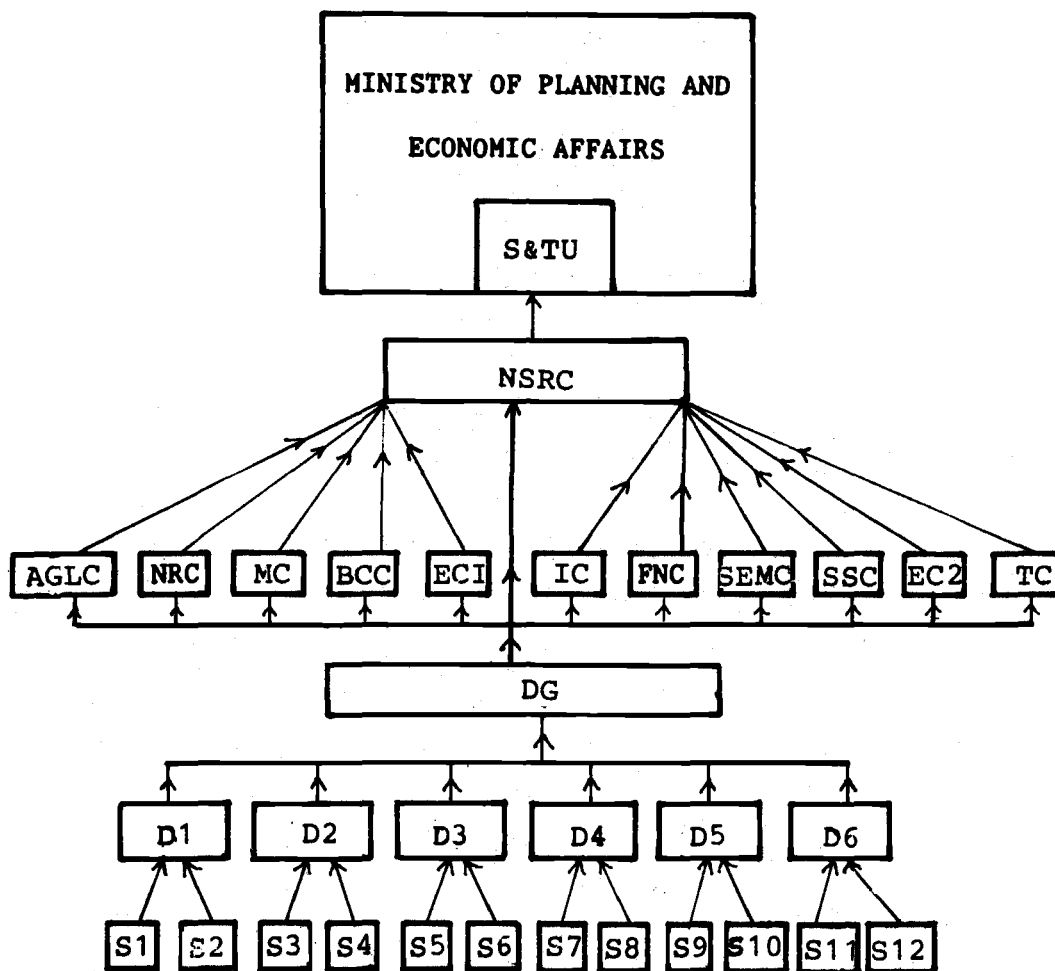
This section will concentrate on the organizational structure of the Council in terms of the general structure, the policy-making bodies and personnel. The purpose is to lay the foundations for a discussion of the powers of the Council, the extent to which they have been used and with what difficulties and results.

3.2.1 The Council's Organization

The Council's organization is one of the simplest in Eastern Africa. This may be because, unlike the Kenyan Council or the Ethiopian Commission, the Council in Tanzania operates more like a government department elevated to a public corporation, with the parent Ministry at the top, followed by the Council, the Council's committee and the secretariat headed by the director general. Ideally, and under the 1968 Act, it is envisaged that the secretariat will have a pyramidal structure with the director general at the top, directors in the middle and heads of sections, mainly principal scientific officers, at the bottom. Fig.3.2 below is a simple illustration of the statutory structure of the Council.

In practice, the Council has been a rather top-heavy, bottom-light institution. While it has been operating with a twenty-one person Council and eleven committees, it has had no directorates. The reasons why directors were not appointed has not been very clear. For quite some time, it was thought that the successive directors general did not want to appoint very senior people as directors for fear that, in doing so, they would be surrounding themselves with a group of potential successors. But it is also not clear why the Council never pushed the secretariat to appoint them until 1985 and, when it did and interviews were organized, it has never been clear why those appointed as directors never reported for duty. Both the leaders of the Council and the would-have-been directors were not ready

Fig 3.2 The Statutory Structure of the Council



Key:

AGLC - Agricultural and Livestock Committee

BCC - Building and Construction Committee

D1-D6 - Directorates 1-6

DC - Director Committee 1

EC1 - Executive Committee 1

EC2 - Energy Committee

FNC - Food and Nutrition Committee

IC - Industrial Committee

MC - Medical Committee

NRC - Natural Resources Committee

NSRC - National Scientific Research Council

S1-S12 - Sections 1-12

SEMC - Scientific Education and Manpower Development Committee

SSC - Social Sciences Committee

S&TU - Science and Technology Unit

TC - Tasta Committee

to offer any explanation on this. Everybody else expressed surprise; but surprise or no surprise, this latest attempt to balance the structure of the Council's decision-making power was not successful. For a long time, therefore, the director general was assisted by three principal scientific officers below whom are about three senior scientific officers and a good number of scientific officers.

3.2.2 The Policy-making Structure

The top policy-making body of the Council is a council which consists of twenty-one members, all appointed by the President of the country. The Council is supposed to comprise people who 'have experience in and knowledge of scientific research' (1968 Act). It works mainly through committees, but its decisions are final. It is under the Ministry of State Planning and Economic Affairs. But the Minister exercises only limited powers over loans and estimates and has powers to make regulations. The secretariat which comprises the director general and his auxiliaries is responsible for the day-to-day implementation of policy and is, at the same time, a very significant source of policy.

3.2.3 The Council's Committees

The Council has eleven statutory advisory committees and one extra-statutory committee. The statutory committees, which include the executive committee, deal with specialized research and policy matters and are enumerated below the organizational chart given above and will not be repeated here. The extra-statutory committee was formed in 1978 when the Council was given powers to issue research permits on behalf of the Prime Minister's Office.

The committees are an integral part of the decision-making structure. They are divided according to sectoral specializations and there are general committees such as the one on the social sciences and the one on scientific education and manpower development. Between 1972 and 1978, they seemed to play a very active role in the activities of the Council. In the

eighties, they seem to have lost their vigour. Their weaknesses will be discussed in the last section of this chapter, but they stem from many isolated and related factors; some are organic and have something to do with the lack of clear statutory powers, duties and role; some are due to their composition, for example, that they have become nuclei for inter-sectoral and intra-sectoral competition for limited resources and some are political in that the Council leaders have been cautious about committees becoming alternative power bases or breeding grounds for successors.

At the same time, some committees have adopted a deliberate drag-of-feet policy in order to avoid being too active or being seen as a challenge to the central administration. All in all the members of the committees have been drawn from key R&D institutions on whose boards the Council is represented. Hence, members have adopted a muffled critical role so as to ensure reciprocal behaviour by the Council's representatives on their boards. Whether or not these and other reasons have been instrumental in its limitation, the fact still remains that the role of the committees has been diminishing. The only one that has remained very active is the research clearance committee and this may be because the Council prefers to deal in such sensitive matters with the blessing of a specialised body.

3.2.4 Departments and Personnel

For quite some time now, the Council has operated without a clear division of power and responsibilities. There are about four principal scientific officers below the director general and these have various responsibilities but engage in general administration. It has been difficult to tell who is the direct assistant to the director general. Although it is clear that one of them who is a Ph.D holder and a bio-chemist is the de facto deputy, the delegation of power has led to a feeling that there is more than one deputy.

As mentioned earlier on, the Council has no directorates so far. However, the management has already proposed the formation

of four directorates for Food and Agricultural Research, Research, Publication and Coordination, Technical Development and Documentation. Most of the proposed directorates are for the research and development functions. There is also a need for a directorate for internal administration and finance. As will be pointed out later, the proposal for four directorates was made before the Commission was proposed and was based on the Council structure. With a new structure, the directorates under the Commission may need a different orientation or function. The personnel of the Council has remained almost constant for a long time. In addition to the director general, there are thirteen professionals, three of whom are principal scientific officers and the remaining either scientific officers or their seniors. Most of these employees are highly trained. The director general is a Ph.D holder and a professor. One of the principal scientific officers is a Ph.D holder in bio-chemistry, eight of the remaining are MSC holders, two are BSC and two have received specialized, technical training.

The non-professional staff are about thirty and include three technical information officers, two research assistants, one technician, three accountants of varying grades, four clerical officers of varying grades, several secretaries, drivers, an office attendant, a telephone operator and a watchman. Given the statutory objectives and duties of the Council, a total number of twelve professionals is too small. The size of professional staff has been limited by several factors. The first is that most director generals have not seen the need to expand their professional force and have seemed to be satisfied with the status quo. Secondly, the Council has had a small budget for staff recruitment and this has provided both the explanation and the excuse. Third, space has been a problem. A Council building started almost ten years ago, remains unfinished up to now. It is not clear why the Council has failed to finish it because, with the aid it receives from foreign donors, a building of that size would not be a big financial

burden. This is one of the things which no-one in the Council was ready to comment upon.

3.2.5 Comments on the Council and its Committees

It is not easy to assess the effectiveness the Council as the highest organ of policy-making because it is not a permanent body. But it is not unfair to assume that the pace at which the secretariat performs its duties depends to a large extent on how much push it gets from the Council. Hence most of the success and some of the failures we shall see in subsequent chapters bear the performance marks of the Council. At this stage, only comments relevant to the composition and functions of the Council can be made.

The first is that in its entire history, the Council has not been composed of people who were necessarily in the field of science and technology or who had 'experience in and knowledge of scientific research' as the 1968 Act required. In most cases, it was composed of policy-makers in Ministries who were involved in many other functions, including research at some stage. Some were regional administrators without any background of science and technology research or function. Most of the Council members, therefore, had no clear theory of science and technology policy or development and viewed the Council as an instrument for the regulation and control rather than the popularization and development of science and technology.

The second is that, although under the Act the President had power to appoint Council members, the selection and recommendation of Counsellors was done by the secretariat and in many cases the selectors recommended Counsellors who would be 'cooperative' and not become a problem or threat. Where the recommendation process was shared between the secretariat and the Ministry, the same factors influenced the appointment procedures. Therefore, in many cases, the determining factor was not whether the appointees were interested or committed to science and technology issues but a mixture of patronage and clientilism.

The third is that the Act did not give a statutory right of representation to heads of R&D institutions and the Ministry of Industries. Their participation depended on the goodwill of the recommending and appointing authorities. This led to withdrawal on the part of some institutions and resistance on the part of others. The relations were further complicated by the cold relations between the leadership of the Council and that of some of the R&D institutions. This lack of integration made the coordinating function of the Council difficult and removed the possibility of creating effective linkages.

The 1986 Commission Act has rectified the situation and incorporated all the directors of research institutes and given the right of representation to key Ministries such as Finance, Agriculture, Industry and Trade, Mineral Resources and Tourism, Education, Water Resources and Urban Development and Education. The Act has, however, left out the Ministry of Information which is as fundamental as that of Education in the popularization, absorption and diffusion of technology.

The fourth is that the relationship between the Council and the Science and Technology Unit of the Ministry of Planning had always been unclear. This, as mentioned earlier, led to withdrawal by the Unit from the control of the Council and the emergence of tension between the two. It may be proper that the director of the Unit be made one of the Commissioners in his own right under the new structure. The answerability and accountability of the Council to the Unit through quarterly manpower and R&D reports should also be enhanced.

On the other hand, the committee structure and functions had their own peculiar characteristics and problems which deserve separate attention. The first problem had to do with membership. The membership of the committees had nothing specifically to do with the specialization of the committees. Consequently this has led to a loss of interest in the activities of the committees by some committee members, hence to permanent absence from meetings

by some of them or a mere physical presence unaccompanied by any serious contribution.

The second problem was reflective of the lack of linkages between R&D institutions at a lower level. This manifested itself in the problem of committee members sticking to sectoral and institutional interests at the committee level. This problem was further aggravated by a lack or inadequacy of resources which made most representatives take a partisan sectoral stand on a variety of issues.

