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Science, Technology and Development

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LIST OF CONTENTS

SUMMARY AND RECOMMENDATIONS

1. Summary

Scientific and technological activities in Somalia are still somewhat meagre, but are growing steadily, both in the Ministries and the various autonomous Agencies, and in the new technical faculties at the National University. Understandably, the greater part of this effort is concentrated in the fields of crop agriculture and animal husbandry, and closely related problem areas such as water resources and pasture development. Certainly much more needs to be known about agricultural and livestock improvement under low-rainfall conditions, especially if the Government's policy of settling the nomads is to be effectively implemented.

This is a matter of primary concern for the future development of the country, and not only research but also related training facilities at all levels are being expanded rapidly.

Research of relevance to this development programme is carried out at institutions attached to the Ministries, particularly those of Agriculture; Livestock, Forestry and Range; and Mining and Water Resources. Some of the major development projects being carried out under the auspices of these Ministries, and the various Agencies, such as the National Banana Agency, the Livestock Development Agency, and the Water Development Agency, include substantial research and investigational components. At present there is little co-ordination and integration of their different programmes, but cohesion will acquire increasing importance as the pattern of agricultural development changes.

Research and related activities in other areas, such as medicine, mining and industrial technologies, are still very limited, and given the constraints in trained and experienced personnel, and in institutional and financial resources, they will take some time to develop. Continued expansion of these activities, however, is essential, if only to keep in touch with relevant work done elsewhere, to participate in co-operative efforts with other countries having similar problems, and to be able to adapt the results to Somali circumstances and requirements. There is evidently a limit to what a comparatively small country can undertake, but some local capability in critical fields is vital.

At this stage it would appear to be somewhat premature to create an over-elaborate central machinery for science planning and policy-making, but a start could usefully be made in involving the scientific community, small though it may yet be, in a more formal way with national development planning, and in co-ordinating existing efforts.

Various recommendations therefore follow which propose the formation of a small Advisory Committee on Science and Technology to the Planning Directorate; the expansion of the new Technical and Economic Studies Unit at the Planning Directorate by a staff member who will be specifically concerned with scientific and technological research, and related activities; and the establishment of an Agricultural Research Council, to ensure an integrated approach to research, extension, training and institutional development in the various related fields.

2. Recommendations

The following recommendations include a number of suggestions as to UNESCO assistance, which could easily be elaborated upon if required.

1) The new Technical and Economic Studies Unit at the Directorate of Planning and Co-ordination should be expanded by one additional staff member, who will be responsible for scientific and technological research and related activities;

2) The Unit should be served by a small Advisory Committee on Science and Technology composed of leading Somali scientists, which would pay particular attention to cross-sectoral and multi-disciplinary matters, and would form the nucleus from which an eventual National Science and Technology Council might be formed;

3) A training programme would need to be developed to ensure that appropriate members of the Unit and the Advisory Committee gained expertise in science planning and policy-making techniques, through fellowships, and when necessary, short-term visits by consultants;

4) Given the growing scale of effort connected with agriculture in the broad sense, the dangers of unco-ordinated scattered efforts when it comes to economic exploitation, and the importance of this sector to the future of Somalia, the formation of an Agricultural Research Council is warranted, which would bring together representatives of the relevant Ministries, Agencies and University Faculties - technical people and planners - on a formal and regular basis, to ensure an integrated approach to research, extension, training and institutional development;

5) In the initial stages the development of these various activities could undoubtedly be helped by the attachment of an outside expert, perhaps through UNESCO assistance, for a preliminary period of 24 months;

6) Key areas in the increased application of science and technology to the development of Somalia are the newly-formed technical faculties at the National University, and their strengthening is an urgent necessity. At present they are heavily dependent on bilateral assistance from certain Italian Universities, which hopefully will continue for some time, but UNESCO involvement might help to broaden the assistance programme and accelerate the development of the University. It is therefore recommended that a preliminary very brief (two weeks) mission be invited to discuss the possibilities of UN aid, particularly in connection with the Science Faculty, which provides the basic training for the applied science Faculties, and multi-disciplinary activities;

7) Other areas which are of urgent importance to science and technology development in Somalia are supporting services, especially instrument repair and maintenance, and scientific and technical information and documentation.

   a) In the case of the former it is recommended that at least three suitably qualified Somalis should be sent for training overseas, with an appropriate mix to cover fine mechanics, optics and electrical/electronic equipment, taking into account the potentialities in the latter case of the Telecommunications School;

b) with regard to the problem of information, the work being carried out with UNESCO assistance on a National Library could usefully be extended to include specifically scientific and technical services, and the development of libraries, including books, journals, reference works, and contacts with overseas sources of papers, for the use of the University and research institutions;

8) Given the strict limit to research possibilities in a comparatively small country, there is an obvious stress on the importance of scientific and technological co-operation between countries with similar problems. This suggests the importance of participation, with at least a minimal local capability, in international efforts, such as the Man and the Biosphere Programme (MAB) of UNESCO, involving co-operative studies in topics such as arid lands and related eco-systems, and work on non-conventional energy sources, including solar and geothermal sources - all topics of pressing interest in Somalia.

1. INTRODUCTION

1.1 Terms of reference

The aim of the mission was to advise the Government of Somalia, and in particular the Directorate of Planning and Co-ordination and the Ministry of Higher Education and Culture, on the possibilities of defining :

i) a national science and technology policy as an integral part of the overall development policy, including suggestions for the most efficient linking mechanism between the national R & D system and the national development plan on the one hand and the users of research results on the other;

ii) the role and scope of science and technology public services required by the country.

