NATIONAL SCIENCE AND TECHNOLOGY POLICY FOR GUYANA

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1. FOREWORD

The ultimate goal of Science and Technology is to serve National Development and to improve the well-being of humanity as a whole. Developed countries continue to dominate the field of Science and

Technology to the extent that around 95% of all technological innovations are implemented by them, while developing countries, which represent 70% of the population of the world, have only 5% of the world's technological capabilities.

Developing countries have long recognised the need to pursue policies of creating the necessary structure at the National Level to maximise their capabilities to develop, absorb and use Science and Technology as well as to distribute the results of the these important tools of development among all sectors of their population.

In the context of the above and taking into account the National Development Objectives of Guyana, a `Science and Technology Policy Paper' has been prepared with a more in depth analysis presented in a supporting document, `Assessment of Needs in Science and Technology'. These Papers were intended to formulate a comprehensive, cohesive National Science and Technology Policy Plan designed as part of the National Plan to contribute to the achievement of Guyana's developmental objectives. A broad-based group was involved in developing these position papers with a view to specifically establish targets for the major Science and Technology Sectors, determining sectoral priorities arising from National Developmental Objectives.

These Policy Papers are intended to begin the process of Coordinating Science and Technology activities. In the final analysis, the operational and implementational modes would evolve from Sectoral initiatives whose involvement and commitment are therefore critical to successful implementation of the Policy perspectives.

It is anticipated that with a well-defined Policy position, mechanisms and options would be also pursued to promote Regional and International Cooperation in Science and Technology and in particular, to strengthen Scientific and Technological cooperation between Guyana and other developing countries.

2. EXECUTIVE SUMMARY

The Science and Technology Policy paper highlights the objectives and benefits to be derived by developing a Science and Technology strategy to support the National Development Plan. It identifies National Priority Areas to be pursued and defines clearly the role to be played by various institutions, both private and public sectors, in implementing such a strategy. It also proposes Governmental responsibility for Science and Technology and possible mechanisms for funding.

Policy Objectives

The Policy objectives clearly define Science and technology inputs into the National Development Plan, taking into consideration the development of the country's Science and Technology infrastructure, human resources development, information sharing and public awareness.

National Priority Areas

Based on current and projected programmes over the next five year period, a number of National Priority Areas are identified in which Science and Technology inputs would be required to make a substantial impact. These areas include mineral development, forestry, manufacturing, information technology, telecommunication, agriculture, research and development, technology transfer, environment, design engineering and engineering consultancy, standardisation, education and training, health and nutrition. Programmes to be pursued in these areas are also proposed.

Institutional Arrangements

The Policy document identifies the Institutional arrangements which will be required to implement a Science and Technology Policy. The roles and functions of the Government, the National Science Research Council, Professional Organisations, International/Regional Linkages, the Private Sector and Educational Institutes are clearly defined.

Funding And Responsibility For Science And Technology

Funding for the National Science Research Council Secretariat and Science and Technology Institutions will be provided, in the first instance, through Central

Government subvention. However, strategies for generating revenues, with the ultimate aim of self-financing, will be developed. The nature of Science and Technology inputs into the development plan is critical and as such, a member of the Cabinet would have direct responsibility for promoting Science and Technology.

3. POLICY OBJECTIVES

- To identify, promote and encourage the development of science and technology relevant to the needs of the country.
- To develop a science and technology infrastructure to meet existing and future needs.
- To develop mechanisms for collecting, analyzing, evaluating, selecting and disseminating Science and Technology information. To ensure there is a regular flow of vital Science and Technology information to key sectors of the economy.
- To utilize science and technology for the efficient utilization of the nation's resources.
- To provide standardization and quality systems in the production of goods and services for the enhancement of competitiveness in local and foreign trade.
- To promote educational and professional development of human resources to support the needs of the scientific community.
- To improve the quality of life of citizens and to protect and conserve the natural environment.
- To support the integration of Science and Technology in macro- economic planning.
- To promote the inclusion and advancement of all social groups in the Science and Technology profession.
- To increase the public awareness of Science and Technology.

