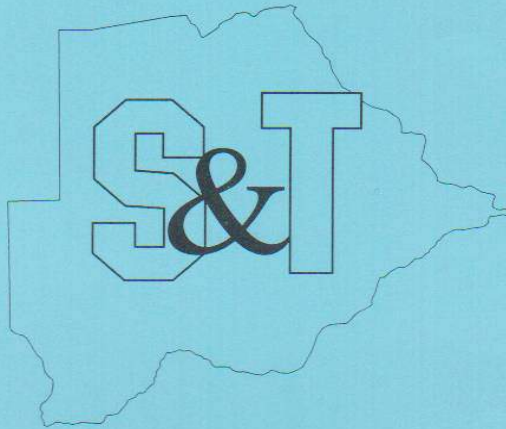


Science and Technology Policy for Botswana



APPROVED BY

PARLIAMENT

JULY 1998



**Ministry of Finance and
Development Planning**

Government of Botswana

SCIENCE AND TECHNOLOGY POLICY

FOR

BOTSWANA

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1.0 PREAMBLE

Development in Botswana is based on four guiding principles of **Democracy, Development, Self-reliance, and Unity**. The main objective of national development planning is to raise the standard of living of the people of Botswana. To achieve this objective, the National Development Plan 8 theme is **Sustainable Economic Diversification**. In the context of this theme, the Government recognises the role of science and technology (hereafter referred to as S&T) in diversifying the economy and improving productivity.

Science can be defined as **the pursuit of new knowledge through the systematic study of nature and the behaviour of the material and physical universe, and is based on observation, experimentation, and measurement.**

Technology can be defined as **the application of science through practical utilisation in the development of products and services, which can create wealth and improve the quality of life.**

This Policy details how increased capacity in S&T will result in improvements in national competitiveness economically, and in improvements in standards of living for Botswana's population.

Despite impressive economic and social achievements during National Development Plan 6 (NDP6) and NDP7, the future challenges for development and for S&T activities in Botswana are immense. There is need for co-ordination of S&T activities which are currently scattered over sectoral ministries, departments and parastatals, and their effective integration into the national development plans. The population is growing rapidly and becoming more urbanized, modernized and better educated. This has resulted in changes in the patterns of demand for goods and services. The demand for industrial products and modern goods and services is expected to accelerate during NDP8. Moreover, the demand for skilled human resources, particularly professionals in the areas of science, medicine and engineering, is expected to increase too.

Recent changes in the region, such as attainment of majority rule in the Republic of South Africa and political settlement in Angola and the expanding regional markets, pose fresh challenges to the political economy of Botswana. At the international level, the future markets for diamond, as with other mineral markets, is uncertain and the impact of the World Trade Organisation (WTO) on trade policies require Botswana to be more productive and competitive. The development of the "Global Village" and recent world regional trade agreements require Botswana to strive for greater development. The ability to compete in the provision of high quality products and services depends heavily on investment in S&T, including research. Successful developed and emerging industrialised countries spend 2% to 3% of their GDP on S&T development. Although no official figures exist, it is estimated that the figure for Botswana is less than 1%.

These challenges require better co-ordination, integration and administration of S&T so as to effect more industrial diversification, promote productivity and improve the quality of production. The need to pursue S&T-led economic development in future development plans has now become urgent in order to strengthen and consolidate national efforts towards sustainable economic diversification. S&T are envisaged to contribute effectively to diversification of the economy and sustainability of the natural resources and the environment. Sustainability is important to ensure that resources are not exploited beyond their natural capacity for replacement and that the environment is conserved. Moreover, in the context of the long-term vision, the process of development requires S&T together with skilled human resources so as to achieve a sustainable long-term path of growth and economic diversification.

Botswana lacks an S&T environment, which is conducive to technology transfer. Such a situation, combined with lack of adequate human resources, is likely to lead to a failure to absorb imported technology. With an expanding and modernizing economy, the demand for qualified professionals is considerable and it would be difficult and expensive to meet this demand by continued reliance on expatriates. Training of qualified Botswana internally, regionally and internationally to the full professional level is important to ensure transference of technologies that are conducive to local conditions.

Against these challenges and urgent needs Government decided to formulate a comprehensive **Science and Technology Policy for Botswana** with policy statements and strategies involving basic and applied science and ways through which the knowledge is shared and used in the community. This Policy outlines a set of objectives and strategies to stimulate, organise and use scientific and technological potentials in order to achieve national economic, social and cultural development goals. The S&T strategies will have to be converted into projects and programmes in order to effect implementation through legislative and executive provisions.

2.0 SITUATION ANALYSIS

Botswana has a stable democracy premised on the traditional institution of *Kgotla* and the culture of promoting social harmony (*Kasigano*). The stable political environment has enabled Government to formulate and implement policies and plans to develop all sectors of the economy. Development has progressed rapidly during NDP6 and NDP7 with real GDP growing at an average annual rate of 9.3% and real GDP per capita increasing by almost 6.0% per year. This rapid economic growth has brought about notable changes, particularly the opening of the economy to regional and international competition and the introduction of science and modern technology in all sectors of the economy. S&T activities have developed rapidly in industrial and manufacturing production, telecommunication, food production and processing, medicine and health, education, and infrastructure. Rural industries have been developed primarily through Integrated Field Services (IFS) stations.

These stations provide training and skills for small scale entrepreneurs. Furthermore, rural development has been assisted through establishment of the Rural Industries Promotion Company (RIPCO) to disseminate appropriate technology for promotion of rural industries and to provide technology adaptation, diffusion, and training in rural areas. The technological and manufacturing capacities of local companies have been enhanced through the Rural Industries Innovation Centre (RIIC) which is a subsidiary of RIPCO.

In order to facilitate advances in S&T, the Government has established research centres such as the Botswana Technology Centre (BTC). The BTC is mandated to serve as a national focal point for the development and dissemination of S&T. Its objectives are to identify, assess, adapt, evaluate and monitor technology in support of national development and to assist in the solutions of technological problems. To achieve these objectives the BTC carries out its activities through three divisions: the Technology Development Division which is concerned with innovation, implementation, development, evaluation and testing of technologies; the Technology Information Service which deals with technical information collection and dissemination; and the Techno-economic Assessment Unit which conducts economic and financial analyses of technological choices.

Government has also established the Food Technology Research Services (FTRS) to develop methods for preserving and processing food resources. Line ministries have established research units, such as the Policies and Programmes Research Unit at the Ministry of Commerce and Industry, to deal with S&T issues. Government activities have been scientifically and technologically enhanced through establishment of the Computer Bureau which is mandated to support computerization in line ministries and coordinate computer training throughout Government. The spread of education, especially at the secondary and university levels, has contributed to increasing public knowledge and awareness on science and modern technology.

In spite of these developments, S&T activities in Botswana remain fragmented and scattered over several sector ministries, and as such, they need coordination, streamlining and proper targeting. Moreover, enhancement of production and diversification of activities in both the services and production sectors of the economy are inhibited by lack of expertise and the transference of appropriate S&T. There are, also, constraints that inhibit the implementation of S&T plans. These include scarce human resources, including lack of experienced scientists and technologists, inadequate scientific infrastructure, and largely uncoordinated research and development activities.

At the institutional level, there is lack of a central body to manage and plan S&T and coordinate the activities and responsibilities of the Government, the private sector and parastatal institutions which are currently operating independently.

