

**Government of Jamaica  
S&T Policy  
1990**

FOREWARD

The Jamaican scientific community has for many years been advocating the preparation a policy which would guide the development and application of science and technology in the country and form part of the national strategy for development. There was a major thrust by the Scientific Research Council, in the late 1970's, coincident with the celebrated United Nations Conference on Science and Technology for Development. This momentum was continued and has eventually culminated in these policy measures.

A comprehensive draft document, approved by the Board of the Scientific Research Council, was widely circulated by the Board of the Scientific and discussed at a seminar held on March 31, 1989 to obtain consensus from the nation's scientists and technologists and from those sectors which were directly concerned with this policy. During November, it was again widely circulated, for comments, to individuals and various interest groups throughout the wider community, including trade union, private sector organizations, development banks, educational institutions and all Ministries and members of Parliament.

The final document, presented as a "National Science and Technology Policy", therefore, includes the inputs of many individuals, groups, agencies and institutions over at least two decades, and reflects a high level of consensus.

It symbolizes the aspirations of those who over many years worked for the promulgation of a national science & technology (S&T) policy, and expresses the faith of many individuals who, through their intellectual contribution to this document, as well as their time and experience, are attempting to ensure essential and significant contribution from S&T to the future development of our country. It presents the principal aims and objectives of a national S&T framework, measures and courses of action, which are

paramount and critical in the application of S&T both as a developmental tool and as an indispensable modern resources.

The promulgation of this National Policy represents the dawning of a new era in the life of our young National and heralds the official acceptance that a Jamaica which opens the frontiers of knowledge, offers the only acceptable future to its children.

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## INTRODUCTION

### 1.1 Science and Technology for National Development

Economic development depends on the optimum use of the human and material resources of a country. The richest countries are those that have best been able to advance scientific knowledge and to use technology have always been valuable ingredients in production. Science and Technology (S&T) is essential to many wealth creating activities: the development of agriculture; health systems; manufacturing and industry; the exploitation of natural resources; and it can also ameliorate the pressures of development on the environment.

Developing countries, like Jamaica, which depend on primary products for economic viability, are threatened by the newer technology-driven methods of production as well as the substitute use of new materials. Further to this, traditional advantages of relatively cheap labour are also being undermined by computer-assisted manufacturing and robotics.

An appropriate S&T capability is also required for such matters of international scope as: allocation of radio frequencies and satellite orbits, air and ocean pollution and radioactive contamination; trans- border data flows; and the challenges of the Law of the Sea and ocean bed mining.

To meet these and other challenges many developing countries are building substantial are building substantial S&T capabilities and, to the extent that they are successful, will become greater competitors in world markets. A most important ingredient of this strategy of development is an appropriate Science and Technology Policy which evolves as the needs of the societies and the Government change.

## 1.2 The Jamaican Perspective

The enormous social, economic and technological changes required to attain developmental goals such as increases in agricultural and industrial outputs, the provision of the basic necessities of life to the ordinary person – health, food, clothing and shelter – the abatement of poverty, the exploitation of natural resources, the upgrading of communications network, and in general, the improvement of the quality of life, demand the extensive, sustained, creative and innovative application of S&T.

The Government of Jamaica, recognizing the pivotal role of S&T in strategies for economic progress and for the improvement of the social conditions of the people of Jamaica, now confirms its commitment to this imperative and has now formulated a national S&T policy which will provide a blue print for the medium and long term development of a national S&T subsystem. This policy will help to power the drive towards economic independence. As the proper use of development of S&T must relate to people's aspirations, reliance and self-sufficiency. It will provide a basis to help to alleviate poverty in our society and improve the well-being of all sections of our people if developed properly.

Promoting the optimization of the development and application of S&T to sustainable development will help to satisfy the basic need of the Jamaican People for food, health, shelter, clothing, education transportation and energy. The S&T policy will also seeks to accelerate the improvement, or where lacking, initiate the development of the productive capacities of the country. At the national level the S&T policy will allow the country to establish criteria for generating, identifying and choosing between various alternatives, and direct action relating to the application of S&T, to the developmental process. On the broader scene it will foster the building up of an active economy and society and the development of peaceful and stable international relationships.

Policies and systems for S&T, its transfer and application are by themselves insufficient. S&T system form part of a broader national system. For the national system to produce the required out-puts, it is vital that each subsystem functions efficiently. To facilitate this, the policy seeks to ensure that the proper linkages, including those inside and outside the S&T subsystem, are established, while taking cognizance

of the fact that the over all national systems must be adapted to the resource endowment of the country and to local and socio-economic conditions.

For the medium and long term, the ability of S&T to meet the needs of the country will largely depend on break-throughs in research and development (R&D); on creativity and innovations, some of which have already occurred and some which are in progress; on the capacity of our national S&T sub-systems and infrastructure to deliver know-how and rapidly adapt and apply the results of research towards self-reliance know-how to rapidly adapt and apply the results of research.towards self-reliance; as well as on the competence in locating, modifying and assimilating existing technologies.