4. NATIONAL PRIORITY AREAS

(a) PRODUCTIVE SECTORS

(i) Mineral Development

Guyana has vast mineral resources which have not been fully exploited. With the exception of exploration, mining and processing activities in gold, diamond, bauxite, granite ore and to a lesser extent, silica sand industries, marginal efforts have been initiated to identify and evaluate other valuable mineral resources.

Some of those would include non-metallic minerals in the feldspar and clay classification groups as well as manganese and uranium resources and fossil fuel resources.

For mining activities presently on-going there is a need to maximize the utilization of what could be regarded as non-renewable resources. In this context Science and Technology inputs to increase recoveries of mined ores would be pursued. Scientific and technological programmes would be developed to enhance the efficiencies of the mining and processing operations especially as they apply to the gold, bauxite and diamond industries. For developing other areas with commercial potential, a fuller characterization of other economic mineral deposits will be pursued. Apart from knowledge gathered so far, Guyana will seek assistance in developing capabilities to provide data retrieval from remote sensing techniques including the use of satellite sensing systems.

(ii) Forestry

The forest resources of Guyana cover more than three quarters of the land area and provide a range of economic and social benefits and services. Forest industries contribute 5% of the country's gross domestic product and provide employment for twenty thousand people. There is an increasing interest in the forestry resources from international timber companies, eco-tourism agencies and those interested in harvesting non-timber products. Guyana's forests have the potential to play an important role in national development. It is essential that such development should be planned and efficiently managed to ensure that maximum benefits are derived, whilst protecting the forest environment for future generations.

Some of the priority areas where science and technology will make an input will include the following:

- establish physical and mechanical properties of Guyana's hardwood species
- develop timber grading and quality control standards for logs
- identify appropriate technologies for the chemical preservation of Guyana's logs and wooden products
- establish methods for the seasoning of hardwood species
- establish drying/season characteristics for Guyana's woods and establish drying schedules for different species to satisfy different end use applications under varying environmental conditions
- develop and establish standards of methods and technology for the conversion of Guyana's woods to different end products.

(iii) Agriculture

S&T inputs into agricultural sector will enhance production and productivity while simultaneously resulting in acceptable products and ensuring sustainable agricultural practices.

More specifically efforts will be directed towards the following:

- develop and implement research programmes (to facilitate increased production and productivity) based on market demands and the experience of farmers. Research should include, but not be restricted to the following areas - improving germ plasma, integrated pest management, integrated crop management, improved quarantine methods, livestock nutrition (both forage and feeds), improved livestock breeds and utilization of agro-waste;
- carry out applied agriculture research, including research into appropriate systems of mechanization, which will provide answers to current and foreseeable problems facing crops, livestock, forestry and fisheries production;
- promote policies to ensure sustainable agricultural practice;
- evaluate under local conditions, scientific findings in other countries, an effectively transfer findings on new technologies to farmers;
- collaborate closely with other agencies and institutions engaged in agriculture and related research;
- utilize information technology as a management tool to improve record-keeping, data storage and retrieval, and for speedy access to production and marketing information particularly from overseas sources;
- capitalize on students early awareness and interest by provision of high standard tertiary educational institutes which will attract students of caliber from Guyana and other Caribbean countries. To this end, learning institutions must be better equipped with teaching instruments such as laboratories, audio visual aids. Practical teaching of agriculture must be emphasized.
- diversify the agriculture base through research and development efforts.