1.2 Work programme

The mission took place over the period 21 January to 16 February 1975. During this period extensive discussions were held with officials in most of the government ministries and agencies whose portfolios include a significant technical content. Visits were also paid to research institutions, technical training establishments, and to the various technical faculties at the Somalia National University.

1.3 Acknowledgements

It is a pleasure to record the enthusiasm with which the many people met offered their co-operation in discussing the problems related to the application of science and technology to development in Somalia. The participants in these discussions are listed at Appendix I, and their help is gratefully acknowledged. Particular thanks are due to Mr. Hussein Kahin Deria of the Ministry of Higher Education, and Mr. Ahmed Dualeh of the Planning Directorate, who together arranged my programme and ensured its smooth fulfilment.

2. SCIENCE, TECHNOLOGY AND DEVELOPMENT IN SOMALIA

2.1 General features

The population of Somalia is composed largely of nomadic herdsmen, most of whom move across the country according to seasonal grazing needs. The latest estimate of population is 2.8 million, though the first national census was initiated only during the period of the mission. Official national accounts are not available, but GDP per capita has been estimated at between $40 and $70, making Somalia one of the poorest countries in Africa.

Livestock raising is the principal economic activity, engaging some 80 % of the population. Livestock and livestock products account for about two thirds of the total value of exports.

Agricultural activities are made up of a small commercial sector cultivating bananas (which account for a further 26 % of exports), sugar cane and cotton, and a large traditional sector growing mainly cereals. The scarcity of water is a major constraint on the utilisation of land - the traditional sector depending on rain and flood irrigation, while the commercial sector depends on controlled irrigation, through dams or pumped water.

Agriculture and livestock have been severely hit by recent drought conditions. It is estimated that as much as one third of the total livestock in the country may die during the current drought period. Cereal and banana production have also been seriously affected. As a result it is anticipated that over 750,000 persons may be in refugee camps before the advent of the rainy season.

Attempts are being made to introduce a sedentary rather than a nomadic way of life for the majority of the people. This, however, raises many technical, apart from social, questions in relation to livestock and range management under low rainfall conditions. A key aspect in agricultural development is undoubtedly increased information and understanding on the conservation and optimal use of water resources. Unfortunately, until recently, research in these areas has been very limited in Somalia. Intensification of agriculture may also be expected to lead to increased losses from pests and diseases. Already it has been estimated that there is a 30 % loss in cereals, in the field and in storage, through insect damage alone, and there are additional crop losses through rodent and bird damage. But again research on pest control has been limited. Another problem in traditional agriculture is that of fragmented holdings, which to a large extent prevent the effective adoption of improved agricultural practices and methods. There is, however, a trend through "Crash Programmes" and large-scale development projects, towards larger holdings, which will allow technological improvements to be introduced.

Somalia's manufacturing sector consists of a small number of large-scale enterprises, mainly government-owned, and a relatively large number of privately-owned small-scale establishments. Apart from the major agro-based industries, such as sugar, meat and fish processing, and textiles, manufacturing industry is primarily concerned with the production of consumer goods, particularly food and beverages. While the total value added is not insignificant, the sector makes little contribution to employment - total employment in establishments with 5 or more persons amounted to only 6,686 in 1973.

There are indications of some mineral prospects, including oil, but these have in most cases yet to be exploited.

2.2 National development

2.2.1 The Five-Year Plan

The basis for current development programmes is the Five-Year Plan (1974-1978), though the drought situation has necessitated substantial modifications. According to this Plan, the long-term strategy of development is framed on:

a) maximising resource utilisation in the production of both commodities and services and ensuring continued growth;

b) creating conditions where the national products are distributed equitably among the people;

c) decentralized socio-political administration for regionally balanced growth;

d) organizing economic activities on a basis where the means of production are owned and operated by and in the interest of society as a whole, and also through that process involve as many people as possible in decisions regarding investment, production, employment and income distribution;

e) mobilizing and utilizing internal resources including the labour force to the maximum, with particular emphasis on self-help activities;

f) creating a co-operative movement in line with the socio-economic requirements and political philosophy of the country.

The development strategy emphasises maximum priority to the sectors of agriculture, livestock, forestry and fisheries, since these primary producing sectors are considered the key to economic development. In agriculture the strategy will be one of creating food self-sufficiency as quickly as possible, and of producing surpluses which can be either exported or which can support dependent projects in livestock and the industrial sectors. It is recognized that the production programme needs the support of intensified research programmes in both agronomy and agricultural economics, in addition to work in the field of plant protection. In livestock, animal health programmes have had priority attention in the past, but the present programme attaches great importance to projects for increasing animal production both quantitatively and qualitatively, and for the more efficient marketing of animals and animal products. There is likely to be increased integration of livestock and crop farming, and increased activities of projects directed to range conservation and management, and the effective use of water resources. Both research and extension work in these fields are seen as of basic importance.

In view of the increased pressure on livestock production for export, considerable importance is also attached to the development of the fisheries industry, with increased productivity through technological improvements.

In industry more emphasis is being placed on the production of intermediate and capital goods, while the establishment of agro-industries for export and for import substitution will be intensified.