The successful application of S&T to sustainable development will require the strengthening, modification and where necessary, initiation of research systems. This requires expanding investment in human resources; paying special attention to applied research; relating research priorities to developmental goals; reinforcing of national capabilities to plan and manage S&T and R&D efficiently; increasing overall capacity for the transfer of technology from overseas; and unleashing the creative innovative potential of the people of Jamaica in this area.

## **2.0 POLICY AIMS AND OBJECTIVES**

### **2.1 General Goals**

The broad objective of the Government is to increase the role S&T in the attainment of economic and social development by bringing about social transformation, removing injustice in the society and improving the quality of life. This is to be catalyzed by putting in place and appropriate S&T policy, which, with the proper linkages between S&T and other subsectors, will foster strengthen and develop S&T. The prime objective of the S&T subsystem will be to provide substantial scientific and technological inputs to realize national development objectives.

## **2.2 Specific Aims**

The aims of the policy are to:

- i) foster, promote, and sustain the development and the coordination of science and technology relevant to the needs and circumstances of the country;
- ii) establish within the country conditions, and the necessary climate which will ensure scientific creativity and innovation and allow the talents of men and women to find full scope in scientific activity;
- iii) develop, through training and education, human resources of high quality and to recognize excellence as a contribution to the strength of the nation;
- iv) assess, develop and manage as appropriate the nation's natural resources;
- v) utilize the results of worldwide research and development to strengthen productive sectors such as agriculture, industry and manufacturing;
- vi) ensure that scientific and technological developments improve the welfare of citizens;
- vii) protect the environment and improve the quality of the habitat;
- viii) increase the nation's competitiveness in trade;
- ix) enhance the cultural, social, and economic development of the country and contribute to programmes of self reliance;
- x) support the integration of S&T in macro-economic planning.

Achieving the above objectives will be facilitated by the use of S&T to generate resources; to compensate for the deficiency of raw material to better exploit resources; to reduce waste; to improve traditional methods and skills of the country; and to increase efficiency and productivity in the fields of agriculture, industry, services and other areas. To ensure this, an assessment of the country's R&D establishment will be conducted to instrument changes which will better focus and coordinate their efforts. Existing policies will be redirected and programmes refocused to effectively translate strategies into S&T activities.

## **3.0 CRITICAL AREAS IN POLICY IMPLEMENTATION**

In implementing the policy, Government will pay specific attention to the following:

### **3.1 Developing a Scientific and Technological Capability**

S&T must be seen as an investment to propel economic growth. The national should, therefore, allocate resources to the development of local scientist and scientific knowledge to provide national capability in science and technology.

The Government recognizes that the education system lies at the heart of this development, which requires a broad spectrum of scientific and technical training, including scientific literacy. Continuous training and upgrading of the S&T skills of the human resources are made more critical by the present rate of scientific advance. The Government, there, commits itself to systems which will provide the nation with the required S&T capability.

Developing this S&T capability also requires close linkages between research institutes, the university and other tertiary education systems, the government and private industry. Government will therefore, endeavour to foster and promote appropriate linkages and support for cooperative efforts. The nation will build capabilities in terms of high quality manpower in growth areas which will provide opportunities in the near future.

### **3.2 Improving the Scientific Environment**

S&T is unlikely to become a creative force contributing to national development without a stimulating scientific climate. Government will, therefore, use its best effort to improve the scientific environment and to ensure that working conditions provide for.

- i) appropriate emoluments and incentives;
- ii) adequate facilities; and critical masses of scientists and technologist;
- iii) recognition of significant work;
- iv) the opportunity for collaborating , sharing of resources and mobility between institutions;
- v) contact with the international scientific and technological community.

Government has the responsibility for coordinating, fostering, promoting and catalyzing S&T in the society. While seeking to create the physical and social environment best conducive to the pursuit of scientific and technological activities, the Government, in its role facilitator will attempt to mobilize support from the private sector and non- Government organizations.

### **3.3 Planning and Infrastructure**

Competing demands for limited resources require that careful attention be paid to planning and the development of appropriate infrastructure at affordable cost. Some important concerns to be addressed are:

- i) ensuring that S&T is intimately structured into the national macroeconomic planning process;
- ii) establishing the most appropriate infrastructure for invention, innovation and the application of S&T;
- iii) determining, from time to time, immediate S&T priorities for selective action;
- iv) acquiring/transferring technology;
- v) maximum utilization of existing physical infrastructure and expertise;
- vi) effecting the appropriate infrastructure for monitoring, evaluating and forecasting and for advising on S&T activities.
- v) providing appreciate S&T support services such as testing, quality control standards, and an adequate indigenous base for design, development and maintenance of science equipment.

The provision of accurate and timely statistic is a basic necessity for proper planning and development. It is necessary, therefore, to improve the S&T statistical services in the country by carry out compilation and scientific analysis of the data needed for planning, programming, financing and evaluating S&T activities.

### **3.4 Some Special Requirements of the S&T Subsystem**

Devising strategies for the S&T subsystem and their integration into the overall national development system, require special emphasis on some elements/determinants within the S&T subsystem itself.