(iv) Manufacturing

Guyana has an abundance of national resources including, as a result of climatic conditions and soil characteristics, a good agriculture base. The value added that can be derived from the development of secondary products from these resources, especially for the export market, would contribute significantly to the foreign exchange earnings of the country. The manufacturing sector is perceived to play a critical role in developing these secondary products. To facilitate this process, science and technology inputs into the manufacturing sector will be necessary. Efforts will be made to apply the appropriate technologies to the manufacturing sectors to ensure cost effective processes are used to produce acceptable end-products. Some of the major manufacturing sectors to be targeted will include the following:

- metal fabrication foundry and machine related products
- leather, textiles and packaging products
- beverages
- chemical and paper related products

- marine related products
- forestry related products
- mineral related products
- livestock and dairy related products

(b) SERVICE SECTORS

(i) Energy

The drastic increases in the price of oil in the early and late 1970's catapulted energy to the centre of worldwide attention. Petroleum by that time, had replaced coal as the major source of energy fueling western economic growth and this sudden great increase in cost had profound effects for oil-importing countries like Guyana. Energy is extremely vital to the production process and Guyana therefore must take appropriate measures to minimize its foreign currency expenditure to purchase fossil fuel resources (US$56 million in 1994) and simultaneously to develop economically its own indigenous resources of energy.

In developing its own energy strategies, Guyana would select and apply appropriate mechanism to pursue the following:

- evaluate the quality and quantity of fossil fuel resources
- develop the hydropower potential of the country including large, medium and small scale systems
- accelerate the utilization of biomass resources including rice-husk, saw-mill waste, bagasse and other organic waste material to develop energy systems.
- evaluate the use of environmentally friendly technologies e.g wind, solar, tidal for energy generation.
- promote prevention of the environment
- develop and promote energy conservation system and technologies.

(ii) Information Technology (IT)

Information, at both the national and international levels, is a key resource and prerequisite for national development in the fields of science and technology. Developing this resource and making it accessible requires that :

- information already existing in various forms will be made available on-line, especially information resulting from S&T research conducted in Guyana, development-related activities by Government ministries and agencies and relevant S&T information available internationally
- connectivity will be developed and coordinated at the national and international levels to facilitate access to on-line information
- institutions and users who need to have access to on-line S&T information will have the facilities to access it and the skills needed to do so
- sufficient IT staff will be trained locally to maintain and expand local information systems.

To utilize Information Technology as an aid to development, the following will be encouraged:

- suitable course in IT be available at the secondary and tertiary levels
- the establishment of adequate facilities especially at tertiary levels to permit advanced training and research
- the development of professional standards for institutions
- ensure managers have a clear understanding of the role of IT in the developmental process
- to make necessary adjustments to institutional structures (especially government, ministries and corporations) to accommodate IT service staff.

(iii) Technology Transfer

For developing countries with limited financial and human resources, technology transfer is the most efficient and cost effective approach for selecting/acquiring appropriate technology. Technology transfer will therefore allow the country to :

- select technology appropriate to the country's needs

- modify and adapt technologies to suit the local environment
- transfer technological developments through S & T institutional linkages
- ensure that technology transfer assists communities to develop or enhance their own technologies.

The Government will encourage both public and private sectors to make use of technologies developed off-shore. To facilitate this, Government will ensure that institutional arrangements are established to carry out the following:

- evaluate local as well as imported technologies and decide on their utilization to ensure maximum benefits
- adapt imported technologies to suit the local needs
- monitor and evaluate the effectiveness of technologies being transferred and implemented
- review current patent and copyright legislation.
- patenting of techniques developed locally

(iv) Education and Training

Education and training in the area of Science and Technology will be promoted to prepare students for life in a rapidly changing social milieu and in an environment that will be heavily influenced by scientific and technological developments. Most specifically the following would be the objectives of developing curriculum and programmes for S & T education and training:

- to provide student from the primary level upwards with the scientific and technological knowledge and skills to define problems and devise solutions, drawing as far as possible from their own environment
- to produce from the secondary system graduates who are scientifically literate
- to accept the obligations to ensure that programmes of research and development, teaching and consultancy particularly at the tertiary level, are supportive of national development and are relevant to the needs of the country
- to provide an adequate number of candidates for future training in Science and Technology for national development.
- to promote continuing education and on-the-job training so as to keep workers up to date with new developments in science and technology
- to enable students and other persons, to use information technology to access the large amount of information currently available
- to promote the regard for ethical considerations in the acquisition and utilization of scientific and technological information.