3.0 PRINCIPLES

The S&T Policy for Botswana:

- a. Takes cognisance of challenges, uncertainties and constraints for future development of S&T;
- b. Recognizes that the approach for S&T must be multi-dimensional and multi-sectoral;
- c. Recognizes the need to co-ordinate indigenous technological innovations with imported technology;
- d. Emphasizes the importance of conducting basic, adaptive and applied research for promoting industrialization and development of appropriate technologies;
- e. Emphasizes the need for environmentally friendly technologies such as biotechnology and alternative energy sources;
- f. Recognizes the environmental consequences of technological development;
- g. Stresses the need to harmonize S&T with the future plans for long term development and sustainable economic diversification; and
- h. Acknowledges the importance of other sectoral policies and programmes and their linkages to S&T services.

4.0 GENERAL POLICY GOAL, OBJECTIVES, AND STRATEGIES

4.1 OVERALL POLICY GOAL

The overall goal of the Policy is to achieve sustainable social and economic development so as to meet the present and future needs of the nation, and to meet the challenges of the next millennium, through the co-ordinated and integrated application of S&T for the upliftment of the standard and quality of life of, Botswana and conservation of the environment.

4.1 CORE POLICY OBJECTIVES

In order to achieve the overall goal the core policy objectives are to:

- a. Establish and strengthen national capacity to research, evaluate, select, acquire, adapt, develop, generate, apply and disseminate suitable technologies;
- b. Develop and raise the national productive capacity and improve competitiveness through efficient application of S&T;
- c. Promote and develop traditional, endogenous, new and innovative technologies, and
- d. Create knowledge and awareness, improve and develop the scientific and technological culture of Batswana.

4.2 CORE POLICY STRATEGIES

The core strategies of the Policy are intended to help realise the set objectives and to build S&T capacities in the priority areas of the economic and service sectors with emphasis on rural areas. They are:

- a. Develop, adapt and apply appropriate technologies for small, medium and large scale processing and manufacturing industry;
- b. Promote and develop traditional technologies and encourage their wider diffusion and application;
- c. Develop human resources to implement the Policy and its programme of activities;
- d. Develop basic infrastructure and establish S&T facilities in rural and urban areas;
- e. Promote and support development, transfer, adaptation, dissemination and diffusion of S&T;
- f. Develop and utilize information; monitor and evaluate systems for S&T;
- g. Identify, evaluate, promote and facilitate areas of comparative advantage for S&T;

- h. Create an efficient system for the protection of Intellectual Property Rights (IPR);
- i. Promote private sector participation and financing of S&T activities and encourage the private sector to promote, develop and commercialise scientific and technological activities and results;
- j. Promote S&T culture in the country;
- k. Encourage and support non-governmental organisations (NGOs) and community based organisations (CBOs) to enhance community participation in S&T activities;
- l. Promote and support national and international co-operation and collaboration in S&T activities;
- m. Introduce S&T in all education programmes and ensure systematic institutionalisation of S&T in the Botswana culture and society;
- n. Build the capacity to search, select, negotiate, procure, exchange, and introduce technologies suitable for socio-economic conditions in the country;
- o. Create a conducive work environment for scientists and researchers and ensure rapid and efficient dissemination and application of research results;
- p. Promote mutual support and interaction between S&T education, research and production activities;
- q. Establish institutional organs for co-ordination, management and financing of S&T activities;
- r. Create centres of excellence, and science parks including business incubators in strategic S&T areas;
- s. Strengthen existing S&T institutions and establish appropriate centres of excellence and support services in various districts of the country; and
- t. Establish a National Council for Research, S&T for co-ordination and management of S&T activities and assessment of their impact.

5.0 SECTORS

5.1 AGRICULTURE, FORESTRY AND FISHERIES

5.1.1 KEY ISSUES

Botswana is semi-arid with varying temperature and highly unpredictable and erratic pattern of rainfall. Productivity in the subsistence and commercial agriculture are primarily constrained by the harsh environment, in addition to the high cost of production. There is concern about over exploitation of forestry resources and under-development of the fisheries sector. Food security is a national goal. Extension services are constrained by inadequate human resources, and poor linkages between research and extension. The contribution of agriculture to the national GDP has fallen from 40% at independence to 4% in 1996. Botswana has a competitive advantage in livestock farming which should be exploited. Women mainly carry out arable farming in the country. Agricultural and related research carried out by the Ministry of Agriculture and the Botswana College of Agriculture should form a major component of S&T activities aimed at improving agricultural activities as stipulated in the National Policy on Agricultural Development (1991) and the National Development Plan 8. Botswana has regional responsibilities for SADC in the agricultural research, livestock production and animal disease control sector, which calls for further capacity building in these areas.

5.1.2 OBJECTIVES

To support the generation, transfer, and utilisation of technologies to enhance agricultural, forestry and fishery conservation, production and processing activities.

5.1.1 STRATEGIES

- a. Strengthen agricultural, forestry and fishery research facilities and institutions to enable well co-ordinated research activities in the various crops and livestock; forestry and fishery sectors.
- b. Enhance effective pest and disease management, prevention and control and promote research in post-harvest technologies and their use.
- c. Upgrade research on development and utilisation of indigenous trees and adaptation of suitable exotic species.
- d. Undertake bio-technological research that has the potential for higher production, productivity and utilisation of agricultural, forestry and fishery products.

- e. Develop technologies for household, on farm and industrial processing of agricultural, forestry and fishery products to add value and enhance shelf life.
- f. Develop appropriate technologies to enhance farming systems including integrated farming that are economical, cost effective and environmentally sound.
- g. Promote water harvesting facilities and technologies for irrigation agriculture where feasible.
- h. Protect national genetic resources through the introduction of legislation regulating export of germplasm.
- i. Provide incentives to trained graduates of agriculture, forestry and fishery who take commercial farming.
- j. Conserve natural resources and support research that improves quality and utilisation of natural resources.
- k. Strengthen research, extension delivery system and teaching linkages, and incorporate indigenous knowledge into the formulation of research strategies.
- l. Promote research on domestication and production of useful indigenous plants and animals.

5.2 COMMERCE AND INDUSTRY

5.2.1 KEY ISSUES

S&T are important driving forces in industrial production and productivity. In order to diversify the economy and lessen dependence on large scale mining and beef exports and to produce goods for export and create sustainable employment, industrial development has to provide the necessary enabling environment for local and foreign direct investment in industrial capacity building. Government offers a number of incentives to encourage industrialisation, including the Financial Assistance Policy (FAP), low taxes and liberalised foreign exchange controls. There is need for more innovative and aggressive approaches to establish new export and industrial development incentives, over and above the present manufacturing incentives.

Further, there is need for a more effective and explicit fiscal policy to promote the setting up of small and medium scale enterprises and industries, especially in the context of S&T supportive mechanisms.

A business development programme, in concert with the existing Integrated Field Services (IFS) programme, must be put in place to provide a full service approach towards systematically moving the entrepreneurial client towards sustained profitability and growth; that is, a fully integrated effort towards assisting businesses in establishing and dynamically implementing viable "business development growth plans". Such a programme should also address the need to more effectively assist promising small enterprises towards further growth, and linkages to the larger corporate and multinational business sector. The importance attributed to the small and medium scale enterprises and industries has been given in the light of this sub-sector's actual and potential significance and contribution to the growth in the private sector employment and the economic diversification objectives.

5.2.2 OBJECTIVES

To support the Commerce and Industry sector through application of S&T; to increase the national capacity for industrial production and economic growth; raise the quality and variety of products for local consumption and export; promote commercial and scientific marketing methods for locally produced goods; to facilitate the creation of alternative engines of growth via the industrial sector and to support small and medium scale business policy development initiative.