These include:

- (a) the creation of the appropriate climate in which S&T and its applications can flourish;
- (b) an appropriate combination of basic and applied research;
- (c) the application of appropriate criteria to allow concentration on a limited number of programmes to ensure early success;
- (d) the strengthening of R&D efforts in specific fields as necessary;
- (e) the improvement of job opportunities and the possibilities for the advancement of knowledge or evolution of technologies which may lead to the creation of new wealth/increase in productivity.
- (f) sufficient investment in S&T and R&D activities;
- (g) creation and maintenance of appropriate information systems with sufficient intelligence and applications capacity
- (h) the encouragement and support of the producer and the user of S&T and R&D;
- (i) the fostering of better selection, transfer and assimilation of both local and foreign technologies;
- (j) the appropriate mix of traditional, locally generated, imported technologies.

### **3.5 Main Criteria for the Support of S&T Programmes**

To achieve early and maximum benefits it will be necessary to foster, promote, and support cooperation between individuals and between institutions on specific programmes and problems. this will require access to, and sharing of, information. Multi-disciplinary S&T communities will be encourage, building as far as possible on existing resources and programmes. Where necessary, these facilities will be enhanced for general use by systems to be established. Emphasis will be given to existing programmes which will encourage innovation and creativity, and which:

- i. are already in a fair state of development and show advantageous potential;
- ii. can make use of existing facilities and provide closer linkages between sectors;
- iii. while uielding valuable data and information, will provide a foundation for further development;
- iv. help to develop job opportunities and to tackle national needs at all levels;

- v. provide opportunities that give Jamaica a competitive advantage
- vi. promote indigenous technological development;
- vii. enhance anticipatory intelligence

#### **4.0 PRIORITIES**

Priorities in S&T are determined primarily in accordance with national development policies. The aims and objectives of such policies are intended to enhance social and economic programmes such as education, health, low cost housing, water, food, transportation and communication. Because it is important that the nation effort in S&T be not dissipated, priorities will be in areas which promise to be vital to economic development, cover a useful mix of low of low and high technology programmes and which help to build the human resources base. Spheres of urgent and special focus are identified below. Emphasis on these priorities is considered essential if there is to be significant contribution from S&T to Gross Domestic Product (GDP) and to social development.

#### **4.1 The Human Resource Environment**

##### **4.1.1 Human Resource Development**

Successful implementation of the S&T policy will not be without the necessary human input. To meet this demand the human resources available in the country will be fully developed and utilized. Efforts will be made to retain skilled S&T manpower and to attract Jamaican S&T personnel living overseas. High priority will be attached to skills development, upgrading and training at all levels including cottage and village industries. In view of the constraints in small economics, such as ours, the need to search for patterns of organization that will permit effective use of scarce scientific manpower will be highlighted.

##### **4.1.2 Science Education**

Science education is essential for our future. All students should have the opportunity for exposure to scientific method and sciences. Strategies will be developed to enhance education in S&T with immediate

emphasis being placed on improving the quality of science in the primary secondary and tertiary systems. Emphasis will be given to providing students with technical proficiency and career guidance towards science subject to better equip them to enter and contribute to the S&T environment

#### **4.2 Scientific and Technological Information**

The management of information is basic to development. Therefore, Government will enhance and modernize the existing information systems to ensure dynamic internal and external linkages for making available world-wide scientific and technological information (S&T) in a cost- effective manner while at the same time providing a balanced mix of domestic and overseas research and development (R&D) for the solution of problems.

This system will provide information on national S&T capability (expertise, R&D in progress), intellectual property and technology transfer; be a repository for locally generated S&T literature and through outreach programmes, translate information into development projects and programmes at the productive and community levels. Scientists and Technologists will be encouraged to publish locally and to share their experience.

#### **4.3 Agriculture and Food**

Since agriculture plays a pivotal role in Jamaica's economic development, it will require sustained and substantial S&T support to raise the prevailing low levels of productivity. Consequently urgent attention will be given to the agricultural research and development , more especially to enhancing its capacity in research policy, organization and management to improve efficiency and effectiveness. Special consideration will be given to securing linkages and strong interaction with extension services. The effects of agricultural practices on the environment will also receive due attention.

#### **4.4 Nutrition and Health**

Nutrition and health are indispensable ingredients to development. While socio-economic development is an important pre-requisite for the health and nutrition of the population, an unhealthy and malnourished population cannot fully achieve the socio-economic goals of national development. Therefore, scientific and technological activities will take into consideration the nutrition and health implications for the people and will address directly the improvement of the health and nutrition of the population, including the adequacy and security of domestic food supply at minimum cost, its equitable distribution at both the community and household levels, and its healthful consumption. The health sciences will be encouraged to give emphasis to the pressing problems peculiar to Jamaica, especially with respect to disease prevention and health promotion and to mechanisms whereby research findings can be successfully implemented.

#### **4.5 Biotechnology**

The implications of biotechnology for the world's future are enormous. Conservative estimates are that world sales in biotechnology which totalled U.S. \$25 million in 1983 will exceed U.S.\$27 billion in 1990s; a thousand fold increase in seven years. Vaccines, diagnostic reagents, enzymes, antibiotics, and purified proteins are already available and vast prospects are being opened up in agriculture, medicine, and industry.