(v) Health and Nutrition

Good health and nutrition are important requirements to the development of a country. A healthy nation which maintains good nutritional intake, will satisfy a fundamental requirement for the socio-economic development. It is therefore imperative that appropriate mechanisms should be put in place to ensure that scientific and technological programmes related to health and nutrition be developed.
More specifically these programmes would include the following:

- utilising information technology for anthropometeric (and other health) data collection as part of a comprehensive health and nutrition surveillance activity.
- continuously undertaking research into the etiology and treatment of the main factors affecting the levels of morbidity and mortality.
- encouraging nutritional status research, e.g into micro-nutrients levels of the population
- promoting research into the composition and utilisation of local and imported source of nutrients and medication.

(vi) Telecommunications

The upgrading and effective utilization of our Telecommunication network will be regarded as an essential prerequisite to facilitate information flow locally and internationally. The following Telecommunication-related activities will therefore be considered:

- increase the carrying capacity (bandwidth) of our links with international telecommunication infrastructures and our ability to use them efficiently
- upgrade local telecommunications facilities to improve service at a reasonable cost
- make suitable data services available at a reasonable cost and thereby encourage national connectivity
- the national radio frequency spectrum is a limited but valuable resource. Rationalize and monitor its use
- research cost effective ways to improve telecommunication facilities available in the hinterland and implement solutions.
- development of institutional capabilities in necessary telenet work.

(vii) Research and Development

Research and development is an integral part of Science and Technology. Without Research and Development, technological advancement will not be practicable and hence economic growth stagnated. To promote research and development, therefore, it is necessary to encourage greater collaboration between academia and industry with a view of addressing the current Science and Technology basis of the country. Pure research which is relevant and responding to needs of the country will be encouraged since it has a number of benefits which include:

- the development of a reservoir of scientist and technologists in the tertiary educational systems who will have an understanding of basic and fundamental scientific phenomena;
- serendipitous findings in which important practical applications may come unexpectedly;
- the promotion of pure scientific thought which is one of the highest expressions of human intellect and which facilitates understanding of deeper implications of science(e.g, where we come from, how life developed etc.).

(viii) Standardisation

Standardisation is an accepted sine qua non for the development of the national economy. The importance of standards in a Guyana's industry and trade is enormous. They define criteria for products (processes and services) as well as for materials and procedures. More specifically, the development of standards would facilitate design and manufacture, rationalize process and operations and promote quality with economy. Standards also touch every aspects of daily life by ensuring safe and reliable products and services to the customers, to safe guard the environment and to maintain health and safety requirements.

For standardisation to play a pivotal role in accelerating economic and industrial process, the entire activity of standardisation, including metrication would be coordinated and made coherent to evolve into a system of standardisation at the national level.

(ix) Design Engineering and Engineering Consultancy

- **Design Engineering** capabilities are essential for the translation of know-how to commercial production and would be developed locally. Building up and enhancing these capabilities will have a catalytic beneficial impact on the utilization of indigenous efforts that have resulted in product and process know-how.

- **Engineering Consultancy** is a vital area for ensuring speedy technological and industrial development. It will ensure the appropriate utilization of indigenous materials, plant and machinery and provides an essential link

between research and development Institutions and Industry. Indigenous engineering consultancy in both private and public sectors would be promoted and be involved in all technology acquisition efforts as counterparts to foreign consultants.

(x) Environment

Development should not upset the ecological balance for short as well as long-term considerations. Poorly balanced efforts to achieve apparently rapid development, ignoring the long-term effects of many technologies on the environment, have resulted in serious ecological damage. It is therefore essential to analyze the environmental impact of the application of each technology. In our development, due regard will be given to the preservation and enhancement of the environment in the choice of technologies. Some specific actions that would be taken at a national level will include:

- development of a sound land use strategy to ensure maximum utilization of land
- monitoring and maintaining a data base of industrial/commercial projects with environmental implications e.g. gold mining, agriculture and forestry
- increasing public awareness of environmental matters which affect daily life.