5.2.3 STRATEGIES

- a. Promote industries with high growth, high productivity to accelerate growth of per capita GDP.
- b. Increase the productivity and employment capacity of the economy and ensure that the country's industrial structure is competitive within the regional and global economies.
- c. Develop an enabling and cost-effective infrastructure by the application of S&T mechanisms.
- d. Transfer technology from foreign suppliers to domestic users and promote the efficiency of assimilation and operation of transferred technology.
- e. Broaden and strengthen the industrial base by encouraging industrial diversification, and expansion of backward and forward linkages.
- f. Provide support mechanisms for the creation and fostering of innovation and independent indigenous technological capacity in the capital goods sector and services.

- g. Facilitate the smoothing of adjustments as shifts in the technology base of the economy occur.
- h. Establish innovative credit programmes including a revolving fund for start-up working capital to enable the setting up of industries based on agricultural and animal by-products, preferably in rural areas.
- i. Strengthen the "One Stop Shop" concept (i.e. Botswana Export Development and Investment Authority (BEDIA)) to provide necessary information and services to investors, as well as to expedite the process of setting up manufacturing units.
- j. Establish Business District Centres to assist businesses in their attempts to carry out their growth plans.
- k. Enhance export-oriented industries and products based on local resources.
- l. Provide technical support and training to citizen entrepreneurs.
- m. Develop effective linkages between research institutions and the corporate sector so as to facilitate the commercial exploitation of by-products.
- n. Implement measures aimed at reducing manufacturing costs.

5.3 EDUCATION AND HUMAN RESOURCE DEVELOPMENT

5.3.1 KEY ISSUES

The success of Botswana's efforts in sustainable economic development through the expansion of manufacturing and services industries critically depends on the quality and quantity of the available human resources. Awareness and the level of appreciation of S&T is generally lacking. As a result, a large part of the population need to be sensitised about issues of S&T in order to build an appropriate culture. There is a chronic shortage of Botswana S&T teachers and trainers at all levels of the education system. There is a low output in S&T education and training compared to the investment made.

5.3.2 OBJECTIVES

To develop adequate human resource capacity with an optimum mix of capabilities to generate and apply S&T based on the needs of industry and the society. To cultivate and nurture a culture of S&T in all sections of the society.

5.3.3 STRATEGIES

- a. Promote S&T education at all levels with a view to produce enterprising Batswana.
- b. Use indigenous and appropriate technologies in the content and examples in courses at the basic level of education.
- c. Induce creativity and inventiveness by including project work at all levels of education, and through building, properly equipping and staffing multi-purpose rooms and specialised laboratories as appropriate and encourage the setting up of appropriate clubs and national competitions.
- d. Increase the use of local materials and enhance local production of teaching equipment and materials so as to achieve relevance and sustainability.
- e. Link project and research work at tertiary education level and vocational training to industrial needs as well as current or perceived needs of the society.
- f. Include entrepreneurial skills and programmes necessary for commercialisation, such as intellectual property, standards, project management and financial management in senior secondary and tertiary education as well as vocational training.
- g. Encourage female students to take up S&T subjects. Induce the use of female role models - women who have taken up S&T careers.
- h. Create opportunities for the disabled in S&T education and training by increasing enrolment.
- i. Provide staff with knowledge in science, engineering, technology and mathematics as well as social sciences to career advice and counselling offices in each school up to senior secondary level.
- j. Increase visibility of S&T practitioners in society so as to advertise the benefits of S&T careers.
- k. Localise syllabuses at all levels of education and training in order to link education to the needs of the nation.

- l. Train sufficient numbers of citizen teachers and trainers in science, technology and mathematics. Make science, technology and mathematics teaching attractive in order to attract and retain sufficient numbers in the profession.
- m. Develop technology forecasting systems and training programmes for new and existing manpower in line with technology trends. Regulate development programmes for new craftsmen, technicians, technologists, scientists and professional engineers entering the labour market in collaboration with appropriate professional bodies and industries.
- n. Sensitise Batswana to their responsibilities as both generators and consumers of S&T and build a culture of S&T in the nation at large.
- o. Integrate cultural issues in the teaching of S&T.
- p. Prepare a national master plan for human resources development in S&T, identify future manpower needs by sector including research and development.

5.4 ENERGY

5.4.1 KEY ISSUES

Energy is essential for most development activities. Wood-fuel is the prime energy source for the majority of rural people and accounts for more than half of the energy supply in the country. Rural areas consume 60% of the overall energy. The adverse effects of land degradation and ultimate desertification are due to fuelwood harvesting, clearing for agriculture and wood cutting for construction and furniture manufacture. The Expanded Coal Utilisation Project (ECUP) that was put in place to address these issues has been modestly successful due to reluctance by consumers to use coal. Since it is not practical to supply grid electricity to all, decentralised solar power for rural energy offers the best alternative, and has to be promoted, specially as it is environmentally sound, the technologies are available and the potential for tapping solar energy is immense. Botswana has a tremendous advantage in solar power, and the country should be developed as a centre of excellence for solar energy technology. There is need to optimise the petroleum products used by the transport and the industrial sectors. The concepts of energy conservation and energy audits are important issues that need to be seriously addressed. Research on renewable energy is strong in Botswana. However, the same cannot be said about conventional energy sources. The manufacturing of solar thermal panels and water heaters is still restricted because of lack of an enabling environment. The use of other solar technology is also limited. The participation of CBOs and NGOs in the popularisation of the new technologies is also required. The Ministry of Minerals, Energy and Water Affairs through its Energy Affairs

Division, is responsible for co-ordination of this sector. The Department is responsible for the formulation of a National Energy Policy and its implementation. Presently the Biomass Policy development and implementation rests with the Department of Crop Production and Forestry of the Ministry of Agriculture.

5.4.2 OBJECTIVES

To research, develop and promote the supply, availability and utilisation of affordable, efficient, sustainable and environmentally friendly energy sources and technologies.

5.4.3 STRATEGIES

- a. Plan, co-ordinate and manage energy and strengthen linkages and institutional framework.
- b. Support research in the fields of renewable and non-renewable energies, energy efficient equipment, product development and applications.
- c. Encourage institutions responsible for the delivery and supply of energy to promote the use of energy efficient appliances and applications.
- d. Establish a national capacity to carry out energy audits of the industrial sector.
- e. Emphasise the wider use of Botswana coal in government institutions and the domestic sector, expedite the adoption of environmentally sound solar energy technologies and clean coal technology, and provide resources to develop and apply other pollution-free technologies.
- f. Encourage small and medium-sized entrepreneurs to set up manufacturing units for solar water heaters, coolers, dryers, cookers, photovoltaic and electricity generators, etc.
- g. Strengthen and restructure institutional capacity in petroleum policy formulation and monitoring.

5.5 ENVIRONMENT

5.5.1 KEY ISSUES

Botswana is blessed with a wide range of natural resources whose exploitation has contributed to the rapid development of the country. However, the exploitation of many of these natural resources has resulted in environmental problems.

The environmental problems that need to be addressed include; degradation of rangelands pastures due to overgrazing, pollution, frequent veld fires, depletion of wood resources and exploitation of veld products. Some of the technologies used in Botswana are not environmentally friendly. The national policy on natural resources conservation and development is already in place to address all these issues.

The National Conservation Strategy Agency has been established to spearhead the country's efforts to protect the environment as well as to promote sustainable development. It is essential to ensure that environmental impact studies take place before projects are embarked on.

5.5.2 OBJECTIVES

To develop and strengthen educational activities, research programmes, technologies, and measures aimed at promoting environmental protection and conservation of the country's natural resources and biological diversity for sustainable development.