2.2.2 Development planning

Development planning and co-ordination have until recently been the responsibility of a Ministry, but since December 1974, this has been up-graded to a Directorate of Planning and Co-ordination, coming

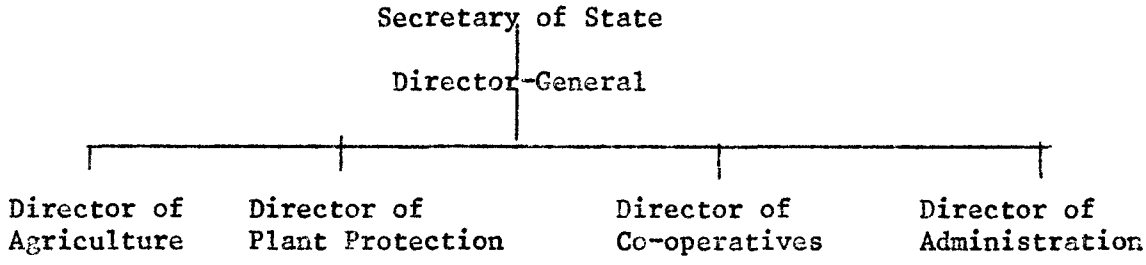
directly under the President's Office. Economic Affairs generally are the purview of a newly-formed Economic Committee, under the Chairmanship of one of the Vice-Presidents. A Technical and Economic Studies Unit has also recently been established, within the Planning Directorate. The functions of this Unit are discussed in a later Section (see p. 12).

3. SCIENTIFIC INSTITUTIONS, RESEARCH AND TRAINING

Virtually all scientific activities in Somalia are carried out within the Government Ministries and Agencies. This Section gives an outline sketch of the main organizations involved, and a brief review of any research and related activities. Institutions under the Ministry of Education and the Ministry of Higher Education, in particular the Somalia National University, are included.

3.1 Ministry of Agriculture

The basic structure of the Ministry is shown in the following figure:



The Department of Agriculture is responsible for the regional and district agricultural staff, and also has four specialist sections, concerned with : Planning; Water Conservation and Irrigation; Extension Services; and Research. The Extension Services Section is new and has so far been largely concerned with the important problem of land tenure policy, while practical extension work has been carried out by the field agricultural staff, working in collaboration with the research staff. The Section is however now being completely reorganized. The Plant Protection Department has its own regional personnel, who serves as a communications link between the farmers' problems and the Research Department.

3.1.1 Central Agricultural Research Station

The Ministry is responsible for the largest research establishment in Somalia - the Central Agricultural Research Station (CARS), which has its main laboratories and experimental plots at Afgoi. There are also three sub-stations, and others are shortly to be added. The main station has a total area of 400 ha., of which some 80 ha. are under cultivation. There is a total staff of 70, ten of whom are professionally qualified (all Somali), including a soil scientist (the Director), six agronomists, a plant pathologist, and two entomologists. Operational sections include soils, entomology, plant pathology, crops and horticulture, which jointly carry out extensive trials on a wide range of crops, covering irrigation and general agronomic

practices, pesticides, fertilizers and varietal improvements. On this basis the Station provides technical advice to plantations, public and private, and to co-operatives, and supports the work of the Plant Protection Department. As yet there has been no proper soil survey, but CARS is able to carry out some soil testing, though equipment is somewhat limited.

The Station was started in 1965, with assistance from the University of Wyoming, USA, but now has an all-Somali staff. More recently there have been discussions with a team from a group of mid-Western US universities (MUCIA) on a 6-year development plan for agricultural research in Somalia.

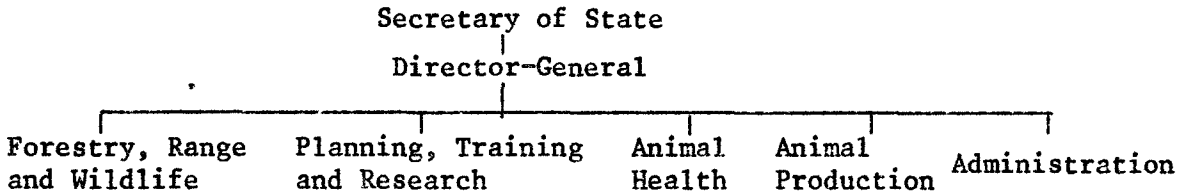
Various enterprises, public and private, use the services offered by CARS, in particular ITOP, the main canning factory which is also located at Afgoi, but comes under the Ministry of Industry, the Sugar Factory, at Jowhar, also under the Ministry of Industry, and the National Banana Agency, which is an autonomous agency with its own research facilities working in close collaboration with the Station. Some of the major development projects now being initiated will also have their own substantial research components, particularly with regard to irrigated crops.

3.2 National Banana Agency

This is an autonomous agency established to co-ordinate the production of bananas, the second largest export, and to provide supporting services, including marketing. Two research farms have been established, which are concerned with variety and fertilizer trials, and the development of new irrigation and transport systems, in addition to providing an extension service. A laboratory is being developed for soil analysis and plant pathology. Professional staff at these two farms consists of two agronomists.

3.3 Ministry of Livestock, Forestry and Range

The organizational structure of the Ministry is shown in the following figure, though this is in the process of modification.



Given the vital importance of the livestock industry in the future economic development of Somalia, considerable efforts are being made to strengthen and improve this Ministry. Up to now the major concern of the Ministry has been animal health improvement, and two diagnostic laboratories have been established at Mogadishu and Hargeisa. In this field trypanosomiasis is probably the major current problem. Recently, however, increasing attention has been given to animal production and range management. Similarly in forestry, while in the past the main emphasis has been on protection of existing resources, more attention is now being paid to problems of re-afforestation and ecology generally.