5. INSTITUTIONAL ARRANGEMENTS

(a) ROLE OF THE GOVERNMENT

The Government will provide the requisite support to effectively promote, coordinate and encourage Science and Technology inputs into the National Development Strategy. This continuous and committed support will ensure that the concept of providing Science and Technology inputs into the country's development programme would have a meaningful impact and that the consequential benefits will accrue. In this respect, the Government will ensure that the policies and guidelines outline in the Science and Technology Policy Framework will reflect programmes associated with the macro-economic plan. These guidelines will be clearly defined and prioritised to ensure maximum impact is achieved in the short, medium and long term.
The Government takes into cognisance the role of the educational system to provide the human resources requirement and of industry to utilise technological results developed and will provide an environment to stimulate and direct efforts to achieve these objectives.

The Government will therefore establish adequate and appropriate mechanisms and systems to coordinate effectively, all the Science and Technology activities being pursued in the country. It will therefore support the role and functions of the National Science Research Council (NSRC) and will demonstrate this support by providing adequate financial and human resources to develop and enhance the functions of this Coordinating Council and other agencies involved in Science and Technology activities.

Although the Government will be proving the leadership role in promoting Science and Technology, it is expected that supported involvement will emerge from NGOs, academia and private sector. Adequate incentives will therefore be established to ensure the participation of these sectors in the development, promotion and implementation of Science and Technological innovations and ideas.

(b) ROLE OF NATIONAL SCIENCE RESEARCH COUNCIL (NSRC)

- The NSRC was established by Act No. 26 of 1974 to create a mechanism of initiation, coordination and implementation of a comprehensive National Science and Technology Policy. Among the general overall responsibilities which appear in this act are:

- to assist in the formulation of, and to advise the Government on, a National Science Policy
- to determine priorities for Scientific and Technological activities in Guyana
- to promote research and to ensure the application of results obtained

More specifically, the principal duties of the NSRC will be to:

- formulate a Science and Technology Policy Framework
- coordinate all Science and Technology activities in the country
- develop strong linkages between Science and Technology Institutions and the private sector, including the manufacturing sector
- promote, market and transfer appropriate technologies
- evaluate, modify and apply technologies required locally
- provide government agencies and the private sector with Science and Technology information that will be beneficial to their operations and would assist in the decision making process
- encourage basic Research and Development programmes at all levels
- promote joint venture programmes between Science and Technology Institutions and other agencies, both private and public
- stimulate research in utilization of local resources
- support research in area of national interest
- improve standards of living of rural and hinterland communities by preservation of indigenous technology and by developing new technology
- promote education and training in areas of science and technology
- ensure the development of an adequate pool of expertise
- promote and popularise Science and technology as a developmental tool develop strategies to obtain financing, local and international, to support Science and Technology activities
- to promote regional and international linkages with other Science and Technology institutions.
- The Government will reactivate the National Science Research Council and establish a small Secretariat to carry out the functions identified.

(c) ROLE OF PROFESSIONAL ASSOCIATIONS

It is anticipated that professional organisations which have as their mandate, the promotion and development of Science and Technology ideas and innovations will provide some support in implementing the Science and Technology Policy Statement. The role of these organisation will include the following:

- identify national science and technology issues to which support can be given
- provide the necessary assistance to monitor the implementation of the National Science and Technology Policy in its technical components and make suggestions for change where necessary
- be a forum for technical update of members, particularly as it relates to the National Science and Technology Policy

(d) ROLE OF INTERNATIONAL/REGIONAL LINKAGES

In the field of Science and Technology, strong regional and international linkages and the corresponding exchange of technological data have been essential requirement in developing local Science and Technology capability. This is especially true for small developing countries where resources are quite scarce. Through these linkages, mechanisms will be established whereby the following would be achieved:

- facilitate access to Science and Technology information which is already available locally, regionally and internationally
- promote joint Science and Technology projects and collaboration between local and international institutions
- assist in meeting needs of the local Science and Technology institutions including funding and required expertise
- support local Science and Technology activities by making available scientific literature, facilitate attendance at international conferences and participating in exchange schemes and joint training programmes

- enable local services goods and expertise to gain access to the regional and international market place.