5.5.3 STRATEGIES

- a. Develop and promote proper waste management systems and research activities on waste management, including industrial waste.
- b. Legislate and conduct environmental impact assessment studies.
- c. Ratify relevant international conventions on environmental protection.
- d. Integrate environmental protection in the national development programmes through S&T intervention.
- e. Develop and enforce fire management policy in protected areas.
- f. Promote resource conservation and recovery through appropriate incentives.
- g. Promote, in collaboration with relevant NGOs, participation and education of local communities in the management and conservation of natural resources.
- h. Promote research on causes of overgrazing, deforestation and soil erosion, and ensure legislation enforcement in these areas.
- h. Encourage and support the private sector to recycle materials such as used oil and tyres.

5.6 HEALTH

5.6.1 KEY ISSUES

Rapid economic growth has enabled the Government to invest in health and introduce modern medical technology. Health services are costly primarily because of adaptation and use of expensive medical technology and trained personnel. The acquisition and use of technologies which are widely used in health facilities need to be rationalised. Drugs are very expensive and the pharmaceutical industry has drastically reduced the importance of plants as a source of drugs as most drugs are now synthesised in the laboratory. In Botswana, marketed drugs are controlled by the Drugs and Related Substances Act of 1992 which aims at ensuring that drugs are safe, effective and of acceptable quality. Within government services, the Essential Drugs List is used whereby the country has 500 items on the catalogue. Drug manufacturing in Botswana is limited to generics due to lack of technical capacity to develop new products. Human resources remain inadequate at the different levels of the health system. This means that available manpower has to be utilised at optimum levels, performing functions best suited for their level of training.

Primary health care, which emphasises preventive, promotive, rehabilitative and curative health, has been chosen as the best strategy to bring about the best health status for the people of Botswana. Poor socio-economic conditions such as inadequate food intake among vulnerable groups, lack of access to adequate potable water, low levels of education, poor hygiene and sanitation services; also contribute to ill health in Botswana. Malnutrition affects about 18.4% (1997) of children under the age of five. Primary health care, which is the main strategy for delivering health care in Botswana, emphasises a judicious mixture of preventive, curative and rehabilitative measures. HIV/AIDS and its co-infections with tuberculosis have become major health problems. Tuberculosis and HIV form a lethal combination; they do not only speed each other progress but also account for the majority of deaths. Tuberculosis remains the single most important killer. Serious outbreaks of malaria that occur annually during the rainy season are also problematic. In addition, respiratory and gastro-intestinal infections are other dominant causes of ill health. Contraceptive technology has been successfully used in the country and has had a positive impact in the health status of women. Reproductive health services, including family planning, have resulted in low infant and maternal morbidity and mortality rates as well as low fertility rates. Traditional healers and local medicine persons are still recognised and used by the population.

5.6.2 OBJECTIVES

To support S&T for the improvement of health and the overall physical, social and mental wellbeing of the population.

5.6.3 STRATEGIES

- a. Enhance human resource development at all levels in the health sector to raise capacity to research, develop, adapt and use of health technology.
- b. Conduct institutional research on medicinal plants, aiming at commercialising the results.
- c. Promote and support research efforts geared towards producing feasible technologies for the prevention and management of common diseases in the country.
- d. Promote basic hygiene as a compulsory component of school curricula at primary and secondary levels.
- e. Develop methods to determine the best mix of health services and commodity deliveries; and optimum staffing levels of health facilities with well trained personnel.
- f. Support research efforts for alleviating malnutrition of vulnerable groups.
- g. Promote programmes to enhance household food security, community education and consumer protection.
- h. Enhance the role and participation of men and women as well as NGOs and CBOs in health activities especially in rural areas.
- i. Document existing traditional medical practices and traditional healers, in order to enhance research in their potential beneficial as well as harmful characteristics.
- j. Conduct research on medical technologies for use by disabled persons.

5.7 METEOROLOGY

5.7.1 KEY ISSUES

Weather and climate affect human daily activities. They affect agriculture, the environment, conservation of natural resources and aviation. The temperature, rainfall and wind patterns vary and fluctuate widely in Botswana. The meteorology department operates in a global partnership with free exchange of meteorology information among members of the World Meteorological Organisation (WMO), using S&T extensively.

Maintenance of an efficient telecommunication network is essential for rapid collection and dissemination of data required for national, regional and international use. The current national observational network is inadequate for establishing and accurately recording weather and climatic conditions in the country. The aviation industry benefits much from meteorological information using modern technology systems. The human resource level in meteorology is inadequate both in numbers and training.

5.7.2 OBJECTIVES

To develop institutional capacity and to promote meteorological research and development with focus on enhancing agricultural production, aviation, environmental and natural resources conservation.

5.7.3 STRATEGIES

- a) Support research on meteorology especially regional and national climatic changes, and co-operate with regional and global efforts in monitoring global warming, green house effect and ozone layer depletion.
- b) Strengthen the meteorological infrastructure in the country. Improve dissemination and utilisation of meteorology data to facilitate socio-economic development. Establish weather stations where necessary.
- c) Utilise meteorological research results in national climate-dependent development programmes.
- d) Develop capacity and capability of human resources through training and development of the existing staff.

5.8 MINING

5.8.1 KEY ISSUES

In 1997, minerals made about 80% of Botswana's export earnings and 33.5% of GDP. The mining sector employed about 13,000 people in 1997. The major contributor to this sector is diamonds, followed by copper-nickel, coal and soda-ash. In 1996 Botswana ranked amongst the three largest world diamond producers by value. Additionally, it is noted that the potential for industrial minerals and semi-precious stones is considerable. Botswana has very large reserves of coal that can be used extensively for its major energy needs. Mining consists of large, medium, and small scale operations, all of which have the potential to damage the environment. Foreign grown technologies, which include both state-of-the-art and old are prevalent in Botswana. There is hardly any local research in this sector.

Further, consultancies are carried out by foreign companies which has led to local capacity and capability not being developed in this field. The sector is highly dependent on imported production materials, inputs and skilled foreign labour. There is limited downstream processing of minerals, which are largely exported in semi-processed form. In the case of diamonds, diamond-cutting and jewellery manufacture is being embarked upon. However no formal training exists in this area in the schools and colleges, in spite of the fact that diamond is the biggest income earner. In addition to mining operations, a diversity of related or unrelated secondary industries offer significant employment opportunities. The Government presently devotes much attention to minerals exploration with the help of the private sector.

5.8.2 OBJECTIVE

To promote environmentally sound exploration, exploitation and utilisation of the mineral resources for the benefit of the nation through appropriate diversification of industries.

5.8.3 STRATEGIES

- a. Enhance the S&T base to create local capacity and capability to undertake mineral exploration, product processing and to serve the needs of the mining industry in general.
- b. Increase productivity and promote competitiveness of the local mining industry by encouraging the application of innovative and efficient technology, which is suitable for local conditions.
- c. Promote the use of environmentally sound technologies to minimise environmental degradation.
- d. Encourage the processing of minerals and semi-precious stones and promote local cutting, polishing and jewellery manufacture to add value and create employment.
- e. Train craftsmen, technicians and professionals in all areas of mining and minerals-processing.

5.9 POPULATION PLANNING AND HUMAN SETTLEMENT

5.9.1 KEY ISSUES

With a young age structure, improving health conditions and declining mortality, the population of Botswana is likely to increase rapidly. The implied high population growth momentum will continue for several years into the future and is likely to result into considerable increase in the working age population, women in the reproductive age 15-49 and the school age population 6-23 years old. Consequently, the demand for employment opportunities, housing, maternal health services, education, etc is expected to increase. These needs are likely to be augmented further by changing life styles, increasing income levels and urbanization. S&T in the areas of health and disease control, and fertility regulation should help in addressing some of the population challenges and issues. Application of sound scientific methods and technologies is crucial for successful planning and management of population and human settlement.