The third problem was that the committees had no specific statutory terms of reference, had no guidelines about how to conduct their business and their efficiency depended on people rather than systems and the forcefulness and charisma of their chairpersons.

The fourth problem was that the committees were not given executive powers. The only notable exception in this case, as we have already seen, was the research clearance committee. Others exercised no delegated authority and had only advisory functions. Their Kenyan counterparts, however, have independent links with their sectors and ministries, enjoy a lot of operational autonomy and make a lot of executive decisions.

The fifth problem was that the committees were not structured on the basis of a sectoral or ministerial alignment. Hence some combined more than one sector or cut across sectors. As a result, they had no direct links with the ministries, had no direct inputs from or impact on ministerial policy decisions and had no power to advise ministries independently. In this aspect, they contrast again with their Kenyan counterparts.

The sixth problem was that the committee structure had not been reproduced at the level of the secretariat. In the absence of a clear departmental structure, it has been difficult for the Counsellors or the public to trace the profile of a decision or an action from the committee level to the Council through the secretariat and, due to changes in the personnel offering

supporting services to the committee, committee members have found it difficult to follow-up on certain decisions.

Finally, the committees, because of their powerlessness, resourcelessness and lack of guidelines, have become very dependent on the secretariat. Their meetings have, in most cases, been determined on the capability of the secretariat to handle them and no specific calendar or almanac has been laid down for them. These and other factors have substantially affected the operational and effectiveness of the Council and its committees.

Let us now briefly examine the powers the Council has over subordinate science and technology institutions and the linkages between it and these institutions on the one hand and the productive sector on the other.

3.3 Powers of the Council

The limited powers of the Council were discussed in Chapter Two. Most of them are supposed to enable it to carry out its statutory functions and they can be divided into defacto and dejure powers. The defacto powers are those which go with its legal personality as a public corporation and with its operational autonomy from the parent ministry. These are all standard powers which include the power to own and dispose of property within any statutory limitations; the power to operate a bank account, enter into financial transactions and into contracts; the power to establish branches or subsidiaries within limitations of the law (if any); the power to have foreign relations with other legal persons and the power to hire and fire. These are usually assumed and go with the right of perpetual succession which an enterprise obtains on incorporation and do not have to appear in the establishing statute.

The dejure powers of the Council are very much limited and are mainly three. They include the power to raise research funds from local or international donors and to distribute them to researchers or research institutions; a general power to carry out research in various aspects of the economy and the

power to publish research findings by oral or written means.

Under the 1986 Act, the Commission is to have wider powers because in its structure a centre for the development and transfer of technology which has very wide functions and powers, including the registration of technology agreements is introduced. In making a decision whether or not to register an agreement, the centre will exercise on behalf of the Commission very wide discretionary powers. These powers, however, remain to be exercised. In the meantime, the Council continues to have no power to intervene in the activities of any training or R&D institution. It has no power to stop any technological process going on in any industry or institution which may be contrary to the interests of the public or to government policy. In such cases, the most it can do is advise the government to intervene. But in both Acts (1968 and 1986), the two institutions are not compelled to advise the government in such situations.

3.4 LINKAGES

Linkages are examined at two levels: first at the level of productive institutions and then at the level of the science and technology institutions.

3.4.1 Linkages with the Productive Sector

Although the Council Act (1968) is quiet on the duty of the Council to establish links with the productive sectors, it has been the policy of the Council to establish operational links with them. Counsellors who come from these institutions have always provided a direct and effective link between them. In addition, the Council has been organizing factory visits by specialized scientific officers in order to get a feel of the problems and achievements of industry.

The role of the Council in the activities of these institutions has been limited by the size of the Council's personnel and its general as opposed to specialized organizational structure. If the secretariat were organized on the basis of the committee structure which ought to be based on a sectoral alignment, it would be easy for the Council's

specialists to specialize in one or two sectors each and have effective links with the productive institutions in those sectors. A centralized bureaucratic machinery would not be useful in that direction. Let us hope that the proposed structure of the Council which envisages four directorates will be soon put into operation and be used to foster relations between the Council or Commission and the productive sectors.

3.4.2 Linkages with other Science and Technology Institutions
As pointed out earlier, while the Council Act of 1968 envisages that the Council will play a coordinating role over all science and technology institutions, no Act of these institutions envisages such role by the Council. The institutions were established in the late 70s and early 80s and, being more recent than the Council's Act, are assumed to have overruled the Council Act of 1968. What is a little surprising is that the Council has always been consulted whenever a new R&D institution was being formed and the Council does not seem to have raised the question of links with Parliamentary Draftsmen or the parent Ministries sponsoring the bills. But this problem has always been recognized by the Council's officials.

In a recent UNESCO-sponsored study of science and technology institutions in Eastern and Southern Africa, the Director General of the Tanzania National Scientific Research Council, who was the principal researcher, stated that the problem of lack of linkages was not limited to the Tanzanian Council. He noted that 'in most cases the terms of reference of the coordinating organs and their structural set-ups did not provide for a clear and smooth working relationship between the organs themselves and the main national institutions of scientific research and technology development including universities' (Msangi, 1985: 4). He noted further that, in most cases, the terms of reference of the main national research institutions and their structural set-ups did not provide for any definite relationship with the central research coordinating organ. He also pointed out the problem that was rising out of

this situation, saying, 'consequently, the scientific and technological workers of these countries were divided up into groups with vested interestes and they sometimes worked at cross purposes rather than in unison...'

The only formal link that exists between the Council and these institutions in Tanzania is that the Director General of the Council is a board member on most of their boards. This, however, is neither statutory nor conventionally guaranteed. Several factors have made it difficult for the Council to have more working ralations with the other institutions. The first is that each of the institutions has its own budget controlled by its parent Ministry. This makes control and planning for the S&T institutions very difficult. Secondly, and very unfortunately, there has been a terrible personality problem between Leaders of the Council and those of other institutions. Most of those leaders were together at university as students or staff. Hence they have opinions of one another and having graduated together or having become professors at the same time, in the same place, they feel as equals and most of them find it difficult to accept that, their background apart, they are heading institutions smaller than and subordinate to the Council.

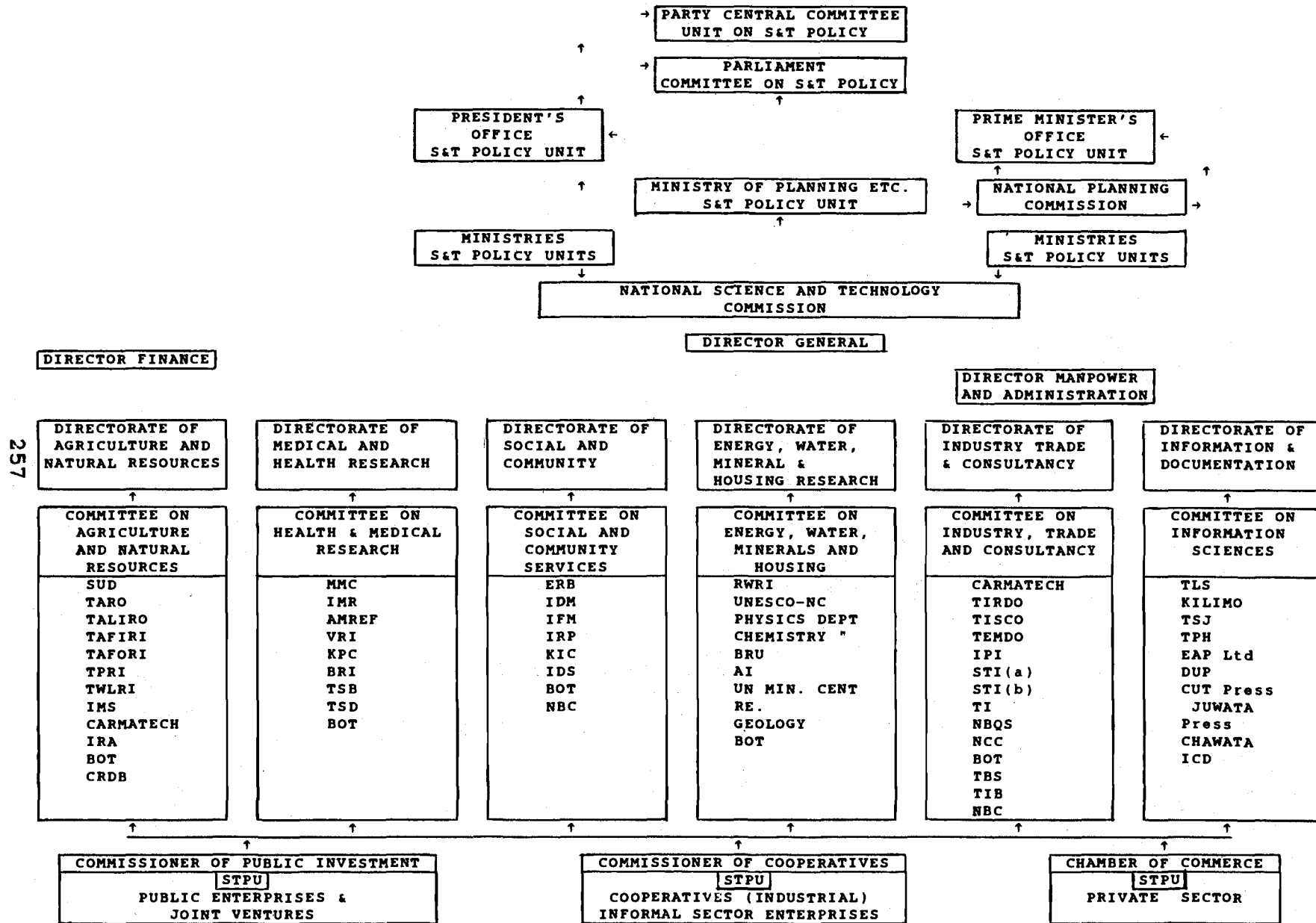
The third and related factor is that due to lack of a statutory demarcation of hierarchy among these institutions, each of them strives to perform better and be on top of others. Income-generating consultancy firms have always tended to adopt an above-others attitude and this is further encouraged by the dependence of the government on them for revenues. Because they generate funds, they can easily resist control from other institutions, including the Council, even to their 'other' mandate of stimulating technological change.

There is now some hope that after the Commission is launched, there will be more and better links with other S&T institutions because of two reasons. The first is that section 5 of the Commission Act (1986) gives the Commission the duty to monitor and coordinate the 'activities relating to scientific

research and technology development of all persons or body of persons concerned with such activities.' The second is because these institutions are adequately represented on the Commission's top decision-making organ. But a lot more changes have to be effected before the new structure can be more effective. First, the statutes of all subordinate institutions have to be amended to reflect the existence of the Commission and its powers. Secondly, section 5 (2) has to be supplemented by another spelling out how the Commission is going to 'monitor' or 'coordinate' the activities of such bodies. In this respect, the Commission has to have the powers of approval and intervention in the S&T activities of these institutions. Also, they have to be made accountable to it on S&T activities and function through annual reports and manpower returns.

Finally, two main changes may help further cooperation between these institutions. First, there have to be statutory guidelines about joint activities between the S&T institutions e.g. annual science exhibitions organized by the Commission in order to popularize technological advances made through research and to link research and production. Joint planning committees, joint awards for innovators and inventors etc. may be vital. The second change is that the Commission may function better if it adopts a federal structure with representation from as many sectors as possible and without leaving out the private and cooperative sectors. The structure suggested below involves the formation of science and technology policy advisory units at all levels from enterprise to party level. Because science and technology issues go beyond economic issues in se, it is suggested these units should be independent from economic units so that they can widen their activities and go beyond a traditional economic advisory role. The suggested structure is roughly as shown on Fig 3.3

Fig 3.3 Suggested Structure for Commission



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The government may want to examine the possibility of allowing institutions involved in various research and development activities to get involved in the selection of members of their relevant committees. Such a democratization process would remove the problem of rivalry in the committees while at the same time enhancing the chances for increased responsiveness and accountability on the part of the committees. Unless the whole structure is aimed at ensuring control and regulation, in which case the committees have to be composed of only appointees of the government, elected committees are more likely to depend on, utilize and value inputs, from below.

What this implies, therefore, is that committees can elect their own representatives to the Commission, and that representatives of this category can be as many as 60% of the Commission. In order to ensure the accommodation of broader government policy and groups which are not covered in the representation structure, the government can go on nominating up to 40% of the Commission members. With such a structure, it is easier and more rational to expect better and more efficient linkages and operational relationships between the Council or Commission and other S&T institutions.