This widening of interest is reflected in the training programmes of the Ministry. Technicians in the animal husbandry field are trained at the Training School for Animal Health Assistance (TSAHA), which is now extending its activities into range management and animal production. A Forestry School is also being established.

Each Department has its own extension programme, but so far there has been limited application outside state farms and more recently co-operatives, though some success has been achieved in the more general introduction of selective grazing and famine reserve areas. The Ministry works closely with the Ministry of Agriculture on fodder production. At the professional level the Faculty of Agriculture at the University will in future offer range management as an alternative option to agriculture, while the new Faculty of Veterinary Sciences will offer degree courses in animal health and in addition animal husbandry.

There is still, however, a basic lack of knowledge on which to found appropriate agricultural systems which correspond to the present and future needs of the country.

Apart from animal health diagnostic laboratories, which are being extended into vaccine production units, some animal husbandry research is carried out at the 21st October Dairy Farm, near Mogadishy, mainly in the form of genetical improvement of sheep and cattle.

There are two small field stations concerned with re-afforestation and range research, in particular the mass production of seed of selected forest species and the testing of grass seeds. The successfull sand-dune fixation scheme at Merka has attracted international attention. The Hides and Skins Development Centre is concerned with up-grading the quality of export leather. There is also research on frankincense and myrrh, which together are the third largest foreign exchange earners.

3.4 Livestock Development Agency

Up to 1974 the Agency was concerned not only with animal production but also with research and extension, but the latter have been transferred to the Ministry of Livestock, and the Agency is now essentially a trading agency concerned with buying animals for export and for the meat processing plant at Kismayo. It is however responsible for two major development projects, each of which will have a significant research component. The trans-Juba Livestock Development Scheme, involving an investment of $11.5 million largely contributed from the World Bank, is intended to produce 30,000 head of cattle a year, through ranch development, holding areas and a fattening area. Basically the scheme is to produce improved quality of cattle through better feeding and health control, and research will be required on nutrition, fattening and pasture development. The second project, in the Shebelle area, is concerned with developing cattle using sugar cane as the basic feed.

3.5 Ministry of Fisheries and Marine Transport

This is a new Ministry, founded to increase fish production using both traditional methods and deep-sea trawling. There are no specialized institutions involved in research, but there have been some partial surveys on fish resources and a general study is soon to be started. But while fisheries is a major development prospect, it has as yet been little exploited as fish does not feature in the traditional Somali diet and fishing is a lowly-regarded occupation.

There has been a growing recognition of the importance of the marine transport sector in a country with limited inland facilities and a 4,500 mile coastline. A substantial training programme in all aspects of marine activities is now in progress, including marine biology, oceanography and marine architecture. There is a Marine and Fishery Institute for technician training, which at present is grossly deficient in teaching staff, equipment and facilities generally, but is shortly to be rebuilt with funds from the World Bank.

3.6 Ministry of Mining and Water Resources

The Ministry is at present being re-structured into four Departments: Geology, HydrogeologyMining, and Administration. While there is no research as such, the Ministry is largely concerned with geological and hydrogeological surveys. The staff includes some 20 Somali geologists, but most are newly trained and there is a severe lack of experienced personnel, as well as of equipment.

While past work has produced some indications of exploitable mineral deposits, and there are many anomalies to be followed up, there is as yet little mining in the country, and that mostly by expatriate firms. In anticipation of future growth in this sector, however, the Mining Department is being set up to collect technical information and to follow mining activities generally. Oil exploration, both on-shore and off-shore, is being carried out by international oil companies under concessional arrangements. In such circumstances it is obviously important to ensure that there are adequately trained and experienced Somalis fully conversant with the technical and economic aspects of the oil and mineral industries.

On water resources there is a National Water Committee, which brings together the various ministries concerned with water resources, and makes policy decisions related thereto. This Committee meets regularly under the Secretary of State for the Interior, with Secretary level representatives together with the General Manager of the Water Development Agency.

The Ministry has a small testing and analytical laboratory.

3.7 Water Development Agency

This is an autonomous agency under the aegis of the Ministry of Mining, with the main purpose in surveying and carrying out research on water resources, both surface and underground, at a national level, and their exploitation whether by deep wells, small reservoirs or dams. While primarily concerned with potable water for humans and animals, the Agency also undertakes contract work for other Ministries, and thus becomes involved in irrigation water schemes more generally.

There are three Departments: Hydrogeology, concerned with survey work; Water, concerned with drilling wells; and Engineering, which is responsible for building reservoirs and dams. The Agency has its own Training School for Technicians.

3.8 Ministry of Posts and Telecommunications

The establishment of a National Institute for Telecommunications has now been approved, and is being developed from the Telecommunications School, with help from the ITU and bilateral sources. This Institute will be involved in technician training, to meet the needs of the Ministry, and also of the Ministry of Marine Transport and of Civil Aviation in certain areas. The Institute will offer some training in instrument servicing and repair related to telecommunications equipment.

3.9 Ministry of Industry

The Ministry has three main Departments: Existing Industries; Industrial Development; and Handicrafts, Light Industries and Co-operatives. At this stage the prime interest of the Ministry is the administration of the state industries for which it is responsible: sugar, meat processing, tanneries, etc... A problem of particular concern is the shortage of middle and higher level technicians essential for industrial development.