5.9.2 OBJECTIVE

To support and promote S&T activities related to population and human settlement planning and management, and facilitate efforts to improve and maintain good health and raise the quality of life of the population.

5.9.3 STRATEGIES

- a. Expand health education and encourage adequate and effective use of family planning methods.
- b. Collect, process and disseminate demographic data and promote management and evaluation of population programmes and activities.
- c. Conduct research on population and technological change, population growth, patterns of human settlement and the environment.

5.10 TOURISM

5.10.1 KEY ISSUES

Tourism is one of the sectors that are expected to propel the economy to high growth levels. There is therefore a need to raise the quality of service delivery through application of S&T. The tourism sector has potential to create substantial employment opportunities especially in the rural areas because of its labour-intensive nature. Tourism can stimulate small and medium scale industries for local people, such as, manufacturing local crafts and souvenirs. As a foreign exchange earner it contributes positively to the country's balance of payments. Therefore, there is urgency for support and need to turn this opportunity into a great success. There is already a tourism policy in place whose main emphasis is to generate employment in the rural areas, raise incomes in the rural areas and reduce rural-urban migration. The guiding principle is low volume high value.

5.10.2 OBJECTIVE

To promote and support relevant S&T activities for the advancement of tourism to contribute more effectively to the diversification of the country's economic base, conservation and sustainable utilisation of natural resources, cultural heritage and monuments.

5.10.3 STRATEGIES

- a. Increase the country's tourism potential and optimise the social and economic benefits to Botswana.
- b. Encourage private sector and community participation in the tourism industry.
- c. Establish adequate training facilities for training cadres in a wide range of fields including hotel catering and management, conservation practices and management, entrepreneurial skills, artefacts, customer-service, etc.
- d. Strive for quality service standards by establishing a profound service ethic through target oriented training.
- e. Emphasise public awareness to stimulate a new perception of tourism in the country.
- f. Devise a comprehensive, and cost effective marketing approach.

- g. Undertake a continuous resource base assessment in order to promote eco-tourism that is sympathetic to the environment while generating substantial economic and social benefits to the country.
- i. Utilise and apply S&T principles in the improvement of the tourism infrastructure and service sector.
- j. Enhance cultural heritage values and preserve archaeological sites.

5.11 TRANSPORT AND COMMUNICATION

5.11.1 KEY ISSUES

Botswana has a surface area of 582 000 km² and a sparsely distributed population that needs an efficient transport and communication system. Population has increased, urbanisation has intensified, average disposal incomes have risen, number of vehicles have increased and other infrastructures have expanded. It is desirable to provide transport and communications services in areas where they are most needed particularly in the rural areas. The network of roads, railways, airports, postal and telecommunication centres need to be further explored. Timely maintenance of the infrastructures has to be ensured. Advanced telecommunications and electronic media are needed to facilitate development.

5.11.2 OBJECTIVE

To promote and support S&T activities for the enhancement of the transport and communication sector in Botswana, through research and development, and involvement of the private and public sectors.

5.11.3 STRATEGIES

- a. Develop, in collaboration with the private sector, transport and communication networks to meet the needs of a growing economy especially in the rural areas, and establish new transport routes and communication links to forge regional co-operation.
- b. Adopt the principles of cost recovery in investments and pricing policies to ensure proper maintenance of the infrastructure.
- c. Promote training of maintenance personnel for transport and communications machinery.

- d. Establish, where electricity is not available, telecommunication links using solar photovoltaic generators to run telecommunication equipment.
- e. Popularize electronic mail systems throughout the country as an efficient and cost effective means of communication.
- f. Enhance the surface mail infrastructure to create an effective postal delivery in all areas of Botswana.

5.12 WATER

5.12.1 KEY ISSUES

Water is scarce and therefore expensive in Botswana. Better water management and improvement of the quality, quantity and efficient storage and utilisation of water is a dire necessity. Adoption of appropriate technology for water resources research and development requires training of human resources for effective implementation. Botswana has a lead in tapping ground water resources and the technology could be commercialised and exported. Available local water resources should be supplemented by co-operating with neighbouring countries.

Botswana has developed a national water master plan to guide water development to the year 2020. Rainwater harvesting could be an effective means of water provision. Waste water should be treated as an economic commodity to be recycled for reuse.

5.12.2 OBJECTIVE

To promote S&T applications to improve the quality, quantity, efficient and effective utilisation and conservation of ground and surface water and adaptation of appropriate technology, with the aim of providing a secure water supply to the entire nation, and to provide water for other developmental applications.

5.12.3 STRATEGIES

- a. Update the national water master plan regularly.
- b. Assist institutions and households to use water saving equipment and adopt strategies to reduce wastage and to have hygienic facilities for water collection and storage to avoid diseases.

- c. Optimise the use of piped water through appropriate technologies for conservation and recycling of household and industrial wastewater to potable use.
- d. Explore, exploit and sustain current and new water resources in collaboration with countries in the region and internationally.
- e. Develop and commercialise appropriate technologies for water distribution and treatment.
- f. Educate and encourage community participation in the management, conservation and utilisation of water resources.
- g. Promote desalination of saline ground water where feasible.
- h. Promote the acceptance of recycled water by the community through education.
- i. Develop water harvesting technologies and legislate for building codes which include the use of water saving devices and appliances in private and public buildings.
- j. Develop industrial capabilities to produce equipment and technologies for further phases of North South Carrier Water Project, and for the water sector in general.
- k. Develop or promote technologies that can reduce the high rate of surface water evaporation.
- L. Promote good international relations on shared water resources based on the SADC Protocol on shared watercourse systems.

5.13 WILDLIFE

5.13.1 KEY ISSUES

Botswana possesses considerable numbers and varieties of wildlife. This sector is contributing significantly to the national development programmes and it has been identified as one of the new engines of growth. It is for this reason that the government has made a deliberate policy of reserving a large proportion of the land for National Parks, Game Reserves and Wildlife Management Areas. It has now become desirable that other types of attractions be identified and developed to diversify away from the old concept of the wildlife and the wilderness.

Other measures include protection of endangered species and maintenance of optimum stocks of veld products.

There is need for sustainable utilisation including domestication where feasible of animal, plant species and to study their breeding methods. Some of these animals and plants have certain characteristics beneficial to humans, i.e., low cholesterol meat and medicinal properties.

5.13.2 OBJECTIVE

To promote and support relevant S&T applications for conservation, management and sustainable utilisation of wildlife.

5.13.3 STRATEGIES

- a. Encourage the private sector through various incentives, to invest in tourism and wildlife industry.
- b. Establish training in all aspects of wildlife and its management needs.
- c. Undertake research to find ways and means to preserve endangered species, both animals, and plants, through appropriate breeding techniques, and to identify methods to increase local participation in wildlife activities.
- d. Encourage and support regional co-operation in wildlife industry.
- e. Identify classes of animals and plants that are capable of increasing food output through biotechnology, i.e. tissue culture, transgenetics and artificial breeding systems.
- f. Establish and support regulations for bio-safety and maintaining bio-diversity, and protection of Intellectual and Industrial Property Rights.

6.0 OTHER AREAS

6.1 POLITICAL CONTEXT

6.1.1 KEY ISSUES

The process of development and sustainable economic diversification requires effective consideration of S&T. Political support for S&T development, which currently is at its infancy in Botswana, is of paramount importance at this stage. This should be achieved by promoting and maintaining regular interactions between political leaders and stakeholders through seminars and meetings to discuss key issues of S&T.