3.4.3 Recommendations

- (1) In order to ease the coordination function of the Council or Commission, science and technology policy units be established in every key Ministry enterprise or relevant institution.
- (2) Science and technology institutions within the same Ministries should be encouraged to have more organizational and operational linkages and they should have a common supervisory organ to avoid duplication and the fragmentation of funding and research efforts.
- (3) Now that the Commission has been given a wider role than the Council, the Acts of the

institutions it is supposed to coordinate and control be amended to reflect this role.

- (4) The Council or Commission be given a statutory place and role in the National Planning Commission.
- (5) Cognizance be taken of the fact that the Ministry of Industry and Trade plays a major role in the development and acquisition of technology. Hence, it be given preferential treatment in the representational structure of the Council or later the Commission.
- (6) Parliament be more involved than at present in issues of science and technology by forming a committee to deal with those matters and efforts be made by it at least once a year in one short session to receive a report on the activities of the Council or Commission and give it directives or policy guidelines. The apparent neglect of the private sector in the organizational structure and activities of the Commission be removed. Recognition be made that a lot of technological activity both positive and negative goes on in the private sector as well.
- (7) The selection of Counsellors and Commissioners be made in such a manner that only those who are committed to the advancement of science and technology are involved on the Council or Commission.
- (8) The unit on science and technology in the Ministry of Planning be given clear and adequate supervisory powers over the activities of the Commission or Council.

- (9) R&D institutions be linked together by sectoral committees and annual activities such as meetings, conferences, exhibitions etc. be encouraged among them.
- (10) Committees be linked to their sectoral ministries and be required to be accountable to them and to act in an advisory capacity to them on various matters of science and technology.
- (11) The Committee structure be reflected at the level of the Council's/Commission's secretariat in order to make easy the linkages between the Council or Commission and the various sectors represented by the Committees.
- (12) Committees be set up on the basis of elective representation by heads of R&D institutions and they be made accountable to the fora (sectoral assemblies) that elect them.
- (13) The Committees be allowed to elect representatives to the Commission whose number should not exceed 60% of the total number of Commissioners.

CHAPTER FOUR

ACTIVITIES OF THE COUNCIL

4.0 Introduction

The annual activities of the Council are not spelled out in its establishing Act of 1968. The 1986 Commission Act also does not spelled them out. By convention, however, the Council has been organizing annual science fairs, some exhibitions, conferences and workshops. Science fairs and exhibitions have been of a limited nature, for lack of clearly defined linkages with other research development institutions, lack of supervisory powers of these institutions to host such activities and lack of appropriate staff to organize them. But conferences and workshops have been very regular and have, in most cases, helped the Council to formulate policies on how to increase its role in planning, coordinating and executing science and technology policy and also on how to increase its advisory role and its activities in popularising technological inventions and innovations. In the next few sections, we shall examine the extent to which the Council has involved itself in each of these activities.

4.1 PLANNING

One of the most important activities the Council has been involved in is planning and this has entailed two major activities: the first is policy formulation and development and the second programming. Each of these is covered separately below.

4.1.1 Policy Development

Between 1972 and 1977, very little was done by the Council in the development of science and technology policy. In 1977, the trend began to change. The Council organized a closed national seminar in preparation for the country's participation in the UN Conference on the Application of Science and Technology for Development in Dakar the following year. The seminar that was organized by the Council was held in Arusha. It involved

mainly the leaders of most of the science and technology institutions and interested government departments. It was followed by an open national seminar in Dar es Salaam in January 1978. Between 30th January and 4th February 1978, the Council organized a successful symposium on 'African Goals and Aspirations in the UN Conference on Science for Development.' This one was also held in Arusha.

These three activities provided the government with the views of Tanzania's scientists on science and technology and how to harness them to the developmental needs of Tanzania. The country's presentation at the Dakar conference which followed was good evidence of adequate preparatory work.

Between 13th and 24th October 1980, in cooperation with UNCTAD and SIDA, the Council sponsored a workshop on 'Technology Policies and Planning for the Technological Transformation.' The purpose was to solicit the views of local scientists and technology policy researchers so as to be able to advise the government on the Lagos Plan of Action for Economic Development in Africa which had been adopted by the Organization of African Unity earlier that year. These four conferences did a lot to enrich and widen the Council's outlook on science and technology policy issues. The Council began evaluating its activities and role in the articulation of the two subjects.

Following the endorsement of the Lagos Plan of Action for Economic Development in Africa, the Council, in collaboration with UNIDO and the Foundation for Reshaping the International Order (RIO), organized a study on the Tanzanian technology system. This started in July, 1980. A report was written immediately; but, while the study was going on, the Council together with the UNCTAD began another study of various national institutions engaged in science and technology policy research or services. Both these studies were aimed at enabling the Council to obtain data and information which it could use in the formulation of sound national technological systems and policies. Another objective was to survey the decision-making structure of

the science and technology institutions and be able to suggest a science and technology policy and decision-making system which would be conducive to a guided and fruitful technological advancement.

These two studies came out with suggestions for change in the national science and technology systems. The RIO report recommended the formation of a Ministry of Science and Technology in order to strengthen the national planning and management capability and facilitate the implementation of science and technology policies. The UNCTAD report suggested the formation of a Tanzanian Centre for the Transfer and Development of Technology which would monitor and coordinate technological development and thereby make possible the implementation of various science and technology policies. It further recommended the formation of research and development centres in rural and urban areas, the formulation of policy guidelines for public enterprises aimed at the formation of operational linkages and of rules on the importation of technology. In this respect UNCTAD proposed there should be a set of rules governing negotiations for the acquisition of technology in order to provide a framework for the effective transfer of technology during project design and implementation stages and also to provide the mechanisms for the acquisition of adequate skills through training and the effective participation of local experts in the project implementation processes.

Following these studies and recommendations, between 16th and 17th August 1984, the Council in collaboration with its parent Ministry organized in Arusha a national workshop on science and technology policy. The policy had fourteen major objectives and targets and contained separate sectoral policy objectives and targets. In the next few paragraphs these will be discussed briefly and separately.

4.1.2 General Objectives of the Policy

The national policy for science and technology can be better understood by reading the original 51 page document published by

the Ministry of Planning (1986). The objectives will be discussed in terms of their categorization. The general objectives are fourteen and they fall into four main groups. The first is that of political objectives and include:

- (a) To safeguard and strengthen the economic independence of Tanzania [clause 8(i)];
- (b) To build up a local technological capability capable of enabling Tanzania achieve its objectives of socialism and self-reliance [clause 8(ii)];
- (c) To use science and technology to attain a higher standard of living and better access to basic needs;
- (d) To set into motion technological progress which will make a better and more economic utilization of national resources within the framework of various national policies.

The second group are aimed at using science and technology for education and mobilizational purposes. They include:

- (a) To stimulate positive attitudes towards science and technology [clause 8(v)];
- (b) To strengthen national institutions for science and technology for teaching and popularizing new technologies and to equip various sectors with the relevant skills [clause 8(vi)];
- (c) To mobilize local experts through material and other incentives to increase their research activities and to minimize internal or external brain drain [clause 8(vii)].

The third category is of those aimed at regulation and control and include:

- (a) To establish rules and guidelines (through law) to govern the identification, selection, acquisition and transfer of appropriate technologies in accordance with national needs and priorities within the broad framework of socialism and self-reliance.
- (b) To establish a system for identifying and developing young gifted scientists in order to establish for the nation a firm foundation based on local technological skills.

The last category is that of transformational objectives. These seek to set into motion a machinery which can lead to the development or acquisition of technological capabilities and also to enable the economy to advance based on sound technological capabilities. They include:

- (a) To be self-reliant in technological manpower by the year 2000, at least in the main sectors of the economy, mainly agriculture and industry, in order to enable the country to adopt and modify imported technology;
- (b) To develop better methods of utilizing national resources such as energy and to ensure there is progress in industry and transport but that it does not adversely affect the environment;
- (c) To mobilize women for increased participation in science and technology issues;
- (d) To develop simple technologies which can be easily used by women in their performance of various roles in the economy;
- (e) To build up a firm foundation for the formulation of appropriate technological policies and decision in Tanzania.

4.1.3 Sectoral Objectives

The Council has set out the major policy objectives that have to guide the activities of the various actors in the various

sectors. These guidelines concentrate on seven main sectors, i.e. agriculture and livestock, industry and trade, natural resources, energy, health, transport and education and manpower. For ease of analysis, although some of the guidelines are very loosely connected, the objectives can better be discussed according to their emphasis. They fall into four main categories. The first covers research and development; the second, popularization and training (advocacy); the third, coordination and regulation and the fourth assimilation, diffusion and internationalization of imported technology.

(a) Research and Development Objectives

In terms of research and development, the policy guidelines advise that all sectors must ensure that their research activities aim at increasing self-reliance at all levels, reduce waste in production, consumption, marketing or harvesting and storage. In the agricultural sector, specific guidelines are given and cover several areas. The policy directs that agricultural research should aim at increasing soil fertility through increased use of leguminous plants and of fertilizers arising from natural waste. Other priority research areas are singled out as being irrigation and soil conservation, pest control, agronomical studies and the search for drought resistant seeds.

In the sector of industry, it is directed that research efforts be concentrated on how to reduce waste, increase trouble shooting and maintenance capability, inventiveness, better use of patents, trade marks and license agreements and establishment of workshops and laboratories for testing and developing techniques and various other technologies. In the construction sector, it is directed that research should be aimed at developing cheaper and more durable building materials, increasing the use of local resources, better and more efficient drainage and sanitation systems, increased design and better construction skills, how to maintain roads and make them passable at all times.

Research on natural resources is to concentrate on better mechanisms for storing and distributing water to the rural areas, increased yield in forestry resources, new techniques for preservation of forest products, better and more efficient lumbering, trimming, grading and storage techniques for forest products, and developing fish resources through better methods of genetic selection and hybridization.

Energy research is to concentrate on the intensification of research skills in the petro-chemical industry, the development of local technological expertise in energy development, increased research into permanent sources of energy (water, solar and wind) and intensified research into hydropower, bromass, biomass and geothermal sources of energy. Health research is directed to aim at increasing diagnostic capability, the data base on communicable and incommunicable diseases, search for possibility of manufacturing medical equipment locally, application of traditional medicine in public hospitals, intensification of research in herbs and through surveys of the informal health sector.

The transport sector is directed to increase its research activities on how to improve existing transport facilities by water, air and land. It is also directed to examine the possibility of reducing reliance on the traditional sources of energy and to look into the possibility of hydroelectric power as a source of energy for the transport sector.

(b) Regulation and Coordination

Each sector is directed to establish various mechanisms for the regulation and control of its activities. More specific directives in this direction are about regulatory mechanisms. The industrial sector, for example, is directed to set up mechanisms for the regulation of the use of trade marks, patents and licensing agreements as media for the transfer of technology. Further directives about control cover different aspects. First, it is directed that the use of industrial designs from outside the country should be carefully controlled. Second, in

connection with industry, it is recommended that a control body be established to control the negative impact of industrialization e.g. pollution. Third, and again in connection with industry, it is recommended that a law be enacted to regulate the registration of patents and trade marks and to control the use of license agreements as media for the acquisition of technology. Fourth, it is recommended that there should be a joint body to coordinate the activities of transport institutions.

The fifth policy proposal in this direction is about control of the use of expatriates. The Council proposes that no major agricultural, industrial or infrastructural project or programme should be embarked upon by using expatriates alone at the professional level and that there should always be a suitably qualified citizen counterpart to work with the expatriates from the very beginning of any such projects.

The sixth is the requirement that local experts be involved in the drafting of technology agreements, while the seventh is that there should be ways of channelling technological information to the relevant people or institutions. The Council proposes the publication, by itself, of an inventory of scientific and technological manpower and equipment.

All these were accepted and included in the national science and technology policy.

(c) Advocacy

Advocacy in this context mainly involves the popularization and commercialization of science and technology. In the national science and technology policy, the Council has identified five major activities and mechanisms of facilitating this function. First, it has identified science fairs and exhibitions as the best fora for popularizing science and technology, the objective being 'to inculcate a scientific and technological culture among Tanzanians.' The mass media has been identified as the second medium and films, newspapers, radio and television will be used to promote scientific knowledge. The third strategy is the

increase of the participatory role of women in the utilization of science and technology because of the significant role they play in the economy and in educating the youth about work and health. The fourth relates to extension and demonstration services for purposes of diffusion, absorption and assimilation of new technologies, whether imported or generated locally.

