## FOREWORD

The current state of affairs in the world indicates that science and technology play a pivotal role in socio-economic development processes. Hunger and disease have, to a large extent, been contained in the developed economies of North America and Europe due, mainly, to significant advances in agricultural and medical technologies respectively. Globalization, and its impact on national economies is fueled by an avalanche of breakthroughs in information and communication technologies. It is, therefore, apparent that if Malawi is to take her rightful place in the community of nations, science and technology and its integration in national socio-economic development processes must be accorded higher priority.

The Government of the Republic of Malawi recognized the important role of research, science and technology in national socio-economic development since independence. As early as 1974, the Government took action to establish national institutional structures that support the development and application of science and technology including the establishment of the National Research Council of Malawi as the focal point for science and technology. Using a combination of the untiring efforts of local scientists and technologists, considerable international cooperation and strong Government support, Malawi has, over the years, developed a wide range of crop varieties which have contributed significantly towards the improvement of productivity in the agricultural sector. The Universities have taken the lead in the development and supply of human resources in various fields of science and technology. In 1998, the Government endorsed the VISION 2020 document which recognizes the need to adopt a science and technology-led development strategy. In addition, the Malawi Poverty Reduction Strategy Paper recognizes S&T as a crosscutting issue for the four pillars of socio-economic development planning.

Despite these efforts, the national system for science and technology continues to suffer major weaknesses and constraints as reflected by the general lack of integration of science and technology in national development planning processes, ineffective policy instruments, poor coordination and inadequate funding for science and technology. Our prevailing science and technology indicators further show that Malawi is far behind in the development and application of science and technology compared with the recommended targets for African countries. In the area of science and technology human resources for example, Malawi has, as of now, 27.5 research and development scientists per million of population compared with the recommended figure of 200 for African countries as at 1980. Our economic indicators are equally disturbing since statistics presented in the Human Development Report for 2001 show that of the total export trade, 95% was, as at 1990, in primary merchandise and only 1% of our manufactured exports were in the high-technology fields.

International experience has shown that science and technology are tools, which nations can use to address major socio-economic development problems. Countries of South East Asia, who at the time of our political independence were at par with us in terms of development, have economies that have benefited extensively from the determination of their governments to integrate science and technology in national development planning. In contrast, Malawi continues to face a number of socio-economic challenges towards which science and technology can play a role. Key among the challenges are in agriculture, health, education and the environment. In agriculture, for example, science and technology could, in addition to improving agricultural productivity, be used to promote the development of agro-based industries which would produce value-added goods for both domestic and foreign trade in manufactured products. In the environment sector, the development and application of renewable energy technologies would, on the other hand, contribute significantly towards mitigation efforts against environmental degradation by providing alternatives to wood-fuel, the use of which is a significant cause of deforestation.

For Malawi to make significant strides in integrating science and technology in national socio-economic development, there is need for renewed, strong and sustained commitment towards the development and application of science and technology by all stakeholders in the country. We must mobilize our scientists, technologists and engineers on the one hand and policy makers, industrialists, farmers and the general public on the other, to interact effectively. Effective interplay between scientific and technological systems and socio-political and socio-economic systems will promote understanding between all actors and, thereby, enhance and accelerate the integration of science and technology in national development. The role of the international community in this process cannot be over-emphasized especially in view of the resource constraints that Malawi faces. The New Partnership for African Development (NEPAD), to which Malawi subscribes, offers new insights and encouragement to our efforts to mobilize resources for the development and application of science and technology in a manner that addresses our most pressing socio-economic development challenges. Similarly, Malawi should utilize the resources made available under the Highly Indebted Poor Countries Initiative in her quest to develop its capabilities in science and technology. Advantage will, to this end, be taken by Government to use the guidelines issued by UNESCO with respect to debt relief for science and technology to enable science and technology to make an effective contribution to my Government's poverty reduction strategies. The Malawi Government, therefore, welcomes cooperation of the international community in establishing and strengthening our national infrastructure and capabilities in science and technology.

In view of the foregoing, my Government is convinced of the need to lay a new and solid foundation for enhanced and speedy integration of science and technology into national development planning. The development and effective utilization of science and technology is, essentially, a national issue requiring political commitment. In sanctioning the development of, and approving this national science and technology policy, my Government is underscoring its political will for, and commitment to, science and technology. Under this policy, the infrastructure for science and technology will, at all the four levels of planning and decision-making; promotional, financing and coordination; research performance, and scientific and technological services be strengthened. At the planning and decision-making level, Government will establish a National Commission for Science and Technology as the apex body responsible for science and technology in Malawi. Efforts will be made to improve funding allocated to science and technology and to that end a Science and Technology Fund will be established as a means of enhancing partnerships between the public and private sectors in the funding of research and development. The development of science and technology human resources will receive priority attention as well as the infra-structural and institutional resources available for the performance of research and development and the provision of scientific and technological services. Special attention will be paid to the implementation of technology dissemination and transfer programmes in order to enhance the impact of science and technology on my Government's poverty reduction programmes.

I, therefore, call upon all Malawians to support the National Science and Technology Policy and actively assist in its implementation.

Dr Bakili Muluzi
**PRESIDENT OF THE REPUBLIC OF MALAWI**

## ACKNOWLEDGEMENT

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I wish also to acknowledge the contributions and support of the scientific community in Malawi towards the development of the policy. Finally, the services of the National Research Council of Malawi Secretariat deserve special mention for making the process of developing this policy a success.