6.1.2 OBJECTIVE

To develop and promote political commitment to S&T-led development in Botswana by encouraging dialogue with the political leaders on the key issues.

6.1.3 STRATEGIES

- a. Sensitise the policy makers about the critical importance of the S&T sector for economic success.
- b. Create incentives for S&T advocates to keep abreast of the latest developments in the sector, so that lobbying can be based on up-to-date information.
- c. Support the development of an environment that will boost the status of S&T in Botswana.
- d. Establish and support fora through which political leaders and stakeholders can deliberate on S&T matters on a regular basis.

6.2 FINANCING OF SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT

6.2.1 KEY ISSUES

There are no firm estimates of the resources, which are currently allocated to S&T. However, it is estimated that they account for less than 1% of GDP. These resources are scattered across the sectors of the economy. Adequate and co-ordinated finance of S&T would lead to diversification of industries and economic activities and would ensure more effective use for S&T in enhancing the

competitiveness of production in regional and international markets. The official commitment to S&T activities needs to be matched with the allocation of adequate resources. In order to contribute to the maintenance of technological dynamism and sustained economic development, the Government in partnership with the private sector and NGOs should put in place adequate financial resources.

6.2.2 OBJECTIVE

To provide financial support and coordinate S&T activities to build up capacity and put in place the necessary infrastructure.

6.2.3 STRATEGIES

- a. Establish a target goal - as a percentage of the total annual GDP for the research and development.
- b. Promote the flow of complimentary funds from bilateral and multilateral sources for the support of S&T development.
- c. Encourage the private sector through various incentives to make effective financial contribution to S&T development.
- d. Create a national fund for S&T activities supported by Government and the private sector.
- e. Generate funds through participation in bilateral and multilateral research projects and participation in regional and international scientific and technological programmes.
- e. Encourage S&T institutions to generate funds by commercialising their services and products and utilise these funds for the promotion and expansion of S&T activities.

6.3 RESEARCH IN SCIENCE AND TECHNOLOGY DEVELOPMENT

6.3.1 KEY ISSUES

Basic applied research and research on culture, norms and values as they relate to S&T development are meagre in the country. Government departments, parastatals, private institutions and the University of Botswana are currently doing limited research. Facilities available are inadequate, funds are insufficient and skilled human resources to conduct research are limited.

Research is needed for development of indigenous technologies and the adaptation of imported ones to local conditions. It is required for determining cultural and social deterrents to scientific and technological development as well as understanding the likely impacts on culture, norms and values of imported technologies. There are also the ethical and legal aspects that need to be addressed. Moreover, the community and family/household responses and reactions to scientific and technological development vary considerably by rural/urban residence, district and geographical location. It is imperative to recognize all these dimensions in order to effect a sustainable technology-led development path in the country.

6.3.2 OBJECTIVE

To support applied research for enhancing both indigenous and imported technology, and research on culture, norms and values as they relate to scientific and technological development.

6.3.3 STRATEGIES

- a. Promote and enhance applied research and research on culture, norms and values relating to S&T development.
- b. Encourage and support local institutions to conduct research on S&T issues.
- c. Provide adequate funds for research and financial incentives for scientific researchers.
- f. Strengthen and support training and research skills of scientific staff to ensure a key role for local scientists in application of imported technology and development of indigenous ones.
- e. Ensure that research results are applied where appropriate and commercialised where possible.
- f. Encourage and strengthen collaboration with regional and international research institutions.

6.4 INTELLECTUAL PROPERTY RIGHTS (IPR)

6.4.1 KEY ISSUES

Intellectual Property Rights (IPR) deal with the protection of inventions and artistic creations in order to afford the creator the opportunity to benefit materially from his/her creations without unfair competition. Patent documents are a very important

source of technological solutions. An intellectual property office is a vital contributor to the speed of technological and industrial development in the country. Botswana enacted an independent industrial property right legislation in 1996. On average, there has been one patent granted every two years. Even with this low average, some of the inventions have not been exploited due to lack of resources available to the inventors. There is need to educate and sensitise Batswana in the field of IPR.

6.4.2 OBJECTIVE

To facilitate and promote the stimulation of innovation through the protection and use of Intellectual Property Rights.

6.4.3 STRATEGIES

- a. Enact appropriate legislation in the protection of intellectual property rights, creativeness and innovation.
- b. Establish a fully fledged IPR office and a system that protects the rights of all to benefit materially from their inventions and artistic creations, and to undertake searches, formal and substantive examinations, grant and register patents, trademarks and copyrights.
- c. Promote intellectual activity aimed at the development of S&T.
- d. Encourage membership to regional and global organisations dealing with IPR in order to enhance efficiency and cost effectiveness of the national system.
- g. Stimulate innovation nationwide by setting up an advisory network in the use, production, protection, and commercialisation of inventions and artistic works.
- f. Incorporate aspects of the IPR law in the school curricula at the various levels of education in order to produce sufficient numbers of patent attorneys and the judiciary at the professional level and a citizenry literate in the legal rights of S&T.
- g. Facilitate the exploitation of indigenous technologies and the evaluation, acquisition and adaptation of foreign technologies for increased competitiveness.
- h. Educate and sensitise all Batswana in the matters of IPR.

6.5 SAFETY AND NATIONAL QUALITY STANDARDS

6.5.1 KEY ISSUES

Safety is fundamental in all research and development activities. Numerous hazards including accidents are generally associated with work in laboratories, in the field, and even at the community level. Quality standards are essential for rapid and sustainable industrial development of Botswana due to the small population size and the globalization of trade. Botswana depends on external markets for her products, therefore the standards to be adopted must be internationally acceptable. There are also producers supplying goods that are harmful to both the human body and the environment. These need to be regulated and controlled in order to protect the consumers and the environment. The Botswana Bureau of Standards (BOBS) has been established to deal with these issues.

6.5.2 OBJECTIVES

To promote the design, development and commercialisation of Botswana products and services to be internationally competitive by developing and enforcing Botswana standards in line with requirements by the International Organisation for Standards (ISO). To raise the quality and variety of Botswana and foreign products for local consumption and to protect local consumers from producers and suppliers selling unacceptable products.

6.5.3 STRATEGIES

- a. Establish a testing system to enable laboratories to test both raw materials and manufactured goods for domestic and foreign markets.
- b. Introduce certification systems for products and companies.
- c. Introduce accreditation systems for both laboratories and company certification bodies.
- d. Ensure national standards are developed to assist in establishing programmes for orderly evaluation, selection, acquisition and adaptation of appropriate traditional and contemporary technologies.
- e. Establish an information system on standards and quality.
- f. Establish an import control mechanism to enforce the minimum quality standards for Botswana.

- g. Train personnel from industry, research and development institutions and government departments in all matters related to standards and quality as appropriate.
- h. Ensure that all goods sold in Botswana conform to the national standards.
- i. Encourage the use of sustainable technologies, which are environmentally sound and safe to the consumers.
- j. Educate the consumers and producers in order to stimulate sustainable industrialisation based on competitiveness.

6.6 SCIENCE AND TECHNOLOGY INFORMATION, AND INFORMATION TECHNOLOGY

6.6.1 KEY ISSUES

S&T information, and information technology are essential for enhancing greater efficiency in the provision of services, productivity of existing manpower, timely decision making and international communications. Botswana has basic communication infrastructure in the form of telephone, telex, postal services fax and e-mail. These areas need further development as well as establishment of S&T reading materials in public libraries. The Telecommunications Policy, which has been formulated and adopted by the government, has paved the way for the introduction of services such as cellular telephones and private radio stations.

6.6.2 OBJECTIVE

To promote and strengthen the development of S&T information, and information technology systems, S&T literacy and data communication infrastructures.