The fifth mechanism has been identified as standardization. This has been advanced for two reasons. First to enhance good relations between consumers and producers and hence facilitate further growth and secondly for purposes of quality control in order to ensure organized technological development. The Council recommended that the Bureau of Standards be strengthened in terms of financial and other resources.

4.1.4 Programming

The programming activities of the Council have featured much more in the national science and technology policy than in previous activities. Most of them revolve around the general policy guidelines discussed above. But what can be noted is that the Council has given wider and more detailed guidelines about the research priorities of various sectors. Two sectors have been given a lot of emphasis - agriculture and livestock. Other activities covered are related to manpower development and education.

(a) Agriculture

Four things have been the basis of the Council's programming activities under this section and they are: agricultural research, agricultural extension, agricultural mechanization, plant and crop protection services and agricultural productivity and extension services. On agricultural research, the Council has proposed in the policy that the focus should be on agro-economical zones and that the researchers should adopt a farming systems approach, use competent staff, maintain a national research data bank and give priority to existing research institutions before launching new ones.

On agricultural extension, the Ministry of Agriculture has been advised to provide adequate resources, ensure the bodies involved maintain vertical integration, provide farmers' training, organize demonstration plots or farms, link livestock and agricultural programmes and as much as possible use professionals. On agricultural mechanization, it has been advised, the means should be launched in accordance with the relative levels of resources endowment and adaptability to geological conditions, and that emphasis should be on animal power and locally manufactured rural-based machinery.

On plant and crop protection services, the institutions involved were advised to start with the expansion of centres for monitoring pests, to intensify research, offer training to people on better methods for pest and crop diseases control and to come out with better definitions of vermin. On agricultural productivity extension services, the agricultural institutions were advised to train agricultural extension officers with better and positive attitudes for farmers and farming and then deploy them equitably through the country. Similarly livestock training institutions were advised to intensify training activities, deploy adequate numbers of experts in the relevant areas and engage in the development of appropriate techniques for animal husbandry.

On livestock research and development, the relevant institutions were required to launch more research programmes in animal production, pasture and animal diseases as the first priority. The second priority was identified as increased research efforts in animal feeds such as seed cake, groundnut cake, simsim cake, bonemeal and molasses.

(b) Training of Scientific and Technological Manpower

The Council pointed out in the national policy that technological development very much depended on the capability of the nation to produce adequate technological manpower. The year 2000 was set as the target year by which all institutions of higher learning will have to have produced, or indicated plans

to produce, the essential and key technological manpower in the country. Their targets were set for all levels of education in order to ensure that the educational system changed in that direction.

At the pre-school level, training was recommended to emphasise the use of safe educational toys which should be made available in shops, nurseries, day-care centres, orphanages and in all institutions that care for young children. At the primary school level, it was recommended that the teaching of science should be based on thorough instruction and experimentation. Vocational-oriented scientific training was recommended for this stage.

In secondary schools and technical colleges, science teaching through practical and applied work programmes was advocated. The Ministry of Education was requested to set up a centre for the manufacture of simple science equipment and also to set up science equipment repair workshops. University teaching was criticised for concentrating on a few scientific areas and the universities called upon to expand training to cover irrigation engineering, architecture, design engineering, solar energetics, hydropower technology, food technology, textile technology, agricultural engineering and leather technology.

In order to provide a non-governmental infrastructure for the development of scientific research capability, the Council recommended that the government support the formation of professional associations, science clubs, academies of sciences and arts, and other forms of science research institutions. It was also recommended that a national system for identifying, evaluating and awarding inventors and innovators for their inventions or innovations be found out and developed.

Finally in the programming function, the Council made specific recommendations on the national coordination and programming of the research function. It recommended that 30% of the research funds should go to agricultural, food and livestock research, 20% to industrial research, 15% to minerals, wildlife,

fisheries and forestry research, 10% to energy research, 7.5% to basic science and 7.5% to social sciences. It was recommended that these quotas be followed for the next twenty years and that 3.5% of the GDP should be devoted to research by the year 2000. It was recommended also that a National Fund for the Advancement of Science and Technology should be established in order to mobilize funds from all sectors, internal and external donors and channel them into the development and evaluation of science and technology.

4.2 EXECUTION OF PROGRAMME AND S&T ACTIVITIES

Most of the science and technology programmes are meant to be executed by other institutions. Hence the major activity of the Council in the execution process has been to lay out an execution plan. It is in this area that the Council has done a very meticulous job, dividing most of the major programmes into sub-programmes and outlining the various stages of programme execution and the actors involved. The programmes are discussed hereunder by sectors.

4.2.1 Transport and Communications

The Council divides the programme into six programmes, starting with the railways. It identifies four main goals in the railway transport sub-sector, including linking the railway systems of different technical specifications, or gauges; developing and improving handling facilities at railway terminals and stations; improving railway networks, locomotive engines, maintenance facilities and electrifying the railway system. The Ministry of Transport and Communications, the Tanzania Railway Corporation and the Tanzania Zambia Railways Authority are assigned the duty of ensuring this programme is implemented between 1986 and 1990.

The second is the inland waterways and maritime shipping sub-programme. Four projects are identified under this sub-programme. They include the improvement of the efficiency and operation of ports; the establishment of more ports and other water landing stations; the improvement of maintenance facilities

for ships; and the establishment of new and the strengthening of the existing marine transport-training institutions. The Ministry of Transport and Communications, the Tanzania Railways Corporation, the Tanzania Harbour Authority and the Tanzania Coastal Shipping Lines are given the role of implementing this programme between 1986 and 1995.

The third sub-programme is on the development and improvement of communications services. It involves the improvement of postal delivery systems and the Tanzania Posts and Telecommunications, the Tanzania Railways Corporations and Air Tanzania Corporation are required to implement this between 1986 and 1990. It also involves five other projects. The first is the strengthening and extension of existing telephone services. The same corporations stated above have to collaborate in this and be ready to report positive results by the year 1995.

The second is the improvement of mass media facilities such as radio equipment and strengthening mass media training institutions and facilities. The principal implementers of this project are the Prime Minister's Office and Radio Tanzania. Collaborative institutions are the Ministry of Trade and Industry, Printpak (T) Ltd. and the National Printing Company. All these have to have completed their work by 1995.

The third is the establishment or procurement of maintenance facilities for telecommunications. The Ministry of Transport, the Tanzania Posts and Telecommunications and the Directorate of Civil Aviation had to implement this programme between 1986 and 1995. The fourth is the establishment of a television network and the fifth the general strengthening of the mass media and telecommunications personnel. The Ministry of Communications and Transport, the Prime Minister's Office, the Tanzania Posts and Telecommunications and Radio Tanzania have to cooperate on this and show results by the end of 1995.

The fourth programme is the strengthening of air transport. It involves three projects. The first is the improvement of airport facilities such as fire fighting equipment and

communication facilities. The principal actors are the Ministry of Transport and Communications and Air Tanzania. Collaborative institutions are the Directorate of Civil Aviation and the Ministry of Finance. The deadline is at the end of 1995.

The second project is the strengthening of aircraft maintenance facilities, including aircraft hangers. The principal actors and collaborative agencies remain the same. The target completion time is 2000. The third project is the establishment of a fully fledged aviation training centre. The actors are the same and the completion target time likewise.

The last programme under the transportation sector is the provision of an adequate urban public transportation services programme. It involves three main projects or sub-programmes. The first is the design and specification of urban roads maintenance facilities. The Ministry of Transport and Communications is the principal actor and the National Transport Corporation and the Tanzania Railway Corporation the secondary actors. The year 1995 is the target time for completion. The second project involves the introduction and electrification of the urban transportation trolley buses and buses. The Prime Minister's Office and the Ministry of Transport and Communications are the main actors, while the Tanzania Railways Corporation and the National Transport Corporation are the secondary actors. The year 2000 is the target date for completion.

The third project is the investigation of the possibility of alternative fuels e.g. alcohol, biogas, etc. and the actors and target time for completion are the same.

4.2.2 Health Services

There are twelve programmes under this project. The first is about the further identification of animal and human diseases. It involves six main sub-programmes. The first involves research into biological agents, mainly viral, bacterial, fungal and parasitic agents causing disease in human beings and also research into animal and plant agents of diseases such as

zoonoses, toxins from animals and plants, snake bites, rodents, etc. The Ministry of Health, the National Institute for Medical Research, the Muhimbili Medical Centre, the Tropical Pests Research Institute, Ministry of Agriculture and Livestock and the Tanzania Livestock Research Organization are the principal actors, while the University of Dar es Salaam Faculty of Science is expected to collaborate with them. The target date is the end of 1990.

The second project is research on the chemical agents of disease such as insecticides, pesticides, etc. The principal implementers are the same as those in the first project, but the Tropical Pests Research Institute is the secondary implementer. The target date for completion is set at the end of 1990. The third project is research into the physical agents of disease and these include burns, fractures, road traffic accidents, radiation hazards, etc. The Ministry of Health, the Ministry of Agriculture and the Muhimbili Medical Centre are the principal actors in this project. 1990 is set as the target year for completion or presentation of results.

The fourth project involves research into epidemiological determinants of common diseases such as climatical, geological, social and cultural factors, while the last project involves research into the mineral agents of diseases such as fluoride, iodine and iron. The Ministry of Health and the Muhimbili Medical Centre are the main actors and the year set for completion of report of findings is 1990.

The second programme in this sector is the control of communicable and infectious diseases programme. It involves diseases such as malaria, sleeping sickness, tuberculosis, leprosy, elephantiasis, bilharzia, cholera, sexually transmitted diseases and virus diseases. It involves five projects. The first is on vector control and involves research and the mobilization of people for naturalistic control measures. The Ministry of Health and the National Institute for Medical

Research are the principal actors and the Muhimbili Medical Centre the secondary one. The project has to bear fruit by 1990.

The second project involves the diagnosis and treatment of communicable and infectious diseases. It involves the examination of the pathophysiology of the involved diseases and research into appropriate therapeutic measures. The principal and secondary actors and the target time are the same as in the first project. The third project involves research into appropriate chemoprophylaxis, especially for malaria in children under five years of age and pregnant mothers. The actors and the time target are the same as in the other projects.

The fourth project involves immunization campaigns. The Kilimanjaro Christian Medical Centre and the Bugando Consultancy Hospital have been added to the list of actors in this project and the target time is the same as in the other projects.

The last project in this programme is on health education. It involves giving counselling services to patients and the public about communicable and infectious diseases.

The third programme in this sector is the control of non-communicable diseases. It comprises only three projects. The first involves the diagnosis and treatment of victims of drug abuse, mental patients and patients with diabetes, rheumatism and cancer diseases. The Ministry of Health, the Prime Minister's Office and the Muhimbili Medical Centre are expected to implement this project and report results at the end of 1990.

The second project involves the detection of risk factors involved in non-communicable diseases and how to avoid them. The principal actors remain the same as in the other projects and the National Institute for Medical Research is expected to collaborate with them. The target time for success is the end of 1990.

The last project is health education for patients and members of the public about diseases and how to avoid them or minimize their impact. The principal actors are the same as in

the other projects and the target time has been set at the end of 1990.

The fourth programme is aimed at the improvement of personal hygiene and clothing. It involves four main projects. The first is on body hygiene and involves a study of appropriate washing habits and water supply. It also involves the study of various methods of topical preparation and the applicable and appropriate dosages. The second project is on the diagnosis and treatment of skin diseases in the population. The third involves a study of how to improve clothing and footwear for various sections of the population mainly living in the rural areas and also how to control cloth-transmitted diseases. The fourth is on dental hygiene and involves further and more detailed research into dental diseases, methods of their diagnosis and the dental prosthesis technology. In all these projects, the Ministry of Health, the Muhimbili Medical Centre and the Prime Minister's Office have been identified as the principal actors. The Ministry of Trade and Industry, the Tanzania Leather and Associated Industries and the Tanzania Textile Corporation are the collaborative institutions. The time target for initial results is 1990.

The fifth programme is on the provision of clean water for human consumption and the control of water, food and waste borne diseases. It involves four projects. The first is about the improvement of water supply and involves studies of trends of water supply and its effect on health, the bacteriological and chemical content of water supplied, the management of water supply and waste disposal. The second involves research into the problem of food borne diseases and how to control them. The third is about waste disposal and involves smaller projects on determining soil and hydrological conditions affecting waste disposal and a study of appropriate waste disposal mechanisms e.g. pit latrines and alternative systems. The fourth project is on the study of sewage systems in urban areas and how to improve them. It involves the maintenance of existing infrastructure and

a study of the safety of re-utilizing of sewage materials. The Ministry of Health, Ministry Water, the Prime Minister's Office and the National Urban Water Authority are supposed to cooperate in this programme and produce results by the end of 1990.