A UN-supported project has recently started which is intended to strengthen the capability of the Ministry in planning and monitoring industrial development, with four UNIDO experts and a team of Somali counterparts.

The Ministry is exploring various possibilities for future industrialization, based on local raw materials, such as sepiolite and gypsum. To date technical evaluations have largely been based on assessments in overseas laboratories , given the lack of local facilities.

3.10 Somali Development Bank

This Bank is the sole source of internal development finance, concerned mainly with agriculture, livestock and industry. The Bank has some technical capability to assist in the implementation of new projects in these fields.

3.11 Ministry of Health

The Ministry carries out no medical research, but various WHO-assisted projects are concerned with investigations into disease control, particularly malaria and TB. There is a Central Public Health Laboratory for analysis and testing, while a Medical Technicians School provides training for medical laboratory technicians, assistant pharmacists, X-ray technicians, and nurse/midwives.

3.12 Ministry of Education

Some of the specialized training institutions which come under the technical ministries have been mentioned earlier. In addition the Ministry of Education has six technical training institutes, including the Mogadishu and Hargeisa Technical Institutes. The Mogadishu Technical Institute has 375 students studying auto-mechanics, general mechanics and electrical engineering, while the Institute at Hargeisa specializes in civil engineering and accountancy. There are still many gaps in the overall technical training position, as for example in agricultural mechanics and road engineering, but the Ministry has developed a systematic approach to the problem which should yield significant improvements.

A Polytechnic is now being built, with assistance from North Korea, but this is not likely to be operational before 1978, and even then demand for higher level technicians will far exceed supply.

3.13 Ministry of Higher Education and Culture

3.13.1 Somalia National University

Until recently Somalia has depended almost entirely on overseas training at the University level. The Somalia National University was not equipped to provide the wide range of manpower required for economic growth. Over the past two to three years, however, there have been determined efforts to remedy this situation. A Faculty of Agriculture has been established, and Faculties of Veterinary Sciences, Geology, Engineering, Medicine and General Sciences are being developed, with assistance from a group of Italian Universities. Following this association, Faculty staff are largely drawn from these Universities on a temporary basis, and the medium of instruction is Italian. International assistance, possibly through UNESCO, might help to alleviate some of the problems associated with the present bilateral arrangements. UNESCO is already assisting with the development of technical and vocational education and with the strengthening of the University's College of Education.

The first graduates of the Faculty of Agriculture - a group of about 20 - will emerge this year, and the Faculty is expected eventually to yield about 60 per year. As mentioned earlier, in future the Faculty will offer range management as an alternative option to agriculture. The Faculty has developed some research activities, which are expected to grow considerably in the next few years.

The College of Education, also within the National University, is essentially concerned with training teachers for primary and secondary schools. At the latter level normal output is about 60 graduates annually, including teachers in chemistry, physics and biology. Here the medium of instruction is English.

The College of Education has a useful general library, which is well patronized, and the Faculty of Agriculture has a small technical library. Overall facilities, however, are well below those required at a University.

3.13.2 Somali Institute of Development Administration and Management

Also under the Ministry of Higher Education is the Somali Institute of Development Administration and Management (SIDAM), which is designed for the improvement of the administrative system through training, research and consultancy. With this mandate, in addition to its training activities, SIDAM has been involved in a number of techno-economic studies on development problems. Professional staff includes 10 Somalis, 5 UN experts, and 2 experts through bilateral arrangements.

3.14 Directorate of Planning and Co-ordination

3.14.1 Technical and Economic Studies Unit

As mentioned earlier, until December 1974 there was a Ministry of Planning, which was then converted into a Directorate coming directly under the Presidency, with enhanced authority. By a Presidential Decree of 8 January 1975 a Technical and Economic Studies Unit was formed within the Planning Directorate. The functions of this Unit are given as:

"1) To formulate viable projects that can be examined in relation to the priorities established in the development plans of the country which can be developed and executed by methods that attempt to ensure the highest economic returns.

The Unit may not necessarily undertake all project preparations itself but where appropriate will provide specialized knowledge both technical and economic in co-operation with individual ministries and if need be with the special skills provided by foreign consultants.

2) To work closely with the technical sections of the ministries to help them bring forward projects ready for implementation.

3) To help train staff from technical ministries in the art of project preparation.

4) To advise on methods to be adopted by the technical ministries in project preparation and lay down standards and to resign all terms of reference to be used by its staff and by the technical ministries both for internal studies as well as those for the guidance of consultants.

5) To co-ordinate all project activities and fix time-tables for the preparation and execution of important development projects.

6) To carry out specific studies and surveys on any aspect of the national economy as may be directed from time to time by the Secretary and/or the Director-General of the Ministry of Planning and Co-ordination."

Initial emphasis will be on project preparation and formulation, and the establishment of project offices in the various ministries. At the same time the Unit will carry out sectoral and area studies, and will later be involved in project monitoring.

Present staff includes the Director (an economist), together with specialists in livestock and animal husbandry, agronomy, agricultural economics, hydraulics engineering, and construction and civil engineering, drawn from the Ministries.

The Unit, which comes directly under the Director-General, is to have three sections, with a total professional staff of 10, including the Director, made up as follows: Economic and Social Studies Services (4); Engineering Services (3); Agriculture and Livestock Services (2).

A firm of Italian consultants, CITACO, is associated with the development of the Unit, with a staff of 6 experts. Their role will include in-service and overseas training of Unit personnel, over a period of 1-2 years.