Biotechnology offers much promise for developing countries in such areas as increase agricultural crop yields, animal production, microbial pesticides and formulation processes. Hence the nation must be guided by clear policies and plans. The research and development work in progress in Jamaica in such areas as plant tissue culture, as plant tissue culture, nitrogen fixation, fermentation, and embryo transplantation will be expanded and intensified. Consideration will be given to selected aspects of medical biotechnology, including the possibility of local manufacture.

#### **4.6 Natural Resources and Including Mineral Marine Resources**

The exploitation of Jamaica's natural resources has contributed significantly to the nation's development. and recent work has identified substantial potential in areas of metallic/non-metallic resources and natural products.

This work will be extended to provide as complete a mapping as possible of the country leading to exploration and maximum exploitation of minerals. Inventories of biological species will be carried out to provide information on renewable resources. Studies on the possible exploitation of the off-shore marine environment, including the sea-bed, will also be undertaken as appropriate. Emphasis will be placed on applications leading to commercialization. Steps will be taken to prevent the loss and unrecognized export of the nations material

#### **4.7 The Environment**

The management of the Jamaica's environment is a continuing concern and requires urgent attention. To this end a variety of programmes will be supported including those which, *inter alia*, provide essential base-line

data on the soils, water and atmosphere, construct models for simulation of the threats to the environment, and monitor pollution. The preservation of the coastal environment and its contribution to the economy through tourism, recreation, and fisheries will also receive attention.

Waste Management is now a critical area in which programmes will be implemented as soon as possible. These programmes will include chemical, agricultural, factory and shipping wastes, and sewage. Economic exploitation, including recycling of wastes will be explored.

#### **4.8 Energy**

Energy is one of the basic requirements of all productive sectors of the country. The problem of adequate supply and demand for Jamaica, however, remains critical. Support will be given in areas which stress the development of renewable, non-conventional sources, and which promote greater use of alternate energy systems. The use of indigenous resources, conservation and energy planning will be emphasized.

In regards to conservation, stress will be placed on promoting:

- (a) more efficient generation, transmission and use of electricity;
- (b) more efficient use of gasoline and
- (c) transportation planning which takes into account energy use

#### **4.9 Microelectronics**

The ever increasing importance of computers and communications technologies has made micro-electronics a growth area which is transforming the face of the modern world. Support will be given to training and developments in this field, including manufacturing/production activities development of software and the provision of maintenance facilities.

#### **4.10 Trade and Industry**

Trade and Industry are essential elements of economic and social development. Due attention will be given to the generation and application of indigenous innovative techniques to the improvement and modernizing

of existing processes and the introduction of new businesses including emphasis on small business and traditional enterprises with special support for those which feed into, or simply niche markets. In this effort, quality control and standards will be assured. Technologies which will result in the highest quality at the lowest production cost and in products marketable close to the point of manufacture, particularly in the rural sector, will be promoted.

The links between R&D and its application, will be enhanced to ensure technology transfer. Copyrights and patents will be used to offer appropriate protection.

#### **4.11 Employment Opportunity**

As a high priority, measures will be adopted for the identification and diffusion of technologies that can reduce the incidence of poverty and unemployment and improve the quality of life. Technology relevant to the cottage, village, and small industries will be supported.

#### **4.12 Efficiency and Productivity**

To increase the productivity and efficiency of existing industries, agriculture, and other areas and to ensure relevance, current technologies will be evaluated on an ongoing basis. Efforts will be made to utilize by-products wherever possible and to recycle waste. Programmes which make use of easily available and less costly materials will be supported.

Reliable and efficient transportation and communication systems are necessary for efficient public and productive sectors. Methods of monitoring and modernizing these facilities will be supported.

## **5.0 TECHNOLOGY DEMAND/PULL**

The generation of R&D supply technology to the industrial users. These latter utilize technology to either improve on existing products or develop new products and process or in cost reduction procedures. A self generating process is completed, however, only if there is a profitable market for the product and which makes the effort commercially viable, S&T infrastructure, however, cannot by itself create a technology pull or market demand which themselves condition technology change. Government will consider mechanism to create, promote ad foster and environment favourable industry and which will stimulate innovation and creative technology. This technology demand can be stimulated by:

- i. adapting processes to use indigenous raw material;
- ii. producing products and services to meet specific local consumer needs;
- iii. encouraging increased efficiency, waste utilization and recycling;
- iv. keeping suppliers abreast of new technologies by requiring that goods are up to accept standards;
- v. giving appropriate protection to manufacturers;
- vi. diversifying and growing to meet the requirements of both domestic and international markets;
- vii. adapting imported products to fit local demand pattern;
- viii. providing incentives to engage in manufacturer

Government will encourage efficiency increases in technology usage through special production incentives, use of local raw materials and indigenous technologies. In the process, the linkage between the productive sector and the S&T community will be strengthen.