6.6.3 STRATEGIES

- a. Develop information technology infrastructure that will foster an enabling environment for quality business.
- b. Encourage efficiency through open competition in the provision of telecommunications services.
- c. Encourage and support the development of information technology skills required to provide the maintenance and support services needed for global competitiveness of local enterprises.

- d. Promote S&T information through public and private libraries with adequate stocks of S&T reading materials.
- e. Promote high national productivity and greater efficiency through use of modern technology information systems within government and private sector.
- f. Develop national on-line database systems on the broad spectrum of the economy through a long-term S&T information needs assessment.
- h. Strengthen and promote telecommunications industry by making it more competitive through deregulation.

6.7 MEDIA AND EXTENSION SERVICES

6.7.1 KEY ISSUES

Media and extension networks provide essential linkage between providers and the end users of goods and services. The media, in particular radio and television, are an effective means to reach the majority of people in Botswana especially those who cannot read and write. The media and extension play vital roles in education and the diffusion of knowledge in the rural areas. Currently, the electronic media lack diversity and coverage. There is need to expand the media by involving other stakeholders in electronic media through awarding of licences to private radio and TV stations. The extension network of S&T needs to be developed to the level whereby it can adequately diffuse information in Botswana.

6.7.2 OBJECTIVE

To facilitate and promote the involvement of the media, extension networks, policy makers, and other stakeholders in the promotion of S&T in Botswana.

6.7.3 STRATEGIES

- a. Encourage and support efforts aimed at sensitising the public about the importance of S&T in Botswana.
- b. Encourage and support efforts to promote S&T literacy in order to facilitate its adoption and application in all the sectors of the economy.

- c. Promote and encourage the setting up of a body to use mass media in popularisation of S&T in Botswana.
- d. Establish efficient mechanisms for a speedy dissemination and application of research results.
- e. Encourage and support the publication and marketing of books, research features, journals and periodicals of S&T.
- f. Create a specialised extension network and strengthen the information units of the existing S&T institutions.
- g. Facilitate the establishment of a national television station and encourage the setting up of private stations.
- h. Develop and promote mechanisms for involving stakeholders in electronic media by awarding licences to private radio and television stations.

6.8 GENDER EQUALITY

6.8.1 KEY ISSUES

Botswana has experienced rapid socio-economic changes that are affecting the social and cultural fabric of society. These changes are dynamic and impact on the traditional activities and roles of men and women. Women and men play different, but complementary roles in the production system, thus technology will impact differently on the activities of each group. In spite of the level of economic development, the traditional gender division of labour is still predominant, and women continue to be marginalised within the society. Research has demonstrated that women contribute significantly to the various sectors of the economy. They perform 60-80% of agricultural work, and over 50% of the entrepreneurs and employees in the small scale and micro business sector are women. Therefore, the role of women in S&T is crucial for diversified economic growth and sustainable development.

6.8.2 OBJECTIVE

To empower women in all sectors of economic activity in order to ensure that the thrust of S&T impacts positively within the context of economic development, and facilitate their participation and involvement in science and technical areas.

6.8.3 STRATEGIES

- a. Introduce S&T education and training at all levels of schooling and incorporate special efforts to facilitate participation of women and girls in science and technical areas.
- b. Intensify education programmes that support the continued participation of girls in the field of S&T at the secondary and tertiary levels of schooling in order to counteract the effects of other negative factors, such as teenage pregnancies and traditional gender stereotyped attitudes.
- c. Promote women's participation in the development of S&T, and provide advice and information to women's NGOs and CBOs on the acquisition and use of technology.
- d. Provide entrepreneur training to individuals and groups of women to enhance their ability to utilise and commercialise technology.
- e. Facilitate the provision of scientific toys to children and promote the development of scientific toys and projects in all levels of the school system.
- f. Introduce specific measures in the awarding of S&T incentives in favour of women and girls.
- g. Promote the use of books, magazines, pamphlets and other materials, with visual images that reflect the equal involvement of men and women in the areas of S&T.
- i. Promote the equal participation of girls and boys in all household chores, through adult literacy and school programmes.
- j. Review and modify as may be necessary, all regulations governing the fields of S&T to ensure equal participation of girls and boys, men and women across all sections of society.
- k. Encourage the participation of women in policy making, resource allocation and implementation structures at all levels.
- l. Promote the use of role models to encourage participation of women in the field of S&T.

6.9 CO-ORDINATION OF PUBLIC FUNDED SCIENCE AND TECHNOLOGY ACTIVITIES

6.9.1 KEY ISSUES

Public funded S&T activities are scattered across sectors and institutions. They lack coordination at the national level so as to determine national priorities.

6.9.2 OBJECTIVE

To create a central co-ordinating body (National Centre for Scientific and Industrial Research) to monitor, evaluate, prioritise and recommend approval of funding for sectoral research, S&T development activities.

6.9.3 STRATEGIES

S&T activities shall be submitted to the National Council on (Research) S&T for approval. Support and approval shall be determined:

- a. on the basis of the S&T policy of the Government; by considering priority accorded to sectors and programmes;
- b. by taking into consideration their contribution to national economic development;
- c. by considering potential in promoting appropriate technology; and
- d. by considering their contribution in mitigating dependence on foreign technology.

6.10 SCIENCE AND TECHNOLOGY CO-OPERATION

6.10.1 KEY ISSUES

International co-operation in the area of S&T is essential to ensure that a competitive edge is maintained. Hence mechanisms are required for sourcing of foreign technology and it is imperative to make effective use of foreign aid and technical assistance.

6.10.2 OBJECTIVES

To enhance regional and international co-operation to keep abreast of S&T developments globally, source foreign technology and make effective use of resources.

6.10.3 STRATEGIES

- a. Participate in appropriate and beneficial S&T fora and programmes both regionally and internationally.
- b. Establish a National Academy of Science and Technology and through it gain membership of the appropriate world academies of sciences.
- c. Enter into bilateral agreements with countries that can offer ample opportunities for co-operation.

6.11 TECHNOLOGY MONITORING, ASSESSMENT, AND FORECASTING; INCLUDING TECHNOLOGY ACQUISITION AND DEVELOPMENT

6.11.1 KEY ISSUES

Monitoring and assessment are required to ensure that science, research and technology contribute to the objectives of; (a) achieving greater effort towards providing for a more S&T literate Botswana entrepreneurial community, and (b) a greater effort towards a more diversified spectrum of products and services as well as the development of a S&T culture supportive of traditional Botswana private sector initiatives. This would provide technological information on sector and non-sector categories supportive of the S&T Policy goals and objectives. It will help predict trends in relation to technology, technology transfer, economic forecasts both locally and internationally, and to find the most appropriate means to provide timely, unbiased and up-to-date technology information to the entrepreneur as well as the public sector. Periodic monitoring and assessment requires collation of information.

6.11.2 OBJECTIVE

To co-ordinate, monitor, assess, forecast and advise on issues regarding S&T, taking into account planning and processes of invention, innovation, and diffusion of S&T outputs.

6.11.3 STRATEGIES

- a. Create a national system of invention, innovation, and diffusion as a technical unit within the National Centre for Scientific and Industrial Research to:
 - Provide advice on S&T policy, developing and promoting scientific and technological infrastructure;
 - Provide advisory services as to the integration of S&T into the development process, in collaboration with Government Ministries; and
 - Evaluate and promote technology choices for private sector entities, liaising with national agencies concerned with industry on formulating evolving industrial technology policies and missions.
- b. Collaborate with representatives of the following stakeholders:
 - Research and development institutions;
 - Relevant professional bodies;
 - Relevant government Ministries, departments and parastatals;
 - Relevant private sector representatives;
 - Consumer organisations;
 - Relevant NGOs;
 - S&T service institutions; and
 - Financial institutions.
- c. Integrate the work of these organisations in light of their complementary and/or similar institutional mandates.