The sixth programme is on food and nutrition. It has three main projects. The first is a study of food-borne diseases, including chemical and biological contaminants during handling, storage, transportation, preparation and consumption. The second is on nutritional problems, mainly diseases associated with under-nutrition and over-nutrition, weaning foods, low cost protein-rich food. The third is on food technology and involves a study of food preservation and processing methods. The Ministry of Health, Muhimbili Medical Centre, the Food and Nutrition Centre and the Bureau of Standards are the main actors.

The seventh programme is aimed at the appraisal of local chemical and pharmaceutical technology and related traditional habits and practices. It involves three projects. The first is the survey of local entrepreneurship in the chemical pharmaceutical industry. The second is research into the feasibility of utilizing low raw materials in drug preparation. The third involves the evaluation of the drug formulation processors in various enterprises with a view to establishing the efficacy of these institutions, the quality control methods they apply and the existing technological capability. The Ministry of Health, the National Institute for Medical Research and the National Chemical Industries are the main actors.

The eighth programme is on medical physics and engineering and involves two projects. The first relates to research into the local entrepreneurship in hospital and laboratory equipment. The second to research in the standards and quality of imported medical equipment. The Ministry of Health, the Muhimbili Medical Centre and the Physics Department of the University of Dar es Salaam are expected to cooperate in this programme and show results by the end of 1990.

The ninth programme is on the improvement of health care systems and the management of health organization. It has five main projects. The first is the study and innovation of health delivery systems with the aim of working out simpler, cheaper and more effective systems. The second is on how to improve the system of patient consultancy and reference. The third on the improvement of methods used by traditional healers. The fourth on further training and the improvement of health management and the fifth on the improvement of the methods used in keeping health data and statistics. The Ministry of Health is the principal actor and all consultancy hospitals, while the Bureau of Statistics and the Ministry of Manpower Development are secondary actors. Target time for completion of implementation is 1990.

The tenth programme is on the improvement of the drugs situation and other supplies in hospitals. It involves two research projects. The first relates to research on the facilities for the storage of drugs and vaccines and the second is a study of the delivery systems of drugs and other supplies. The National Chemical Industries and the Tanzania Bureau of Standards are the main actors and the end of 1990 is the target time.

The eleventh programme is on training health personnel and involves five projects. The first is a study of the appropriate length of training various categories of health employees need and the appropriate curricula for them. The second involves the establishment and improvement of training centres for all categories of health science in schools and colleges. The third is the establishment of the necessary facilities for continuous health education and the fourth on the publication and dissemination of literature on health for the purposes of health education. The Ministry of Health and the Ministry of Finance, Development Planning and Economic Affairs are the principal actors. The Prime Minister's Office, the Ministry of Education and the Department of Education at the University of Dar es

Salaam are secondary actors. The year 1990 has been set as the target.

The eleventh and last health services programme is industrial safety and the control of environmental pollution. Five projects are planned under this very wide programme. The first involves a study of the sources of industrial health hazards with a view to enacting a law providing for discoverable hazards. The Ministry of Health and the Labour Department are expected to have finished this study by the year 1995. The second project aims at developing audio-visual methods on safety precautions in industries. The Ministry of Health, the Prime Minister's Office, the Tanzania Film Company and the Audio-visual Institute are expected to cooperate and have something already done by the end of 1990.

The third project involves research into the varieties and constituents of potential hazards emanating from industrial, transport and health activities and the specification of the levels of pollution which may not be dangerous and those which may be dangerous. The Ministry of Health, the Tanzania Industrial Research and Development Organization, the Tanzania Bureau of Standards, the University of Dar es Salaam, the Sokoine University of Agriculture and the Ministry of Labour have been assigned this programme and the results of their studies are expected by 1990. The fourth project is aimed at establishing systems and mechanisms for mandatory periodic medical check-ups for all workers in all work places in order to enhance the early and timely diagnosis of diseases. The Ministry of Health, Ministry of Labour, the Prime Minister's Office and the Occupational Health Group will cooperate on this programme and results are expected by end of 1995.

The fifth project involves intensive investigation of the levels of pollution arising out of emission of effluents from industrial, transport and other activities in order to control environmental pollution and its resultant hazards. The Ministry of Land and Natural Resources, the Ministry of Industry and

Trade, the National Environmental Council, the Ministry of Transport, the Ministry of Justice, the Tanzania Bureau of Standards and the National Chemical Industries are expected to cooperate and show results by the end of 1995.

4.2.3 Energy

The Council puts a very heavy emphasis on the development of the energy sector. This is because its philosophy on this has been that 'energy and development are interrelated'. It defines the goals of the energy sector as being mainly three i.e. to reduce dependence on imported energy, to reduce dependence on woodfuel and to intensify the development of indigenous sources of energy. It has also worked out the main framework of the development strategy of this sector. This involves four things, namely, the development of local technological and negotiation capabilities, the development of design and fabrication capabilities, the development of maintenance and standardization techniques and the intensification of research into new and renewable sources of energy. In the national science and technology policy, there are six main programmes for the energy sector.

The first programme is on petroleum and gas exploration and development. It has only two projects. The first is the establishment of adequate oil storage facilities in readiness for any national emergencies. The Ministry of Water and Energy in collaboration with the Ministry of Trade and Industries are expected to have completed this project by 1990. The second is the intensification of oil and gas exploration and related development activities. The Ministry of Water and Energy and the Tanzania Petroleum Development Corporation are supposed to finish this project by 1988.

The second programme is for the development of coal resources. It involves six projects. The first is the intensification of the development of coal collieries in order to increase the coal mining capacity. The second involves the conversion of some oil-fired production systems into coal-fired systems. The Ministry of Water, Energy and Minerals, the State

Mining Corporation, the Ministry of Industries and the Saruji Corporation are expected to cooperate and finish these projects at the end of 1995.

The third project involves the rationalization of the pricing mechanisms for coal at the national level and this may require the formation of a coal regulatory agency such as the National Coal Board. The Ministry of Water, Energy and Minerals, the State Mining Corporation, the Ministry of Planning and the Price Commission are expected to work on this project and finish it by 1990.

The fourth project involves the establishment of a coal technology training scheme at various levels of the education system. The Ministry of Water, Energy and Minerals, the Ministry of Education, the Labour Department and the University of Dar es Salaam are expected to work on this project and to have accomplished it by 1990. The last project entails the substitution of coal or gas for oil. The Ministry of Water, Energy and Minerals, the Ministry of Industries and the University of Dar es Salaam are expected to work together on it.

The third programme is on the development of hydro-electric power. It has five projects. The first is concerned with the phasing out of diesel-fired generation plants and their substitution by coal-fired or hydro-electric power plants. The Ministry of Water, Energy and Minerals, the Tanzania Petroleum Development Corporation, the Tanzania Electricity Supply Co., and the Ministry of Industries are expected to have made substantial progress on this project by 1990. The second project is on the identification and utilization of the hydro-electric power potential and the popularization of electric power in the rural areas. The Ministry of Water, the Tanzania Electricity Supply Co., the Ministries of Agriculture, Industries and Finance and the Small-Scale Industries Development Organization are expected to have finished the study by 1995. The fourth programme involves the study of the possibility of electrifying urban public transport. The Ministries of Transport and Energy, the

Prime Minister's Office and the Tanzania Railways Corporation have been given this task. The target year is 2000. The last project on this programme is the development of simple and cheap electric cookers.

The fourth programme involves the assessment and development of biomass energy. It has seven main projects. The first involves the assessment of biomass resources in general and woodfuel surveys in particular. The Ministries of Water and Natural Resources, the Sokoine University of Agriculture and the Institute of Resources Assessment were supposed to have completed this project in 1986. The second involves the identification of fast-growing tree species suited to various ecological zones in Tanzania with emphasis on semi-arid areas. The same institutions named above were supposed to have completed this project by the end of 1986.

The third project is the establishment of woodfuel plantation and the fourth and related project the provision of tree seedlings for afforestation. The Ministries of Natural Resources and Agriculture, the Prime Minister's Office, the Sokoine University of Agriculture and the Tanzania Forestry Research Institute are expected to complete these projects by 1991. The fifth is for the utilization of various forms of waste biomass for energy production and the range of sources includes agricultural and forestry wastes, molasses, bagasses, cashewnuts, coconut husks, rice husks, etc. The sixth and related project is the study of the potential of hydro-carbon producing plants as sources of fuel. The seventh and supportive project is the establishment of an industrial and commercial capability for the popularization of the use of fuel oils from oil seeds, bagasses, molasses and other waste. The last project is further research and development, the demonstration and diffusion of improved designs for woodfuels, cookstoves and kilns for charcoal production. The Ministries of Natural Resources, Water and Energy, Agriculture and Industries, the Tanzania Agricultural Research Organization, the Tanzania Forestry Institute, the

Botany and Chemistry Departments of the University of Dar es Salaam, the Prime Minister's Office and the Tanzania Petroleum Development Corporation are expected to cooperate on these projects and the target time for completion is 1995.

The fifth programme is further research into and the development of alternative renewable sources of energy. It has eleven major research projects. The first is research on electric power generation. The Ministry of Water is the main actor and the Ministry of Trade and Industries, CARMATEC and the Institute of Production Innovation at the University of Dar es Salaam are expected to cooperate. No target time has been set, but results are expected before the year 2000.

The second project is biogas technology research and involves the same actors and time span. The third is research on solar energy, solar water heating, crop drying, desalination, low cost solar thermal electric conversion (STEC) e.g. in photo voltaic communication, refrigeration, simple solar electric power systems, photo-voltaic and thermo-dynamic solar water pumping and related projects. The Ministry of Water, Energy and Minerals, and the Tanzania Electricity Supply Co. are the principal actors and the Ministry of Trade and Industries, the Institute of Production Innovation, the Physics Department of the University of Dar es Salaam and the Sokoine University of Agriculture are expected to be the principal researchers.

The fourth project is geothermal energy exploration and exploitation, research on tidal wave power, animal, research on simple mechanical power (hand pumps, hydraulic rams, etc.), the generation of energy from urban waste, and peat and research on nuclear power. Most of these are long-term projects and involve all the institutions in the first four projects. No specific time target has been set.

The sixth energy programme is for the establishment of an environment and energy research institute either at the University of Dar es Salaam or the Sokoine University of Agriculture between 1987 and 1988. The seventh and last

programme is for the development of technological education in the area of energy resources. It involves two projects. The first is training technicians in mineral exploitation and processing, oil and gas production and distribution. This is expected to be completed by the year 1991. The Ministry of Water, Energy and Minerals, the Tanzania Petroleum Development Corporation, the East African Mineral Centre (UN) and the Rwegalulira Water Resources Institute are expected to cooperate on this. The second project is the establishment of specialized courses at university level for training in fuel technology, mining and petroleum engineering. The Ministry of Water, Energy and Minerals and the University of Dar es Salaam are expected to have completed the project by the end of 1992.

4.2.4 Agriculture and Livestock

The general goals set out by the Council in the case of agriculture and livestock are to achieve self-sufficiency in food and livestock production, increase cash crop and food production, increase the use of fertilizers, insecticides and irrigation. It has nine programmes under the policy for the improvement of food production in terms of both quality and quantity. There are five main projects. The first is research into the nutritive aspects of food with the aim of meeting the people's requirements. The Ministry of Agriculture and Livestock, and the Tanzania Agricultural Research Organization are the main actors and the Ministry of Health, the Tanzania Food and Nutrition Centre and the Sokoine University of Agriculture are expected to collaborate. The target time for completion is 1991.

The second is research and development in food conservation to ensure the retention of the nutrients in food during harvest and storage. The actors and the time limit are the same as in the first project. The third is research geared towards improved marketing and the distribution of consumer goods. The fourth is research involving the breeding of higher yielding varieties of staple foods (mainly cereals) and the fifth is research on the

improvement of soil fertility through the selective use of legumes, compost, farm yard manure and other natural fertilizers. The Ministries of Agriculture and Trade, the National Milling Corporation, Tanzania Agricultural Research Organization, Biashara Consumer Ltd., Tanzania Seed Company and the Sokoine University of Agriculture are expected to cooperate in these projects and complete them by 1991.

The second programme is for soil and water conservation, improved land use and mechanization. It has seven projects. The first project is for strengthening existing and establishing new bioclimatical centres in order to provide data for various ecological zones and thereby help in facilitating early warning systems and bioclimatical surveillance. The Ministry of Agriculture and the Ministry of Natural Resources in collaboration with TAFORI and TARO are expected to be through with this project at the end of 1991.