## **6.0 TECHNOLOGY TRANSFER**

The transfer of technology from one country to another is most successful where there are effective institutional mechanisms in the local S&T sector and an adequate indigenous competence which allows the country to:

- i) ensure the selection of technology appropriate to the country's needs;
- ii) acquire and assimilate the technology and adapt it as necessary to suit the local situation;
- iii) take advantage of technological development elsewhere through well defined collaborative arrangements in research and development;
- iv) ensure that the transfer of technology helps communities to develop or enhance their own technologies or enhance indigenous technology.

Government will take steps to encourage optimal use of imported technology both by government itself and by the private sector. This requires more information about the availability of different technologies and the putting in place of the appropriate institutional arrangements which will have the capacity to perform the following tasks adequately and effectively:

- i) evaluation of technologies as well as expertise available at home and ensuring their maximum utilization;
- ii) identifying areas where research development or adaptation may be required for progressive indigenization of technology;
- iii) regulating, adopting and monitoring (in particular cost and performance) the import of foreign technology;
- iv) reviewing of the operation of Patent Legislation and Patent System.

In both the acquisition and development of technology the country will:

- a) devise national and, where appropriate regional mechanisms for registering, screening and evaluating technology imports, and for assisting governments in technology negotiations;
- b) support consultant engineering capability in the nation;
- c) establishing mission-orientated industrial and agricultural extension services, with special emphasis on small and medium-scale enterprises, focusing on specific priority areas that can be quickly improved through transfer of knowledge to producers, and on generating feed-back on specific problems;

- d) strengthen mechanisms to co-ordinate technical and other forms of assistance from international agencies.
- e) establish a system to constantly monitor, assess and update technologies to suit the proposes of the country
- f) institute mechanisms to increase the local demand for forefront technologies;
- g) ensure that foreign technology input enhance the development of indigenous capabilities

The S&T subsystem will be employed to provide adequate expertise and service to industries which adapt and absorb technologies. The active participation of non-government organization (NGO) in bringing technology, particularly to the rural areas, will also be encouraged. Priority will be given to technologies that entail low cost, are adaptable on a small scale, are labour intensive, and at least neutral in their overall social impact.

In general, efforts will be geared towards the development and utilization of technologies likely to be adapted in key subsectors of the society such as agriculture and industry.

## **7.0 INSTITUTIONAL FRAMEWORK**

### **7.1 The Role of Government**

Although many existing institutions are anxious to contribute and possess the capacity to do so, S&T development is unlikely to occur in Jamaica unless Government provides the necessary leadership. Therefore, Government will provide and coordinate resources, promote strategic thinking and planning, afford opportunities and incentives, and help ensure that the results of research are exploited.

The Government recognizes that while the education system provides manpower resources and industry supplies and opportunities for the utilization and exploitation of technology results, the government must provide the necessary stimulus, the appropriate environment and the overall thrust and direction for these endeavours.

The Government will accordingly, continue to support and strengthen its own laboratories and institution [e.g. Scientific Research Council (SRC), Jamaica Bausite Institute (JBI) as necessary. These laboratories will normally not compete with other institutions, but will mainly respond to government's needs. Areas of responsibilities of these and other relevant public sector institutions, as well as their goals and objectives will be clearly defined.

Although government must play the paramount role, it is by no means the only actor and various other sectors will have to contribute. Therefore, industry (and academia) will be encouraged to do more research and development and particularly to concentrate on programmes likely to benefit the nation. Mechanisms will be put in place to assist the commercialization of the results of R&D programmes.

## **7.2 International Co-operation**

There are many programmes offered by governments, international agencies, academies, and other institutions, which can provide significant benefits to Jamaica. Appropriate international cooperation will therefore be encouraged. This is expected to provide inflows of knowledge, expertise, and funds, and improve standards. Some forms of cooperation would be enhanced with the formation of an Academy of Sciences. Another mechanism to be examined is the assignment of scientific attaches to diplomatic missions in a small number of appropriate countries, to facilitate international cooperation and technology transfer.

## **7.3 The Role of the Scientific Research Council (SRC)**

The Scientific Research Council is the only institution in Jamaica with the mandate and legal responsibilities for the development of S&T at the national level. This role will be rationalized with a view to intensifying the impact of the Council, and as such it will be strengthened and supported through increased resources.

The Scientific Research Council was founded in 1960 to “undertake, foster and coordinate scientific research in the island and to encourage the application of the results of such research to the exploitation and development of the resources of this island.” [Scientific Research Council Act (1960)]. The mission of the SRC is threefold:

**Information**, i.e., the collection, review and dissemination of information on research and technical knowledge of potential developmental value to Jamaica

**Coordination**, i.e., the coordination of scientific research programmes within the public sector (including statutory organizations) and, with their consent, of research schemes and projects undertaken by other organizations.

**Research**, i.e., to undertake directly or to support research on the development and utilization of local natural resources, on the improvement of existing technical processes and methods for the expansion of local industry and the utilization of waste products.