3.15 Conclusions

From the foregoing review, which while not pretending to be fully comprehensive, does cover most of the relevant institutions, it may be seen that the total scientific and technological effort in Somalia is limited, but is sensibly concentrated in the fields of agriculture and animal husbandry. Furthermore, the effort is being rapidly expanded, particularly with the development of improved training facilities at the University and elsewhere. But there is at present little co-ordination and integration of the different programmes, and cohesion will acquire increasing importance as the pattern of agricultural development changes. This problem is discussed further in Section 5.

As the technical Faculties at the National University become established, they may be expected to play an increasingly leading role in science policy in Somalia. The strengthening of these Faculties, albeit they will remain relatively small, is an urgent necessity. At present they are heavily dependent on assistance from certain Italian universities, aid which hopefully will continue. UNESCO involvement might, however, help to broaden the assistance programme and accelerate the development of the University. A preliminary brief mission is therefore recommended. An existing UNESCO programme is already concerned with the development of technical education and vocational training.

Other areas which are of urgent importance in connection with science and technology development in Somalia are supporting services, particularly instrument maintenance and repair, and scientific and technological documentation and information. A great deal of new equipment is being received by various laboratories. If this is to have a reasonable working life, technicians capable of servicing and maintaining the equipment will be required, which are at present not available. The training of a small cadre of Somali technicians in this field, covering fine mechanics, optics, and electronics, is considered an urgent necessity.

Plans are at present being developed for a National Library, with UNESCO assistance. These should be extended to incorporate a national plan for Library and Information Services generally, including scientific and technological information and documentation.

4. SCIENTIFIC AND TECHNICAL MANPOWER AND FINANCIAL RESOURCES

4.1 Scientific and Technical Manpower

The most recent manpower survey was carried out by the Ministry of Labour and Sports in 1971, with ILO assistance. The Report of this survey indicated the existence of some 190 professionally qualified scientists and engineers, excluding medical doctors. This corresponds to a ratio of approximately 70 qualified scientists and engineers per million inhabitants. It is interesting to note that the target adopted at CASTAFRICA (January 1974), for attainment, if possible before 1980, was 1,000 scientists and engineers per million inhabitants for a country at the economic development level of Somalia (under $100 per capita GDP). On the assumption that 10 % of these would normally be engaged in R & D, the target for research scientists and engineers was set at 100 per million inhabitants. According to a UNESCO survey, however, Somalia in 1970 had only 24 scientists and engineers engaged in research.

The Ministry of Labour survey report estimated that 1,525 persons with university degrees or equivalent qualification would be required during the 5-year period ending in 1976. At that time the total output from institutions of higher education was expected to be about 440, with an additional 600 Somalis graduating from foreign universities. It was thus estimated that there would be a shortage of 500 graduates. Steps have since been taken to expand the university in volume of enrolment and range of specializations, but these developments are still at an early stage.

Probably more important is the lack of experienced personnel. It has been estimated that the public sector requires 260 professionals with 5-10 years post-graduate experience. Post graduate training is urgently required for a number of specializations, including engineers of all kinds, doctors, scientists in agriculture and animal husbandry, and geologists with specialized fields such as geochemistry. It will be some time before the university can provide this type of training, but at present, according to the statistics of the Ministry of Higher Education, there are only some 18 Somalis engaged in post-graduate studies overseas in science and technology related subjects.

Technicians also are in very short supply, in relation to demand, and there is as yet no indigenous institution for the training of higher level technicians. In particular there is an almost total lack of instrument technicians. A considerable number of new instruments has recently been acquired by the University and various laboratories, but without proper servicing and maintenance this equipment will have a very short useful life.

4.2 Financial resources

According to the UNESCO survey, the total expenditure on R & D in 1967 amounted to about $130,000. As shown above the main research centre in the country is the Central Agricultural Research Station of the Ministry of Agriculture, which has an annual research budget of Som. Shs. 1.5 million or approximately $250,000.

This is in effect the cost of running the research station, and therefore includes expenditure which is not strictly research. But given that there is some research carried out in other institutions, it seems reasonable to assume that current national expenditure may be of the order of $300,000, which is equivalent to about 0.15 % of GNP.

The target agreed at CASTAFRICA, to be attained if possible before 1980, was an annual expenditure on R & D and supporting scientific and technological public services of at least 1 % of GNP.

5. SCIENCE AND TECHNOLOGY POLICY IN SOMALIA

5.1 Science and technology policy in a developing country

Science and technology policy, as here understood, is concerned essentially with the optimal use of science and technology as agents of economic growth and social development. This process involves the application of existing scientific knowledge, augmented as found necessary by indigenous research and the importation of technologies from other countries, to development problems. It covers the whole chain of research, experimental development through to technological

innovation and diffusion, bearing in mind that the translation of research results into economic uses - the innovation and diffusion stages - are often the weakest links in the chain. Thus the scope of science and technology policy is not confined to the sphere of discoveries and inventions, but encompasses the totality of the operations leading to effective contributions to the productive sectors of the economy.

Acceptance of science and technology as vital levers essential for economic and social development and change points the need for some means of control and guidance over the development of scientific and technological manpower and facilities, and their harnessing to the national development effort. This is what science and technology planning and policy-making is all about. These are problems of particular concern in developing countries, as indicated by the remarkable growth of science planning and policy-making bodies in recent years. In African countries this development is well documented in the reports relating to the CASTAFRICA Conference held at Dakar in January, 1974. This trend has stemmed primarily from a recognition that, with limited human and financial resources at their disposal, the optimal allocation of these resources and their proper orientation are of critical importance.