The second and third projects involve the study of ecological and farming systems in order to determine the types of crops suitable for various zones and research in soil systems and methods for the control of soil erosion. The Ministries of Agriculture and Natural Resources, the Sokoine University of Agriculture and the Tanzania Agricultural Research Organization are expected to have completed their research by the end of 1991. The fourth project is on the study and development of farm implements and new farming methods. Mechanization and oxonization are expected to be the main target of the studies and the Ministries of Agriculture and Industries, the Ubungo Farm Implements, the Mbeya Farm Implements and CARMATEC are expected to cooperate in these projects and produce results by 1990.

The fifth project involves research on the best use of compost and farm yard manure and chemical fertilizers. The Ministry of Agriculture, TARO, TALIRO and the Tanga Fertilizer Company are expected to have made substantial progress on this project by the end of 1990.

The remaining two projects are for the development of packages for recommendations on agricultural practices, mainly on the use of fertilizers, land preparation, planting, weeding and plant protection and also the best methods for land use aimed at increasing soil fertility. The Ministry of Agriculture and other institutions involved in the other projects above will take action on these projects also.

The third programme is for water development and irrigation. It has five projects all of which involve the same institutions i.e. the Ministries of Agriculture and Natural Resources, TARO, the National Engineering Company, TAFORI and the Sokoine University of Agriculture. They are expected to have been completed by 1991. The first involves the research and development of new techniques of water conservation for crop production through minimum tillage, strip cultivation, agroforestry, use of ridges, terraces, bands, etc. The second involves a study of the water requirements of important vegetable crops. The third involves studies on the possible ecological implications of dam construction and dam maintenance. The fourth is aimed at a comparative study of various irrigation techniques and the fifth involves the development of soil water conservation methods such as rainfall management through the use of small dams and ponds, their construction and utilization for crop management.

The fourth programme involves a long-term plan for the genetic improvement of the main crops. It has six main projects. Five of them involve the Ministries of Agriculture and Natural Resources, TARO, TPRI and the Sokoine University of Agriculture (SUA). The first is the genetic breeding of major food crops such as maize, legumes and root and tuber crops. The second involves the establishment and strengthening of centres for producing quality seeds. This is expected to be accompanied by the expansion of the existing seed farms and the setting up of new ones. The third involves the enforcement, review and reenforcement of plant importation regulations and strengthening

the plant quarantine unit at the TPRI. The fourth is the use of bio-technology to produce bacterial inoculants for sustaining high forage yields and soil fertility. The fifth is the development of high yielding varieties of cash crops with standards required by the international markets. The aim is to make them pest and disease resistant. The last project is the development of drought resistant crop varieties for the drier areas of Tanzania.

The fifth programme is for research and development in animal production. The main problem which the programme aims to tackle relates to poor livestock management, poor pastures, overstocking, poor breeds and the susceptibility of animals to diseases. The programme involves six projects which have to be implemented by two Ministries (Agriculture and Natural Resources) TARO, TALITO, TAFORI, SUA and the Sugar Development Corporation. The first project is the establishment of new and the strengthening of existing centres for research into the adaptation and genetic improvement of livestock for milk and meat production. The second is the development of new methods and the strengthening of the existing capability to use artificial insemination and embryo transfer techniques for livestock improvement.

The third is the establishment of new and the strengthening of existing research centres for pasture development and range management. The aim is to ensure adequate water and animal feeds and the maximization of livestock productivity. The fourth project is research and development into the use of agro-industrial by-products such as molasses and upgraded low quality roughages and crop residuals such as maize cobs, stover, sisal pulp, rice and wheat straws, various grasses, sugar cane tops and bagasses as animal feeds. The fifth is the establishment and strengthening of poultry parent stock and grand stock breeding centres, while the last is carrying out livestock censuses every five years in order to facilitate judicious land use planning and to ensure an adequate and regular supply of livestock products.

The sixth programme is for the control of livestock disease and animals. The aim is to ensure maximum production from livestock. Only two projects are involved and they in turn involve only the Ministry of Agriculture, TALIRO and SUA. The target accomplishment time is 1991.

The first project aims at the establishment of new and the strengthening of existing centres for the control of contagious animal diseases such as bovine pleuro-pneumonia tick-borne disease, trypanosomiasis, foot and mouth diseases, gastrointestinal diseases in goats and sheep. The second involves the establishment of new and the strengthening of existing veterinary and dip services centres, the strengthening of extension services and the supply of drug and vaccines.

The seventh programme is for research into dairy farming, ranching and animal nutrition. The Ministry of Agriculture, SUA and TALIRO have to cooperate on this programme, which involves three projects. The results have to be seen at least by the end of 1991. The first involves the establishment of programmes for the application of artificial insemination techniques. The second involves research into the possible sociological problems of introducing new animal production techniques by using the law. The third aims at strengthening research on animal production and nutrition.

The eighth programme is for research and development in the storage and preservation of agricultural products. The basic aim is to reduce and if possible prevent food wastage when planting, weeding, harvesting, storing and processing food crops. The actors and time target are the same as in the other two previous programmes. There are three projects: the first is research into rodent control. The second is research into post harvest crop management to reduce crop losses caused by insects. The third involves information dissemination on better grain and other food storage methods in the rural areas.

The ninth programme is for research into and the development and utilization of improved agricultural techniques

for traditional and new crops. The aim is to increase crop yields and reduce production costs. Three projects are involved. The first is the diffusion and popularization of simple rural techniques and implements such as animal drawn ploughs or simple power-traction equipment. The second is soil fertility studies and research into better and more economic use of chemical and other types of manure. The third is weed control and the development of improved cropping systems. The Ministry of Agriculture, TARO and SUA have been put in charge of these last two programmes and their implementation time limit is the end of 1995.

4.2.5 Industry

The goals of the programmes in this sector are to develop priority areas in the national long-term industrial strategy (1975-1995) and seven programmes have been laid down. The first is for expansion and research in the food and agro-processing industries. Five projects have been planned in this programme. The first is the expansion and improvement of the industrial processing of local food materials. The Ministry of Industries, the Food and Nutrition Centre and SUA are the principal actors in this project. The second is the industrial processing of local vegetable fibres. The third is the establishment of guiding criteria in the choice of technology in food processing industries. The fourth is the improvement of food processing methods and the fifth the strengthening of the existing institutions for the control of standards in the food industry. All these are supposed to be implemented by the Ministry of Industries in collaboration with the Ministry of Agriculture, the National Milling Corporation and the Tanzania Bureau of Standards. The results are expected by the end of 1991.

The second programme is for the development of building materials. It has three projects. The first is the enhancement of the industrial production of local ceramics and the use of siliceous materials, the manufacture of sheet glass and other glass products. The second is the increased use of forestry

products in the building industry and the third involves research into alternative building and construction materials such as posalamic cement, soil cement and sisal cement. The Ministries of Industries and Natural Resources and the National Development Corporation, the National Construction Council, the Building Research Unit and the Prime Minister's Office are expected to cooperate in this programme and show results by 1991.

The third programme is for research and development in low-cost housing using local materials. It has three projects. The first is the development of safe, durable and cheap local materials for low-cost house roofing. The Ministry of Natural Resources, the Prime Minister's Office and the Building Research Unit (BRU) are expected to cooperate. The second is the manufacture of glass and ceramics from local siliceous materials. The Ministry of Industries, the BRU, the Saruji Corporation and the Ministry of Natural Resources and the University of Dar es Salaam (Faculty of Engineering) are supposed to cooperate in these two projects and begin showing positive results by the end of 1991.

The fourth programme is for the development of small-scale rural-based industries. The aim, according to the Council, is 'alleviating the drudgery of life in the rural population thereby improving the quality of life through employment-generation, particularly during the dry season, when farming activities are at the lowest level' [UTAFITI, 1985(b)]. Eight projects are involved in this programme. The first is the production of farm implements based on traditional technologies. The second is the production of building materials. The third is the improvement of methods and the production of traditional equipment for food and crop storage. The fourth is the improvement and production of wood and charcoal stoves. The sixth is the production of beverages on small-scale basis under government control. The seventh involves the establishment of small-scale mining activities by industrials and the eighth is the further design and development of animal-drawn carts. The Ministries of

Industries and Water, the Ubungo Farm Implements, MEIDA, the National Development Corporation, SIDO, CARMATEC, BRU, Prime Minister's Office and the Mbeya Farm Implements are expected to implement this programme up to 1991.

The fifth programme is for the establishment of basic engineering, machine and capital goods industries. It involves four projects. The first is the establishment of iron and steel manufacturing industries. The National Development Corporation (NDC), Ministry of Industries, Ministry of Water, Energy and Minerals and the State Mining Corporation are expected to have implemented this project by the year 2000. The second is the establishment and strengthening of capabilities and facilities for the design and production of farm machinery, implements and equipment, including irrigation equipment. The Ministry of Industries, TEMDO, NDC and CARMATEC are expected to have made substantial progress by the year 2000. The third project is the strengthening of metal working and engineering industries. In addition to the four institutions involved in the second project, MEIDA is expected to cooperate and the results by the end of 1995.

The last project in this programme is for the establishment of machine building to cater for the production of various machines and tools for use in industry and agriculture. The project is also aimed at maximizing capacity utilization in existing industries e.g. in the textiles, cement, farm implements, leather, paper and chemical industries. The Ministry of Industries, NDC, SARUJI, the NCI, TKAI, TEXCO, \$DM, UFI, MFI, and TLAI are expected to have completed this project by 1990.

The sixth programme is for the improvement of technology for industrial production. It involves three projects. The first is the development of cottage and small-scale industries for consumer goods in urban and rural areas. The Ministries of Agriculture and Industries and SIDO are expected to implement this project up to 1991. The second project is the strengthening of existing patent and licensing laws and procedures. The

Ministry of Industries has to have completed this by 1991. The third is research and development for upgrading indigenous technology in the metallurgical industry. The Ministry of Industries, TEMDO, MEIDA, TIRDO and SIDO are expected to cooperate in this project. Results are required by the end of 1991.

The seventh and last programme is for the development of indigenous industrial service laboratories. This programme is aimed at quality control and the regulation of products from the traditional and informal sectors. It involves four projects. The first aims at acquiring and providing the Tanzania Bureau of Standards and TIRDO with equipment for chemical and metallurgical analysis. The Ministries of Industries, Water, Energy and Minerals, the National Chemical Industries and the State Mining Corporation are expected to help on this. The second project is the establishment of centres and facilities for materials testing. The third is strengthening the facilities for mineral identification and analyses. Both projects are under the Ministry of Industries and the University of Dar es Salaam is expected to cooperate. The target time is the end of 1991.

The final project involves the search for solutions to technical problems in industrial plants. The Ministry of Industries in collaboration with the Faculty of Engineering at the University of Dar es Salaam is expected to implement this project and show results by the end of 1991.

4.2.6 Building and Construction

The programmes of the building and construction industry are aimed at tackling five problems. The first problem is a lack of establishment standards for traditional rural housing. The second is a rapid increase in the cost of building materials and subsequent stagnation in housing standards. The third is the low level of local participation in building construction activities. The fourth is a lack of skills in the building and construction industry and the fifth the failure of the building and

construction industry to make use of data available from past and on-going research.

The science and technology policy implementation programme has nine programmes. The first programme is for the development of pollution and waste control systems. It involves three projects. The first is the design of improved garbage and refuse disposal systems. The second is the design of improved sewerage and drainage systems and the third is the establishment of mechanisms for monitoring and controlling environmental pollution. The National Resources and Environmental Council (NREC), the Prime Minister's Office and the Institute of Resource Assessment (IRA) are expected to complete this project in 1991.

The second programme is for further research and development in the use of local clay and sand for making low-cost, structural and non-structural building components. The BRU and the IRA are expected to implement the programme and finish it in 1991. The third programme is for the development of suitable housing designs. The BRU, the Ardhi Institute and the National Construction Council in cooperation with the Prime Minister's Office are expected to complete this programme in 1991.

The fourth programme is for investigation into the effects of climatic conditions on building materials. The Ministries of Industries and Communication and Transport in collaboration with NREC, BRU, NCC and the Prime Minister's Office are expected to implement the programme up to 1991. It involves two projects. The first is aimed at research on the effect of tropical temperature and rain on the strength and durability of cement materials and building components. The second aims to research on the effects of climatic conditions and insect and fungal attacks on timber and other structural materials.