The recognition and use of the SRC as an institution for the developmental process is vital to the successful implementation of the S&T policy. The Council will therefore be identified as one of the focal points in the Government’s National S&T Plan for the building of S&T. The institution will be one of the chief institutions with the responsibility for translating the policy into short-term and medium-term plans. The council will coordinate, with the various planning institutions, the transformation of the S&T requirements of the national development plan into well defined programmes and tasks, which will then be implemented in the appropriate R&D agencies.

Effective implementation strategies require monitoring and feedback mechanisms. Through supportive mechanisms established by the Government, the council will ensure that the necessary facilitating S&T systems and linkages are instituted and effectively coordinated.

Necessary mechanism will be established to ensure that, as the umbrella organization charged with the development of S&T, the SRC will have the capacity and competence to properly discharge these overall functions.

The Government will emphasize the advisory role of the Council, particularly in the formation of S&T policies and programmes, and in the evaluating and monitoring of indigenous and imported technologies.

The responsibility of the Council as one of the principal agencies for national and international liaison in S&T, and coordination between S&T organizations and the production sector, will be reinforced.

#### **7.4 The Role of the Private Sector**

Every effort will be made to support Private Sector efforts to improve efficiency and productivity using available scientific and technological resources. Suitable financial mechanisms will be adopted to facilitate pilot processes and prototype developments and investments in order to enhance commercial exploitation and development of commercial activities. Linkages will also be established between the S&T institutions in both the public and private sectors. Gaps in technology will be identified and suitable corrective measures taken. Fiscal incentives will be provided in particular to:

- i. promote and increase the use of the indigenous expertise, resources and raw materials;
- ii. encourage in-house R&D activities in industry;
- iii. support efforts directed towards the adaptation and absorption of appropriate technology;
- iv. develop and apply of indigenous technology.
- v. encourage a systematic approach to the transfer and assimilation of technology

Active private sector participation will be encouraged through contract R&D to be carried out by R&D institutions for private industry clients and through joint government-industry research projects

In addition, special support will be given to initiatives aimed at developing capabilities in design engineering and translation of know-how to commercial products, particularly in the areas of agriculture,

agri-industries, chemical and industrial machinery, and capital goods. Existing design capabilities will be strengthened and upgraded and interaction encouraged between engineering groups in the public and private sectors, as well as in academic institutions.

The private sector will be encouraged to support research and to utilize the technological outputs of R&D in profitable commercial enterprises, thereby creating meaningful jobs and facilitating career development in S&T. The government will provide, review from time to time, the necessary assistance to the private sector, to enable it to provide it to participate in the development, utilization and dissemination of technology break-throughs. Consideration will be given to special tax relief on approved research and development

expenditures whether internal (which will include personnel costs) or external i.e. on funds contributed to other organizations [e.g. the SRC, Bureau of Standards, Institute of Jamaica, Jamaica Bauxite Institute (JBI), University of Technology (UTECH), University of the West Indies (UWI)]. Other innovative measures to increase private sector participation in S&T efforts will be explored.

## **7.5 Capital Goods Industry**

It is recognized that many of the major innovations in the western technology have emerge in the capital goods sector of the economy of developed countries. Developing countries, however, with heavy reliance on imported capital goods have not been able to sufficiently develop the technologies base of skill knowledge, facilities and organizations upon which such further technical progress largely depends. Even with import substitution the indigenous capital good sector is often undermined by the entry of foreign capital goods.

This sector, however, can:

- i) play a very special role in technological change, because of the ability and necessary to adapt technology to local circumstances and also because its vital role in the implementation of laboratory and field results;
- ii) provide conditions necessary to adapt and improve products and processes;
- iii) be an essential ingredient for the enhancement of indigenous technological capacity and for more advanced form of indigenous technological capabilities.

Government will therefore encourage the private sector to institute the necessary mechanisms to promote a strong capital goods sector from which substantial benefits such as the development of national indigenous capacity, capital-saving forms of product innovation, foreign exchange earning and skills formation can accrue

## **7.6 The Role of the University**

The university will be requested to assist, to a greater extent, in the development of S&T in the nation. This will include the usual educational inputs as well as the mounting of seminars, intensive training, summer courses etc. and greater cooperation with national institution and the private sector in R&D.

A major objective of the application of science and technology is to find appropriate solutions to the needs of a country and this, almost invariably, implies research by skilled personnel. The human resource available in Jamaica for research is presently quite inadequate so that some short term expedient is necessary. Some imports of qualified staff will be required, but every effort will be made to take advantage of the significant staff resources and infrastructure in science, agriculture, and engineering in the University.

Thus effort will be made to harness the potential of University staff and their research students to produce data, methods, and information aimed at contributing to national development and simultaneously to train personnel for continued development. Support will be given to the University to obtain funding for

appropriate programmes. The social science potential of the University will be incorporated into the process of applying S&T to development.

#### **7.7 The Role of the College of Arts, Science & Technology (CAST)**

The College of Arts, Science and Technology, with its wide range of science and technology training offerings at the technician, technologists and professional levels, will be a key institution for the educating and training of persons to enhance the productive of the country. It will be strengthened and supported with the necessary infrastructure and staff to provide the country with trained manpower required.