6.12 SOCIAL SCIENCES IN SCIENCE AND TECHNOLOGY DEVELOPMENT

6.12.1 KEY ISSUES

Social sciences and culture tend to be neglected in the S&T development process. Community responses and reactions to scientific and technological advancement are determined by cultural attitudes, values and norms. It is imperative that S&T policy recognises culture as an integral part of development, thus taking into account ethical considerations. Technologies have ethical aspects that need to be addressed. The impact and effects of technologies and effects on culture are therefore, important considerations.

6.12.2 OBJECTIVE

To undertake social science research in the S&T development process, to reinforce S&T culture and to ensure that the development and absorption of technology are culture-friendly for socio-economic benefit.

6.12.3 STRATEGIES

- a. Support and strengthen social science research activities in the area of technology needs identification and assessment.
- d. Involve social scientists in research and development to ensure integration and absorption of S&T into the communities.

6.13 ORGANISATIONAL STRUCTURE AND MANAGEMENT OF SCIENCE AND TECHNOLOGY

6.13.1 KEY ISSUES

S&T activities in Botswana are scattered and as such lack streamlining and coordination. There is no national body that centrally plans, manages and co-ordinates research, S&T activities. At the lower level there are government and parastatal institutions in various ministries responsible for different activities and operating independently. There is lack of an organizational structure for S&T. A unified national body for S&T would include adequate structure, institutional arrangements, management system, personnel and committees in place to provide supervision and accountability. The activities and functions of the existing R & D institutions should be harmonised as a matter of urgency.

6.13.2 OBJECTIVE

To establish a functional organisational structure for the promotion, co-ordination, management, development and application of S&T to stimulate, facilitate and support institutional arrangements and management for technology-led development.

6.13.3 MANAGEMENT

The organisational structure (see Appendix) is a reflection of the goals, objectives, strategies and functions of this Policy. The Policy proposes establishment of a National Commission for Science and Technology (the Commission), a National Council on Research, Science and Technology (the Council), and the National Centre for Scientific and Industrial Research (NCSIR).

A) NATIONAL COMMISSION FOR SCIENCE AND TECHNOLOGY

This body is to be the supreme advisory body to Government on S&T, shall chart policy directions in the area of S&T in Botswana. The composition of the Commission shall be such that it is perceived to have authority as an advisory body and to command the respect of all existing and potential stakeholders in the development of the country.

Functions

The Commission shall meet at least once a year to:

1. Advise on priorities in S&T including financing.
2. Examine ways of improving 'smart partnership' between government, the business sector, and the scientific community.
3. Consider major strategic changes recommended by the Council.
4. Articulate and discuss any concerns about S&T at the political and business level.

Structure/Composition

Chairperson:

H. E. the President

Membership:

First-rank policy/decision-makers from the public, private, scientific and parastatal sectors (corporate leaders and business magnates, chief executive officers, academics, chiefs etc).

Secretariat:

To be provided by the NCSIR.

B) NATIONAL COUNCIL ON RESEARCH, SCIENCE AND TECHNOLOGY

The proposed National Council on Research, S&T shall act as an umbrella body for all academic and professional associations with a view to promote research, S&T activities, and serve as principal coordinator for this area. The Council shall be endowed with powers, responsibilities and a mandate to provide leadership in S&T in Botswana. It shall be responsible to Government for the overall management of S&T activities in the country and for the oversight of efficient and effective development and utilisation of the necessary human, fiscal, and physical resources. It shall also act in an advisory capacity to the Commission and, therefore, to the Government, reporting to the Minister of Finance and Development Planning.

Functions

1. To establish priorities in S&T and economic indicators.
2. To monitor, evaluate and review the national S&T mission, policy, objectives, activities in order to ensure pro-active and dynamic impact upon the developmental strategies and plans of Botswana.
3. To oversee the planning, programming, and budgeting of S&T activities through;
 - a. initiation and oversight of a policy and strategic plan for human resource development and management in S&T.
 - b. oversight of the mobilisation and allocation of financial and human resources to the various research and S&T institutions.
 - c. development of an effective, efficient, and innovative system for the management of S&T and the management of S&T information systems in Botswana.
4. To facilitate the realisation of Botswana's S&T mission by monitoring and co-ordinating the development and implementation of all S&T activities.
5. To direct the promotion of the application, transfer, and assessment of S&T, developed in Botswana and elsewhere, for the benefit of both the public and private sectors in accordance with national needs and aspirations;
6. To promote the popularisation of S&T at all levels of society, especially among women and young people;

7. To advise Government, through the National Commission, on:
 - a. the priorities for S&T in Botswana;
 - b. human resource development in S&T;
 - c. means of promoting private sector investment in, and commercialisation of, S&T research results;
 - d. the nature and extent of Botswana's participation in regional and international collaboration in S&T;
8. Publication of annual reports to Government on the S&T programmes and activities of the country.
9. To administer a research fund for special research projects.

Structure/Composition

Chairperson:

The chairperson shall be an appointee of the Government (non-executive Chairperson).

Membership:

- Representatives of Ministries associated with science, technology and research;
- Heads of institutions, professional bodies, and private sector organisations which are active in S&T research or its applications;
- Leading representatives of economic and commercial sectors with the potential to utilise S&T results (e.g. agriculture, mining, manufacturing);
- Outstanding individuals appointed in their own right on the basis of their contributions in the of field of S&T;
- Representatives of the sectoral sub-sector committees which will be set up.

Reports to:

Minister of Finance and Development Planning.

Secretariat:

The Secretariat will be housed in the NCSIR and will serve the Commission, the Council, and the NCSIR itself.

C) NATIONAL CENTRE FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

The NCSIR will be an institution formed by the co-ordination, affiliation or rationalisation of existing research and S&T institutions. Principally, it shall embrace the current research and development functions of the Botswana Technology Centre, the Bureau of Standards and Quality Assurance, the Food Technology Research Service, the Rural Industries Promotion Company, and the Rural Industries Innovation Centre.

While strongly oriented towards promotion of industrial development, the NCSIR shall also draw upon the research expertise of establishments such as the University of Botswana, the Botswana College of Agriculture, the Botswana Institute for Development Policy Analysis and the Agricultural Research Department.

Functions

1. To develop human resources to implement the S&T policy.
2. To develop and build S&T infrastructure.
3. To promote the adaptation, dissemination and diffusion of technology.
4. To promote and support the development and the transfer of appropriate new technologies to the rural areas.
5. To promote the utilisation of Botswana technology abroad and, within Botswana, the horizontal transfer of technology from industry to industry.
6. To identify, evaluate, promote, and facilitate areas of comparative advantage in S&T.
7. To create an efficient system for the protection of Intellectual and Industrial Property Rights.
8. To promote private sector participation and financing in S&T activities.
9. To encourage and support NGOs and CBOs to enhance community participation in S&T activities.

10. To create centres of excellence, and science parks incorporating business incubators in strategic S&T areas.
11. To promote and support national and international co-operation and collaboration in S&T activities.
12. To promote the development of industrialisation through S&T applications and integrated support in business planning and productivity.
13. To administer all research grants provided by the Government, for all areas of research including the arts and social sciences.
14. To appoint specialist committees to advise on the awarding of grants.

ORGANISATIONAL STRUCTURE FOR SCIENCE AND TECHNOLOGY IN BOTSWANA