The main object is to enable science and technology to contribute to the development process, and account must therefore be taken of the guidelines provided by the overall development plan. An operational strategy must be devised to cover the two main functions of science and technology policy - the development of the national scientific and technological potential, and its effective application. The national science and technology policy should thus be a reflection of long-term national goals and objectives, and the economic and social development plans designed to achieve these goals. Only within the context of such an overall plan can effective policies be formulated, whereby the application of science and technology from both indigenous and external sources is directed towards national politically-determined objectives, while at the same time developing science and technology internally so as to widen the range of options available to the country.

Given the breadth of interests involved it is apparent that science policy straddles the work of many ministries and agencies, and has a particularly important role to play in cross-sectoral activities. Effective economic and science policies both necessarily require horizontal co-ordination of many activities cutting across the traditional boundaries of government departments.

The problem of co-ordinating a wide array of activities in a number of different institutions is not an easy one. Science policy bodies usually lack direct budgetary powers to effect positive control in the implementation of national science policies. On the other hand a body with too wide powers and too heavy a hand may lead to resentment and resistance from the operational departments. The answer to this problem is broad representation of all sectors concerned with science and technology, including scientists and the users of scientific knowledge and improved technology, in the formulation of science policies. To ensure an adequate level of discussion and participation in such inter-ministerial co-ordination - which will help to ensure that decisions are as acceptable as possible to all concerned - informal as well as formal mechanismsare needed, which must be designed to suit the particular society concerned, and tailored to match the scale of effort involved. Formal mechanismsfor science policy typically consist

of a central science policy body concerned with planning and policy decisions related to science, technology and development at an inter-ministerial level, with a number of specialized research councils which promote, finance and co-ordinate R & D within various sectors of national activity.

But, until a nation has an adequate scientific and technological potential, arising from a well-conducted and persistent policy for science, it cannot reach the point where it can usefully apply science for policy.

5.2 Science policy machinery in Somalia

In Somalia the heavy dependence for development on the exploitation of its natural resources, within its particular historical, social and cultural context, underlines the need for local scientific and technological activities, including research and resource surveys, to develop technologies tailored specifically to suit national circumstances. But as yet, as the brief review presented earlier indicates, the network of scientific and technological institutions in Somalia is meagre, largely due to constraints of skilled qualified manpower, and there is no machinery for overall guidance and direction.

In a comparatively small country, there must evidently be stringent limits on what can be undertaken locally. But as a result of current policies the pool of qualified scientific and technical personnel is growing steadily, and the effective deployment of these people will become of increasing importance. They will be required not only to carry out local research and development of improved technologies, and to ensure their effective implementation in the field, but also to serve as communications links with research and development work carried out in other countries with similar problems. In these circumstances the need for machinery for overall national-level science and technology planning and policy-making becomes increasingly apparent.

At the present stage, however, it is particularly in agriculture, understood in the broad sense to cover crops, livestock, range management, mixed farming, optimal use of water resources, and forestry, that the need for a national-level machinery becomes most apparent. Some form of Agricultural Research Council, which will bring together the various Ministerial, Agency and University efforts concerned with different aspects of the overall agriculturaldevelopment problem, particularly in view of the planned large-scale development projects which will themselves have substantial research components, would seem to be urgently required.

On a broader front of science and technology it may be premature to set up too elaborate a machinery for science planning and policy-making, though this will need to develop as the country itself develops. Undoubtedly a central science policy body will ultimately be required, in which the University Faculties and the technical Ministries will play leading roles. At an even earlier stage, additional Research Councils may be required, as for example in Geology and Mining, and Medicine. As has been stressed above such machinery needs to have a close working relationship with the national planning organization. At the same time it must be recalled that a fully-fledged science policy organization will require the support of a small but highly competent Secretariat capable of carrying out or supervising techno-socio-economic studies on various aspects of national development, from which long-term research priorities can be generated.

The newly-formed Technical and Economic Studies Unit at the Planning Directorate, would seem to be well-placed and well-qualified to form the nucleus of such a Secretariat. But while this Unit could carry out the long-term studies required, there is also need to mobilize the leading scientists and the users of research results in Somalia to formulate and oversee plans for the development of science and technology in the country.

From these considerations it is suggested that, on the one hand, a cell should be formed within the Technical and Economic Studies Unit, with an additional staff member, specifically to concern itself with R & D and related activities in Somalia, and at the same time that a small Advisory Committee on Science and Technology, composed of leading Somali scientists, should be formed to advise the Unit on national scientific and technological development, including manpower and training in the scientific and technological field, institutional development, and priority assessment. This Committee would form the embryo from which a fully-fledged science policy council could later be formed.

A training programme would need to be prepared to ensure that appropriate members of the Unit and of the Advisory Committee gained expertise in science planning techniques, through overseas fellowships and, when necessary, short-term visits by consultants. SIDAM might also beneficially be involved in these developments.

In the initial stages the promotion of these various activities - the Agricultural Research Council, the Advisory Committee on Science and Technology, and the development of a capability in science planning and policy-making at the Planning Directorate - would undoubtedly be helped by the attachment of an outside expert, perhaps through UNESCO assistance, for a preliminary period of 24 months. If such an expert were acceptable, one of his first tasks would be to prepare a training programme for his Somali counterparts.