#### **7.8 The Role of Other Training Institutions**

Although the University and the College of Arts, Science and Technology must play special roles in scientific training and research, other tertiary institutions will also have essential roles. The College of Agriculture will play a key role in national agricultural development through training and field pilot studies. The teacher training colleges will have to respond to the needs for improved training of science teachers. Community colleges will be strengthened to play their special roles in the national training efforts for S&T manpower development. Schools at various level will have to ensure higher standards in the teaching of science and that interest in science is developed and stimulated at an early age.

#### **7.9 The Role of Professional Organizations**

Professional organizations and learned societies play a vital role in scientific and technological development by way of transfer of information, providing the opportunities for seminars and other discussion groups, setting standards of performance, and peer recognition. Such bodies which meet appropriate criteria will be supported and facilitated as much as possible to continue and improve their activities.

#### **7.10 Consultancy Services**

Consultancy services in various technical fields including R&D work, will be organized in the public sector. These, operating on commercial lines, will utilize the available scientific and technological talent in the country.

Surveys, feasibility studies, plans and design could be prepared not only for projects within the country, but also in the Caribbean region where such services are increasingly in demand. The funds so generated will be used, *inter alia*, for supporting appropriate R&D activities and improving national capability in S&T.

Apart from being an opportunity to make full use of their knowledge and expertise, consultancies to individuals will provide an incentive to professionals to remain in the country or return home, and to our young people to opt for careers in S&T.

Surveys, feasibility studies, plans and designs could be prepared not only for projects within the country but also in the Caribbean region where such services are increasingly in demand. The funds so generated will be used *inter-alia*, for supporting appropriate R&D activities and improving national capability in S&T.

#### **7.11 Utilization of Retired or Otherwise Available Scientists and Technologists**

In the context of the criticize shortage of high trained and experienced S&T manpower. Government will give consideration to the utilization, at the national level, of the services of retired or other available scientists and technologist, including their use in the science education system.

### **8.0 NEED FOR NEW INSTITUTIONS**

Although much of the institutional framework already exists there appears to be need for a number of new institutions to solve existing problems and to stimulate new developments and directions. Due note will be taken of the fact that the nation's reservoir of scientific expertise is being depleted. The various bodies contemplated will be phased in as the situation warrants.

### **8.1 A Scientific Branch of the Civil Service**

It has been difficult to attract and maintain scientific expertise in the public sector. The promotion of productive scientists to the administrative stream often compounds the problem. Although the advantages of high level scientific managers are clear, the good scientist should not have to abandon science and seek other fields for economic survival. (the same should apply to good science teachers). The feasibility of establishing a scientific branch of the Civil Service with its own terms and conditions of service will be studied with the aim of improving the situation and encouraging more local mobility within the scientific community.

### **8.2 Inter-Ministerial Committee on Science and Tehcnology**

Because many Government Ministries are involved in aspects of S&T, problems of coordination and execution are likely. A committee which brings together on a regular basis the Ministries' technical expertise would serve a useful purpose by providing of facilitating an overview of the work being done in the various Government agencies. It would not be necessary for this Committee to have outside membership although it might be desirable for members of the scientific community to provide specific services.

The composition and terms of reference of the Committee will be determined following relevant consultations.

### **8.3 A National Fellowship Scheme**

A national fellowship scheme which would allow government or industry staff to research at the University and vice versa, on problems of agreed national importance, would strengthen the S&T infrastructure and make technology transfer easier. In developing an appropriate scheme for Jamaica, the schemes operated in certain Latin American and other countries which selectively provide substantial rewards for successful research workers, will be examined.

#### **8.4 National Academy of Sciences**

In most countries a National Academy of Sciences, or its equivalent, is considered essential. The development of science and technology in Jamaica could be well served by the formation of a prestigious Academy which, though operating under a Charter provided by Parliament and at least partially (but adequately) funded by the government, would be an independent organization. It should be comprised of persons on the highest level of achievement in science and technology and membership should represent the most significant scientific honour that can be achieved in Jamaica. As membership thus provides recognition of merit, the formation of the Academy will provide a boost to the morale of the scientific community and stimulate the ambitions of the individual scientist.

The Academy will have the capability to carry out independent studies and thus to advise Government on policy issues and programmes. It should be mainly concerned with strategic thinking, the provision of advice on the allocation of resources, an overview of S&T, critical evaluations of selected work, studies of trends in science to assess the likely effects on Jamaica, as well as the advancement of science and technology in Jamaica. The academy will interact with other academies and seek particularly close links with the newly established Caribbean Academy of Sciences.

#### **8.5 National Committee of Science and Technology**

There have been several recommendations for the formation of a high level, broad-based, cross-sectorial national advisory committee on S&T. Consideration will be given to the establishment of such a committee with the Minister responsible for science as the Chairman and membership including, scientists and technologists, leaders in the relevant public and tertiary institutions, senior civil servants from relevant ministries and representatives of user organization of S&T. This body would advise the Minister on matters affecting activities in S&T or which will be affected by developments in S&T. Such matters would be referred to the committee by the Minister or independently identified by the committee. This committee would also have promotional functions.