The fifth programme is on research and development into road and airport runways building techniques and materials. It involves the Ministries of Transport and Communications and Education. Four projects are involved. The first has the

objective of strengthening existing and establishing new construction materials testing laboratories and facilities. The second is the establishment of a National Road Research Institute. The third is setting up research and development units in the major construction companies and the fourth is the establishment of pilot road construction projects and carrying out a feasibility study for the establishment of central batching plants for concrete in large urban centres such as Dar es Salaam, Dodoma, Mwanza and Tanga.

The sixth programme is for the development of labour-based construction technology. The Ministries of Transport, Communications, Water and Lands, the Prime Minister's Office and the National Urban Water Authority are expected to cooperate in this programme. It involves four small projects most of which are aimed at reducing construction costs and promoting employment generation. The projects aim at the construction of low-volume feeder roads, small dams, small water supply and sewerage schemes and further research and development into the use of locally produced bamboos for water systems.

The seventh programme is for the development of appropriate vehicles for rural areas. The aim is to work on cheap, economical and easily adaptable means of rural transport. Three projects are involved. The first, which is expected to be implemented by the Ministry of Industries, the State Motor Corporation and the Prime Minister's Office, is aimed at developing a rugged, tractor-type of vehicle for rugged terrain in the rural areas. The second project to be implemented by the Ministry of Industries and the National Bicycle Co. is to develop a modified bicycle or a tricycle which can carry loads or passengers for use in the rural areas. The third project involves the design of a simple and modified motorcycle by the National Bicycle Company and Ministry of Industries. Such a motorcycle should be able to carry bigger loads than existing models. All these projects are expected to have been completed by the end of 1991.

The eighth programme is for establishing national building and construction standards by passing housing regulations for rural and urban areas, and standardizing building materials and contract documentation. The National Construction Council and the Tanzania Bureau of Standards are expected to complete this programme by the end of 1991.

The last programme in this sector is on training manpower for the building and construction industry. The main project is the adaptation of training to tropical architecture, urban planning and hydro-meteorology. The Ministries of Education and Transport, the Prime Minister's Office, the Building Research Unit and the University of Dar es Salaam are expected to have implemented the project by the end of 1991.

4.2.7 Environment and Natural Resources

The main objectives of programmes in this sector are the maximization of the national exploitation and utilization of natural resources, the preservation, protection and conservation of these resources, the strengthening of capabilities to control environmental hazards and the minimization of degradation and the uncontrolled harvesting of natural resources. There are thirteen programmes in this sector. The first is for the conservation and protection of the environment. It has five projects. In the first project, the Ministry of Agriculture, the University of Dar es Salaam and SUA are required to establish a bio-climatological centre as soon as possible. In the second, by the year 2000, the Meteorological Department of the Ministry of Communication, Works and Transport is required to have established measures that can be used to curb top soil loss for purposes of preserving soil fertility. In the third, fourth and fifth projects, the Ministry of Agriculture in cooperation with TARO and SUA are required to have made studies on the control of pollution of ground water by faecal wastes and agro-chemicals; the relationship between ecological conditions and farming systems and also the physical and chemical qualities of soils. These are all long-term projects expiring in the year 2000.

The second programme is for inventory planning and management in the development of natural resources and energy. The Ministries of Water and Natural Resources and the National Environment Council have two projects to implement by the year 1995. They involve the provision of adequate mapping and surveying services, of facilities for planning and carrying out adequate and detailed investigations for natural resources, including mineral deposits and identifying new mineral deposits, establishing the size, shape and commercial value of various mineralized zones or bodies and recommending further development on the basis of laboratory or pilot experimental processes, including industrial tests on the utilization of such mineral deposits.

The Ministry of Water, the Rwegalulira Water Resources Institute, the Ardhi Institute, the IRA and the University of Dar es Salaam are expected to carry out systematic surveys for water resources with a view to establishing detailed knowledge on surface and subterranean water resources, the chemical and biochemical properties of this water and the external factors influencing its quality and quantity and the possible utilization of unconventional sources of water. They are also required to undertake studies in order to develop remedial mechanisms for the utilization of polluted water and to intensify research, training and the dissemination of information on these matters.

The Ministry of Natural Resources, the TBS, University of Dar es Salaam and TIRDO are required to implement two projects: one involving the provision of adequate and qualified personnel and facilities for bio-mass assessment and the other the establishment of the necessary infrastructure for monitoring the atmospheric environment for the presence of heavy metals and poisonous gaseous substances. The Ministry of Industries and the National Environmental Council are expected to establish acceptable standards for control and regulation of environmental pollution. The Ministries of Health and Water are required to study the impact of VIP latrines on ground water in areas with a

high water table. The Ministries of Health, Lands and Water together with the Muhimbili Medical Centre, the National Institute for Medical Research, the University of Dar es Salaam and the Building Research Unit are required to carry out studies for the development or improvement of waste disposal methods and drainage systems in urban areas in order to remove breeding sites for mosquitos and other dangerous insects.

The University of Dar es Salaam and the National Radiation Commission are required to study the level of radio-active pollution in wastes dumped in Tanzania's territorial waters. The Ministry of Natural Resources is required to set up and establish the National Environmental Council and the Prime Minister's Office, the Ministry of Education to intensify radio and other campaigns aimed at increasing public consciousness of environmental problems.

The third programme is for the development and construction of low cost waste disposal systems. It involves three projects. The first two involve the development and design of improved garbage and refuse disposal systems and the general improvement of sewerage and drainage systems. The third involves research into appropriate mechanisms for controlling industrial pollution. The Prime Minister's Office, the Building Research Unit, the Faculty of Engineering - University of Dar es Salaam, TIRDO, Ministry of Industries and the National Environmental Council are in charge of those projects.

The fourth programme aims at strengthening research, technical training and education in the area of natural resources. It involves the strengthening of existing courses in mining and petroleum engineering and geology and post-graduate training in various areas of natural resources. The Ministries of Natural Resources and Education are required to implement this programme which stretches up to the year 2000.

The fifth programme is for land conservation and afforestation. It involves the Ministries of Land and Natural Resources, Education, and Transport, TAFORI and the Wildlife

Research Institute. Three projects are involved in and are aimed at land reclamation, afforestation and the strengthening of training programmes in forestry, wildlife, fisheries and beekeeping management. They are expected to have been completed by the end of 1991.

The sixth programme is for fisheries research and development and involves the controlled breeding of rare fish species in major rivers, lakes and the Indian Ocean, upgrading and the proper storage of fisheries statistics, strengthening fishery biology, socio-economic and marketing studies, hydro-biological and water pollution studies, fishing gear technology and fish processing techniques. The University of Dar es Salaam, the Tanzania Fisheries Institute and the Tanzania Fisheries Corporation are expected to complete these projects by the end of 1991.

The seventh programme is for the conservation and development of the bio-sphere reserves. It involves six projects two of which are aimed at identifying endangered species and effecting their conservation, one is aimed at reducing overcrowding by tourists in the national parks, one at fire control, two at the monitoring and establishment of data on the genetic resources of the bio-sphere and bio-spheric changes and one at pasture utilization in the grasslands ecosystem of the Serengeti, Ngorongoro and Mikumi National Parks. The Ministries of Lands and Agriculture, the Serengeti Wildlife Research Institute (SWRI), the Tanzania National Parks Authority (TANAPA) the Ngorongoro Crater Conservation Authority, TALIRO, SUA and the University of Dar es Salaam are expected to implement these projects up to the end of 1991.

The eighth programme involves research into multiple land use in some bio-sphere reserves, the determination of space and the characteristics of existing parks and game reserves, monitoring programmes to determine changes in these factors and characteristics, research into the inter-relationship between livestock and wildlife in their use of the reserved ranges, the

impact of human beings on the bio-sphere and the study of the long-term proper utilization of land by man, livestock and wildlife. It takes the same institutions as the previous programme and is expected to continue up to year 2000.

The ninth programme is on wildlife diseases and involves the survey of these in the national game reserves and in reserves where livestock graze together with wildlife and the role of wildlife in the transmission of livestock diseases.

The tenth programme is for the modernization of the bee-keeping industry for improving the quality of honey, beeswax and other bee products. It involves six projects aimed at developing appropriate equipment such as hives, protectives, honey extractors, honey and beeswax containers, etc., improvement of the quality of bees through bee-breeding, the establishment of standards for the regulation and control of bee products, diversification in the use of bee products and the dissemination of information and training on new methods of bee-keeping.

A related programme is for the use of bees in pollination to improve the quality of crop, forest and livestock production. It involves the establishment of pollination projects at the Serengeti Wildlife Research Centre and Njiro Bee-keeping Research Centre for the development of food, fodder and cash crops and the selection of honey flora suitable for the integrated agro-forestry agriculture programme launched by the Ministry of Natural Resources.

The last programme is on bee-keeping conservation and development strategies and involves research on bee diseases and pests and the establishment of preventive and control methods and the use of appropriate bee-smokers during the harvesting of honey which reduce the death of bees as well as forest fire hazards. All these are long-term projects and will extend up to the year 2000.

4.2.7 The Minerals Sector

The objectives of the programmes in this sector are to increase its contribution to the national income, and to direct

efforts towards national self-reliance in energy, mining and mineral extraction. There are seven programmes in this sector. The first involves basic minerals research and has nine projects mostly concerned with investigating, identifying and ascertaining mineralized zones. The second programme is on mineral exploration and has six projects for specific exploration of gold, base metals, uranium, agro-geology, peat and building materials (exploration and development).

The third programme is devoted to training the technical staff, computer experts and engineers and mineral economists. The fourth programme is for the development of coal resources and supplements the coal energy programme seen earlier. The fifth programme aims at increasing gold, diamonds and salt development and production. The sixth programme is for strengthening the existing and building new laboratory facilities, while the last programme is for the improvement of data processing methods, the publication and popularization of minerals information and the procurement of modern and up to date books, manuals and other publications on mining and mineral research and marketing.

4.2.9 Comments and Recommendations on Programming

It is in the function of programming science and technology policy activities that the Council has been most effective. After twelve years of careful studies and planning, it has not only come out with concrete sectoral programmes, but also recommended its own dissolution and transformation into a Commission. The programmes were passed and accepted by the parent Ministry in 1985. Three years later, it may be too early to expect a lot to have been accomplished. What has been done on the programmes will be discussed in the next chapter. At the moment, it would be useful to comment on the programming function and the programmes themselves.

Ten comments will be made. The first is that most of the programmes involve new projects and do not seek to continue existing ones. This may have the impact of new programmes completely submerging existing or previous R&D efforts or posing

as a modernizing force. Secondly and similarly, where new regulations are aimed at being passed e.g. in the control of environment and standards, no mention is made of existing regulations or studies into why they are not effective. This may lead to a proliferation of new but equally inoperative regulations because the factors propelling non-compliance or inoperativeness may still be subsisting.

Third, most programmes which need a lot of human power and financial resources have been given a very short span of time for implementation. The time can of course be usually extended, but if it is too short, it gives some uncommitted officials an excuse for not starting at all. Fourth; some programmes would be more successful if they involved certain kinds of enterprises which do not appear in the programme. In some programmes, collateral institutions have been included which do not exist. Some have been included when they are known to be ineffective or incapable of performing their roles. A review of these programmes may readjust the situation.

Fifth, a noteworthy problem which may affect the success of the programmes is the total exclusion of the private sector from the implementation of programmes. The private sector in Tanzania contributes over 50% of the GDP and has a lot of scientific and technological activities. It is very dominant in the chemical, textile and food processing industries. For quick success and in order to ensure it does not become a problem in the implementation of the programme, it must be drawn in and integrated.

Sixth, some programmes are too big and involve too many institutions. When you have a multiplicity of principal and collateral actors, you stand the danger of having very little progress or repetitious activity and, most important, failure of control and accountability.

Seventh, each programme points out several principal actors without pointing out who the main actor is. This renders the

projects a no-man's projects and accountability channels become blurred. A review may easily rectify this situation.

Eighth, some programmes overlap, especially in the environment and energy areas and transport and industry. A repetition of project programmes always gives excuses for non-implementation and withdrawal. It also creates the problems of duplication of efforts and expenditure.

Ninth, a problem likely to constrain the implementation of the programmes is that at the conference which set the programme and adopted the implementation agenda, the question of extra funding was not discussed. In spite of that, some projects were expected to start immediately and be ready by 1990. At the same conference, some research institutions such as those for medical, agricultural and livestock research, reported how their research activities had almost come to a standstill due to lack of funds. The tactful avoidance of funding issues then and in the future may very much affect the implementation of an otherwise very serious programme.

Finally, it does not seem that either the Council now, or later the Commission, has or will have the power to supervise the implementation of these programmes. Unless the power structure of the Council or Commission is changed to enable it to evaluate and control the implementation of the national science and technology activities of the various organs in the various sectors, the programmes may take longer than projected and, worse, may come out with unprojected results.