6. INTERNATIONAL CO-OPERATION

The unavoidable limitations of a relatively small country suggest inevitably the importance of co-operation in science and technology between neighbouring countries with similar problems.

At the Sub-Regional Meeting of Experts on Scientific and Technological Co-operation held at Cairo in October, 1974, as part of the follow-up to CASTAFRICA, and attended by Egypt, Sudan and Somalia, priority issues for co-operation were given as:

- water resources and water management,
- desert reclamation,
- non-conventional sources of energy.

A similar list of priority topics was agreed at the Sub-Regional Meeting for Central Africa, held at Yaoundé in February, 1975. In this case emphasis was placed on using existing scientific and technological knowledge for the exploitation of solar energy, but including economic co-operation in the hardware required, in view of the small national markets.

There are many opportunities for international co-operation in such fields, as for example with the Institute of Solar Energy Research and Related Environmental Studies at Khartoum, provided Somalia has the necessary basic capability to converse effectively with specialists in other countries.

UNESCO's Man and the Biosphere Programme (MAB) could also provide useful information for Somalia, in that problems of arid lands and related eco-systems are specifically included in an internationally integrated approach to research, training and action-oriented programmes.

APPENDIX 1

LIST OF PEOPLE MET

Supreme Revolutionary Council

- Major General Hussein Kulmie Afrah, Vice-President and Chairman of the Economic Committee

Directorate of Planning and Co-ordination

- Mr. Hussein Haji Bod, Director-General
- Mr. Ahmed Dualeh, Planning Co-ordinator
- Mr. Abdi Giirre, Director, Technical and Economic Studies Unit

Ministry of Higher Education and Culture

- Jaale Sharif Saleh Mohamed, Secretary of State
- Mr. Ahmed Ali Kassim, Director-General
- Mr. Hussein Kahin Deria, Secretary-General, National Commission for Unesco
- Mr. Mahmood H. Ismail, Director, Planning and Ideology
- Mr. Colin Judd, Unesco Chief Technical Adviser
- Mr. Raymond Stobart, Unesco Specialist in Library Services

Ministry of Education

- Mr. Abdirahman Abdulle Osman, Director-General
- Mr. Ali Mohamed Hersi, Central Inspector for Technical Schools
- Mr. G. V. Boycov, Unesco Chief Technical Adviser on Technical and Vocational Education
- Mr. Osman Ahmad Mubaarak, Director, Mogadishu Technical Institute
- Mr. F. A. Gomes, Unesco Adviser

Ministry of Agriculture

- Mr. Mohamoud Ahmed Dukseyeh, Head, Agricultural Research Services
- Mr. Bashim Axmed Aden, Head, Agricultural Extension Services
- Mr. Nur Hagi Dhere, Acting Director, Central Agricultural Research Station

Ministry of Livestock, Forestry and Range

- Dr. Ahmed Aden Osman, Director, Planning and Training
- Mr. Abdul Rahman Haji Nur, Director, Division of Forests, Range and Wildlife
- Dr. Ali Yusuf Ahmed, Co-Manager, Training School for Animal Health Assistance (TSAHA)
- Mr. R. B. Drasad, FAO Adviser

Ministry of Mining and Water Resources

- Mr. Ali Issa Farah, Director-General
- Mr. Abdisamad Sheikh Osman, Director, Geological and Hydrogeological Survey

APPENDIX I

Ministry of Posts and Telecommunications

- Mr. Mohamed Ahmed Abdulle, Director-General
- Mr. A. Y. Jama, Head, Planning and Training Unit
- Mr. Abdi Ibrahim Ajala, Director, Telecommunications School

Ministry of Fisheries and Marine Transport

- Mr. Bashir Axmed Gardaad, Director-General
- Eng. Abdurahman Amin Mohamed, Director, Maritime and Fisheries Institute
- Eng. Ali Mohamed Ali, Vice-Director

Ministry of Industry

- Mr. Mohamed Issa Salwe, Director-General
- Mr. Omar Hersi, Director of Planning

Ministry of Health

- Mr. Osman Haji Ali, Director, Planning and Co-ordination
- Mr. Haji Jama Gibril, Director, Mogadishu Nursing School
- Mrs. Faduno Haji Mohamed, Nurse Tutor, Medical Technologists School

Somalia National Bank

- Mr. Adan Omar Elayeh, Head, Foreign Department

Somalia Development Bank

- Mr. M. Nur, Director

Livestock Development Agency

- Mr. Mohamed Ahmed Ali, Director

National Banana Agency

- Dr. Hassan Mohamed Ghibin, Technical Director
- Mr. Abdurahman Osman Behi, Commercial Director

Water Development Agency

- Eng. Abdulaziz, General Manager

Mogadishu Water Agency

- Mr. Hussein Jama, Engineering Director

Somalia National University

- Mr. Abdirahman Aideed Ahmed, President
- Mr. Farah Hussein Gedleh, Dean, College of Education
- Mr. Mohamed Abdi Nur, Dean, Faculty of Agriculture
- Mr. Abdullah Musse Isak, Secretary, Faculty of Medicine
- Mr. Abdulkahin Sheek Ahmed, Administrator, Faculty of Science

Somalia Institute for Development Administration and Management

- Mr. Omar Osman Mohamed, Director-General

United Nations Development Programme

- Mr. Jan de Lapidot, Deputy Resident Representative
- Mr. Raouf Galal El Din, Assistant Representative