#### **8.6 Venture/Risk Capital Institutions for R&D Programmes**

The funds spent on R&D to generate new technologies and products very often represents only a small fraction of the amounts required to take research results onto the industrial production phase. The development of new technologies and production involves complex activities usually falling into three separate and distinct categories:

- i) inventions/innovations which are derived from R&D in the laboratory;
- ii) pilot-plant production which demonstrates the technical and economic feasibility of the production/manufacturing procedure;
- iii) production/manufacture on a commercial level.

The effort through the engineering and product design phases, is often twice as large as that needed for R&D which leads to the invention; a further seven-folded increase in effort is often needed to accomplish

the required tooling and manufacturing technology, to which must be added, start up costs. Until full manufacturing capacity has been developed and initial operational marketing and financial difficulties are mastered, the cost of a commercial scale manufacturing products could vary over a very wide range, involving a substantial financial risk, and be an unattractive investment.

Government will either establish or facilitate the establishment of organizations/bank which would sponsor and support, with necessary venture capital, development projects resulting from indigenous research, will special concession for the use of indigenous raw materials. Special financial and technical assistance will be provided for projects, which improve existing technologies, as well as for strengthening the capabilities of innovative entrepreneurs with limited resources for development.

Government will also encourage/instruct public sector banks to finance important R&D activities on concessional terms. To facilitate loan negotiation, access to S&T expertise will be provided.

## **9.0 FINANCING OF S&T**

Scientific and technological activities, which by their nature, are spread over the entire spectrum of the national economy, will require additional investment.

Government will mobilize budgetary allocations for S&T and R&D programmes and activities. Research and R&D institutions will be encouraged to become self-sufficient as far as possible, by seeking contracts and providing services. Development banks will be expected to respond more positively to innovation projects and programmes.

Appropriate tax reliefs will be considered for organizations for the conducts or contracting of R&D work.

## **10. PUBLIC AWARENESS OF S&T**

In the end, the support of science and technology must come from the people. This can only be maintained in the face of competing priorities if the work done is worthwhile and is appreciated as such by the general public as well as by the scientists and technologists. Thus every effort will be made to increase public awareness of S&T and of their social implications, and to involve as much public participation as possible, in decisions which could have a significant and critical influence on the lives of the people of Jamaica. A key element in this is the availability of information and its widespread dissemination.

Encouragement will, therefore, be given to the full use of the mass media and information services, professional and popular publications, science and technology centres and museums, exhibitions and fairs, seminars and other efforts to popularize appropriate aspects of science and technology.

## **11. MINISTERIAL RESPONSIBILITY FOR SCIENCE AND TECHNOLOGY**

Science and technology impacts on all Ministries of Government as on many important spheres of private endeavour and will therefore continue to merit a senior cabinet portfolio.

An effective process of accountability at all levels will be developed in order to ensure that the nation gets a satisfactory return on its S&T investment in terms of greater insight into national problems and improved technologies for their solution.

The S&T system will be restructured as to fill in the existing gaps to facilitate the formulation, implementation and evaluation of coordinated action plans based on S&T policy.

## **12. SUMMARY**

Scientific advances and worldwide trends indicate that Jamaica should urgently seek to expand and deepen activities in science and technology particularly in areas which appear likely in the short and medium term to make contributions to the economy and standards of living of its people and to build a cadre of scientists who can further assist in national development.

Although there are many problems, the state of science in Jamaica is by no means hopeless. There are some traditions, active groups of workers, an education system, which despite justifiable complaints does turn out some very good people, some infrastructure and equipment. The main lack is a sufficiently sized body of experienced scientists, technologists and the environment necessary for the generation of a large body of quality work.

There are substantial resources which include: the University of the West Indies with its qualified researchers and facilities; the College of Arts, Science and Technology with emphasis on technical proficiency; the Scientific Research Council; the Bureau of Standards; the Jamaica Bauxite Institute; the Petroleum Corporation of Jamaica; and the Agricultural College and research stations.

The Government accepts the major role in encouraging scientific and technological development and will take steps towards the creation of an environment in which S&T can flourish and contribute to national development. Government will therefore seek the full co-operation of existing institutions and take advantage of ongoing programmes and resources. It will provide its major support for those efforts which support its aims and agreed policies. In developing these, a limited number of new institutions will be formed: these include a National Academy of Sciences, an Inter-Ministerial Committee on Science and Technology, and a National Advisory Committee on Science and Technology.

Attention will be paid urgently to human resource development. Steps will be taken to attract and retain high quality staff and skills development through appropriate training programmes and schemes. These will involve the examination of remuneration at certain levels and the creation of national fellowship schemes.

The national responsibility for science and technology will continue to reside in the office of a Minister with a senior cabinet portfolio.

Finally achievements in Science and Technology both in the medium-term and the long-term will depend on the quality of the educational system. Despite the problems, the improvement of science education in the schools will be undertaken. The scientific community will be encouraged to contribute to this improvement.