CHAPTER FIVE

GOAL ATTAINMENT

5.0 Introduction

It is not very easy to measure the success or failure of an advisory and promotion institution. This is because the actual execution powers or functions lie outside the mandate of such an institution. In assessing whether the Council has so far achieved its goals, we shall look at both the functions executed by it and those executed on its advice or guidance. This chapter will, therefore, focus on the extent to which it has attained its goals in planning, executing programmes, advising and popularizing science and technology shortened here as advocacy.

5.1 PLANNING

Planning as seen earlier for the purpose of this review, covers policy formulation, development and programming. As seen in Chapter four, the Council has had a lot of activities in the two areas. The discussion below will concentrate on their dimensions and characteristics.

(i) Policy Development

The policy development function of the Council is limited by the Council's restricted mandate over other S&T institutions. Hence each of them has its own policy planning and development mandate. Hence the role of the Council has been limited to coordinating policies developed by other institutions and also policies of a general nature. As has been seen in Chapter four, the Council organized a series of policy workshops which enabled it to make a substantial contribution to the development of the national science and technology policy and programmes. The planning activities in the area of policy development, however, seem to have suffered from several shortcomings.

The first and perhaps major one is that neither through its activities nor through the national science and technology policy has the Council attempted an in-depth analysis of the nature and dynamic of the country's scientific and technological backwardness. This question of the politico-economy of science

and technology in Tanzania has been deliberately avoided as being 'political'. Most leaders of the Council do not understand or accept the political aspects of scientific and technological under-development. This deprives the majority of them of a theory of what the political role of their institution is and how to use it for the mobilization of industry against technological backwardness. Without a clear theory of the current socio-economic and political aspects of our present backwardness, most of the plans on science and technology are unlikely to be accompanied by a significant structural socio-economic transformation.

Secondly, in policy development, the Council has very much concentrated on the future and made very little reference to either the present or the past. The sectoral goals outlined in the national policy do not make an assessment of what has been attempted in the past and how the Council fared. Instead, the authors go straight to what the goals should be and the reader is kept in the dark as to whether the policy objectives are new, mere innovations or simply unconscious repetitions of what may have already failed in the past. Future policy developments may have to reflect the experiences of the past and the lessons drawn from them.

Thirdly, it is apparent that in the formulation or development of sectoral policies, the tendency has been to treat each sector separately, with inter-sectoral linkages being ignored. This is very clearly reflected in the programmes on agriculture and industry on the one hand and energy and environment on the other. It would have been easier to link sectoral goals if an attempt had been made to identify the principal problems involved in each sector. Once identified, solutions emanating from those sectors and from sister sectors would have been easily fused.

Fourth, the role of trade in the whole process of acquisition, utilization, diffusion, innovation and internationalization of science and technology has not been

touched. This may be because the programmes have been tackled on the basis of their being scientific. Not falling within the traditional sciences, trade has been generalized under industry. The role it has played to date in the circularization of existing technology and its potential use for the transformation of industry, agriculture, transport and other sectors, deserve particular emphasis and attention.

Fifth, it is apparent from the programmes that their acceptability by the policy-makers and operational staff is taken for granted. The whole science and technology policy was a product of a series of consultations and conferences organized over a period of more than half a decade. To assume that, after this effort, the implementation of its product would be automatic, is to condemn the whole policy to inoperation. When interviewed, some officials of the Council expressed a negative attitude towards the popularization of the whole policy among enterprise and government operative staff. The argument was that the policy was adequately discussed when it was being launched and that what remained was implementation. If indeed this was the case, there would be no need in Tanzania to discuss the Arusha Declaration passed twenty-one years ago or the 1987 Party Programme. In spite of the fact that politicians, the mass media and the whole education machinery have devoted their efforts to explaining these two policies, the discussion continues even after twenty years in the case of the Arusha Declaration. The latter is not technical, involves no implementation linkages, no financial resources. To argue that implementers of the science and technology policy already know what to do and do not need mobilization is to belittle the work of the Council and the nature of the policy itself.

These shortcomings notwithstanding, the Council has played a significant role in policy development. It has done, in a short time, what would have taken bigger institutions with better resources much longer to do. By working out the policy objectives of each sector and the programmes through which to

attain them, it has provided the relevant sectors not only with the objectives but also with the measures of their own success. It is only through such policies that such institutions will be able to provide the public and institutions under their control the yardstick by which to evaluate their performance. A similar role has been played in the programming function.

(ii) Programming and Advocacy

As mentioned from time to time, the Council does not have the direct power to programme the activities of others. But as noted earlier, in working out the policy objectives of each sector, it has played a big role in programming sectoral science policy-based activities. Most of the problems involved in the programming function of the Council have been discussed in the previous Chapter. At this stage, it may only be important to point out a few things which may have been overlooked.

First, the programming exercise mainly involved ministries and very few productive enterprises. It is hoped that the ministries will communicate with their relevant enterprises and get them involved. This may be the case where the institutions involved are S&T institutions. It may be difficult where this is not the case. In the development of ox-carts, for example, the Tanzania Wood Industry Corporation and the National Steel Corporation will be involved. To make them aware and involved, it is not enough to mention their parent ministries. They have to be given direct tasks through direct involvement. Similarly, the programme involving the development of special means of transport may involve more than the ministries mentioned on the programme. It involves tyre companies, tyre retreading companies, motor assembly corporations, etc. It is important that when sectoral policies of this nature are being worked out, every institution that can be involved in the implementation be involved in the formulation.

Secondly, the coordination of the programmes is going to be difficult at the ministerial level and at the level of the Council, because of the lack of science and technology policy

units in ministries and enterprises and also of directorates at the Council level. Further programming in future may have to start from the basic institution level to the ministerial level and end up at the level of the Council or Commission. The infrastructure for this kind of policy linkages has to be developed.

Thirdly, the coordination function of programming and coordination may be made much easier if the Council or Commission is given wider powers of supervising or monitoring the implementation process. Without turning the Council into a super-ministerial unit, all enterprises can be required by law to submit to it their planned annual activities of a scientific and technological nature and reports on their implementation of national science and technology policy projects.

5.1.2 Execution of Programmed Science and Technology Activities

In this section, we shall examine the extent to which the Council has been able to execute some of its own programmes. As mentioned earlier on, its capability to execute some of its major programmes has been limited by lack of space, finances and manpower. Its achievements in the formulation of a science and technology policy have been adequately covered in Chapter four. Other areas in which actual success has been recorded are in the funding of research and the promotion and popularization of science and technology.

In the area of funding research between the end of 1976 and 1986, the Council funded a total of 135 research projects, most of which involved individual researchers. About 84% of this support went into agriculture, plant and animal research, 6% into fisheries and marine research, 4% into medicine and health, 2% into archeological and education research, about 2% into the popularization of research and the remaining funds into industrial and other research. The insignificance of industrial research in the funding profile of the Council may be due to either alternative sources of funding for researchers, minimum

research activity in this area, or a lack of research capability. The Council may have to take a special interest in this kind of research and stimulate the public's interest in it.

The popularization of science and technology has been mainly through science fairs, the funding of public meetings, workshops and symposia, journals such as the Science Journal and the Tanzania Medical Journal and the encouragement and award of inventive and innovative activity. Beginning 1982, the Council embarked on a programme under which it gives annual awards to Tanzania's best inventors and innovators. In that year the award was given to two institutions and one individual. Of the two, one was an agricultural research institute which had developed several varieties of cotton seeds which had become popular and were giving high cotton yields; the second was a private company which had succeeded in utilizing used motor engine oil instead of black fuel in its ovens and kilns. The individual had designed and fabricated a hand-operated pneumatic drive to replace a malfunctioning electric motor at a farm implement manufacturing plant.

Similar inventions have been awarded ever since. In 1983 a farmer who fabricated two hand-operated farm implements got one. In 1984, the award went to a group of workers who designed an oil extracting machine as well as to a person who discovered 'Tanzanite,' a precious gemstone. In 1986, the award went to a group of workers who designed and fabricated a punch press machine and another person who designed and fabricated a shuttle manufacturing machine. In 1987 the awardee invented a game for cripples and in 1988, one of the awardees designed and fabricated a manual duplicating machine made of wood and another one fabricated a multi-purpose planter.

5.2 Comments on Goal Attainment

It is very difficult to measure the extent to which the Council has attained its goals, because in most cases it has just set the goals to be implemented by others. As there are no well established channels for feedback from the implementers, even the

Council itself has not been quite able to measure its own impact. In the popularization of science and technology, however, the Council could have done better. More conferences and workshops could have been organized for scientists, industrialists and policy-makers. Furthermore, there have been no implementation seminars on the national science and technology policy. As stated earlier on, some leaders of the Council do not seem to believe in this kind of activities.

The system of awarding scientists and inventors is not based on a thorough search or screening process. The process of identifying innovators and inventors is very secretive and, in 1988, there was a deliberate effort to restrict publicity of the screening process. In addition, the educational institutions, especially the universities, were deliberately kept uninformed about the selection procedure. The brochures announcing the selection date were restricted from being circulated at the two Universities. Such discriminatory practices on University researchers in the competition for awards is neither in the interest of the Council nor of the nation.

Another observation worth making at this stage is that most of the innovations for which awards have been given have either involved a modification of existing technologies or an imitation of inventions made elsewhere. The procedures for selecting winners does not have safeguards against imitation or duplication. In addition, only a very small proportion of inventors or innovators is dealt with. Science fairs and exhibitions would be the best ways of allowing a full and fair participation in the competition for awards. Otherwise patronage, protectionism and clientilism are likely to predominate. Finally, the practice so far has been to give monetary incentives to inventors. Equipment and further training could also provide the necessary motivation for more and accelerated research efforts.

Lastly, it is worth pointing out that the performance of the Council has so far been determined by the amount of resources

available to it. The total budget has been usually small and was below shs. 9 mi. until 1987. Only in 1987/1988 was it raised to shs 30.088 mi. Most of the budget has been going into labour costs, which have consumed an annual average of 30% of the total annual budget up to 1987 and the increase in July 1987 was mainly to enable the Council to meet labour and other administrative costs. The limited budget has also affected the size of research funding over a period of time. The amount spent on research was as little as shs 212,611 up to 1983, but it has since risen substantially, reaching shs 1.75 mi. in the year 1986/87. The rise was due to increasing travel, accommodation and equipment costs for researchers and in no way implied an intensification of research activity. It is quite clear that if given a better financial resource-base, the Council or in future the Commission may engage in a wider spectrum of activities which may enable it to attain its statutory objectives.

CHAPTER SIX

CONCLUSION

After sixteen years of operation, the Council's performance and impact remains a difficult subject to comment upon. When asked whether they were satisfied with their role and influence, most leaders of the Council expressed the feeling that, with an institution like theirs, it is not very easy, even for themselves, to measure the impact it has had on other institutions. This is quite true. But in spite of this problem, it is easy to single out, as has been done in the previous chapters, the Council's main achievements. It has organized several workshops and conferences, effectively represented the government on matters of science and technology policy in international fora, sponsored and initiated research projects, put into practice the idea of giving awards to Tanzania's inventors and innovators, secured the passing of new patents and trade marks legislation, outlawing restrictive covenants in technology transaction and, important, drafted and brought into operation a national science and technology policy and its action programme.

These are not small achievements for a Council constrained by many factors. We have seen some of the organizational and operational constraints. It would be important at this stage to point out that there are some constraints which emanate from the Council's own legal framework such as the lack of powers over other institutions, lack of policy linkages with Ministries and productive or service enterprises, a total absence of enforcement mechanisms or powers, lack of feedback and evaluation machinery for policy; and lack of accountability channels or mechanisms for the Council itself.

At the same time there are operational constraints which have a lot to do with the Council's organizational patterns, styles and ideology. They include a lack of space, lack of clearly defined organizational structures and hierarchy, a poor financial structure, lack of links with researchers, voluntary

organizations and training institutions and failure to mobilize policy-makers to understand and implement the national policy for science and technology. Most of such problems could have been solved at a very low cost or at no cost at all. Some problems, like a poor financial support, reflect only a lack of initiative and tendencies to stick to traditional donors. There may, of course, be better explanations, but, whatever they are, those which are within the capability of the Council to solve should be solved without waiting for external stimulus. It would be wise to stop here and recommend that the Council or Commission be launched into a second phase with new and renewed responsibility and capability to stimulate theoretical and practical changes in the scientific outlook of the Tanzanian community as a whole.

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