(e) ROLE OF THE PRIVATE SECTOR

In many developing countries a large proportion of the Science and Technology activities take place in the private sector. In developing countries like Guyana this trend will be encouraged and valuable partnership between public and private entities facilitated. The role of the private sector will therefore include the following:

- identify research problems and opportunities which might require the services of local Science and Technology researchers
- maintain a willingness to work with others (including local Science and Technology researchers) towards the solution of Science and Technology problems and in introducing appropriate innovations
- support progress in Science and Technology in general, including public awareness of S &T issues, and Science and Technology institutions (including educational institutions) . Support can be financial, in terms of expertise or in other ways. It is expected that the private sector will increasingly become involved in funding Science and Technology Programmes either directly or indirectly
- make available Science and Technology information in their possession accessible to others (with due regard to intellectual property rights and commercial interest) where possible (e.g, via internet).
- promote joint training programmes involving participants from the private sector, government-supported institutions and non-governmental organisations.

(f) ROLE OF EDUCATIONAL INSTITUTIONS

A key requirement for development in the modern technological age is a population that is well educated and trained in science and technology and capable of being readily mobilized to meet changes in technology. If Guyana is to meaningfully compete in the world market, it is essential that it puts in place a comprehensive Human Resource Development Programme aimed at strengthening its capability in Science and Technology.

An effective and well-managed National Training Strategy is vital for the effective delivery of a coordinated programme for the advancement of Science and Technology. Institutional training is coordinated by the Ministry of Education, University of Guyana and other Technical/ Vocational Institutions. In-plant training is coordinated by Industry. To avoid omissions or overlaps in training programmes and to achieve continuum, the overall coordination and management of a National Training System will involve functional linkages among the various agencies. The various linkages will allow for the flow of information to facilitate decision-making and coordinating and monitoring activities.
A National Training Unit will be established and its functions will include identifying training needs in Science and Technology and to monitor training delivery and training standards. The unit will work towards the harmonization Science and Technology training at both the formal and non-formal levels with a view of ensuring that the manpower demands in these areas are properly addressed. It will also advise on the maximization of the resource, both human and material, to enhance Science and Technology training at all levels. Support for promotional and motivational programmes that are aimed at creating high public awareness, the Science and Technology skills are lucrative.

6. FUNDING AND RESPONSIBILITY FOR SCIENCE AND TECHNOLOGY

(a) FUNDING

(i) National Science and Research Council Secretariat

The reactivation of the National Science and Research Council will result in the need to establish on the first instance a Secretariat with minimum staff to carry out the

functions identified. The financing required to maintain the Secretariat will, in the first three years, be provided through Governmental subvention. During this period of time, the Secretariat will develop appropriate strategies, mechanisms and linkages to ensure that it becomes fully self-financing by the end of the third year.

(ii) Science and Technology Institutions

The Government will continue to support Science and Technology Institutions through the traditional ministerial allocations. However, these institutions will be encouraged to develop strategies which will reduce their dependence on Governmental financing and eventually establish themselves as self-financing Institutions. Some of the strategies that would be encouraged would include:

- contract research for public and private sectors
- developing joint-venture programmes on a commercial level
- provide technical services and information on an on-going basis

(b) RESPONSIBILITY FOR SCIENCE AND TECHNOLOGY

In a developing country like Guyana, attempts to change and modernise traditional systems can be a difficult task. This can be due to limited understanding of what is being proposed and the consequential socio-economic impact that would accrue as a result of these changes. Scientific and technological inputs into the development strategy can be regarded as an area where this resistance to change may be encountered. It is however essential that the implications and resulting benefits for scientific and technological inputs be clearly defined, understood and accepted at the highest possible decision making forum in the country. In addition science and technology encompass all facets of daily life and therefore must be represented appropriately. The Government will therefore ensure that Science and Technology will be the responsibility of a member of the Government's Cabinet.