Dr Chrissie N Mwiyeriwa

**SECRETARY FOR NATIONAL RESEARCH COUNCIL OF MALAWI**

## PREFACE

The development of the National Science and Technology Policy has been highly consultative. In December 1996, the National Research Council of Malawi held a symposium on Science and Technology that took stock of the state of science and technology in Malawi. One of the recommendations of the symposium was the need for a new, broad-based National Science and Technology Policy. The symposium acknowledged further that, although the 1991 Science and Technology Policy document was adopted by Government, its implementation was not effective. This was due to the pluralistic approach in the management of science and technology, the lack of integration of the policy into the overall development plans of Government, the lack of human, financial and material resources and the lack of necessary supporting legislation.

With the support of the United Nations Development Programme, the National Research Council of Malawi established a task force whose mandate was to outline terms of reference for a consultancy to develop the new National Science and Technology Policy. The task force held a weeklong meeting from 10th to 14th November 1997 at which the terms of reference that guided the development of this policy document were outlined.

The United Nations Educational, Scientific and Cultural Organisation, being the focal point for scientific and technological issues in the United Nations System lent its support to the process of developing this policy document through technical initiatives to identify and contract consultants to develop the framework of the National Science and Technology Policy. The consultants undertook their work during the period 1st May-31st July 1998 and issued a draft National Science and Technology Policy in December 1998. The National Research Council of Malawi established a special taskforce that reviewed the draft policy document and made general and specific comments that guided the preparation of the final draft policy that was presented to a stakeholders' workshop for a review and discussion. The final document has therefore taken into account the views that emerged from both the stakeholders' workshop that took place from 2nd –4th June 1999 and a subsequent high-level consultative meeting that involved Principal Secretaries and Chief Executives of S&T related institutions held on 31st May 2001 at the Malawi Institute of Management.

The policy sets out guiding principles, strategies, institutional and legal framework for effective interface with sectoral policies and the development and application of science and technology for poverty reduction. The policy is backed up by a bill to facilitate its implementation.

## LIST OF ACRONYMS

| | |
|---|---|
| AASToM | Association for the Advancement of Science and Technology in Malawi |
| APRU | Agriculture Policy Research Unit |
| ARET | Agricultural Research and Extension Trust |
| ASC | Agricultural Sciences Committee |
| CASTAFRICA | Conference of Cabinet Ministers responsible for the Application of Science and Technology to Development in Africa |
| CERT | Centre for Education Research and Training |
| CHSU | Community Health Sciences Unit |
| CSIRD | Committee for Scientific and Industrial Research and Development |
| CSR | Centre for Social Research |
| DAHI | Department of Animal Health and Industry |
| DARTS | Department of Agricultural Research and Technical Services |
| EIA | Environmental Impact Assessment |
| GDP | Gross Domestic Product |
| GNP | Gross National Product |
| GRBC | Genetic Resources and Biotechnology Committee |
| HSRC | Health Sciences Research Committee |
| HIPC | Highly Indebted Poor Countries |
| ICLARM | International Centre for Living Aquatic Resources Management |
| ICRAF | International Centre for Research in Agro-Forestry |
| ICRISAT | International Crop Research Institute for Semi-Arid Tropics |
| IEC | Information, Education and Communication |
| ISI | Institute for Scientific Information |
| LPPC | Legal and Patenting Policies Committee |
| MASTA | Malawi Award for Scientific and Technological Achievement |
| MBS | Malawi Bureau of Standards |
| MIRTDC | Malawi Industrial Research and Technology Development Centre |
| MITI | Ministry of International Trade and Industry, Japan |
| NADICC | National Documentation and Information Coordinating Committee |
| NCST | National Commission for Science and Technology |
| NEPAD | New Partnership for African Development |
| NHBGM | National Herbarium and Botanic Gardens of Malawi |
| NGOs | Non-Governmental Organizations |
| NRCM | National Research Council of Malawi |
| OECD | Organisation for Economic Cooperation and Development |
| OPC | Office of the President and Cabinet |
| R&D | Research and Development |
| SADC | Southern Africa Development Community |
| SCC | Science Competitions Committee |
| S&T | Science and Technology |
| TEVETA | Technical Entrepreneurial and Vocational Education and Training Authority |
| TRIPS | Trade-Related Aspects of Intellectual Property Rights |
| TRF | Tea Research Foundation |
| UNDP | United Nations Development Programme |
| UNESCO | United Nations Education, Scientific and Cultural Organisation |
| WTO | World Trade Organisation. |

# 1. BACKGROUND AND HISTORICAL CONTEXT

## 1.1 *Historical Background*

The importance of science and technology (S&T) was recognised by the Malawi Government as early as the 1970s when it established the National Research Council of Malawi (NRCM) in 1974. The decision to establish the NRCM was, partly prompted by Malawi's participation at the Conference of Cabinet Ministers responsible for the Application of Science and Technology to Development in Africa (CASTAFRICA I) held in Dakar, Senegal from 21 to 30 January, 1974. At that conference it was observed that Research and Development (R&D) and scientific and technological services are a source of momentum for development and that to turn them into best account, each country should possess its own scientific and technological base capable of generating and accelerating this momentum. It was further noted at CASTAFRICA I that any nation, however underdeveloped or small in population, must have a national science and technology policy.

While the establishment of the NRCM may be linked to the results of CASTAFRICA I, Malawi never prepared a coherent national science and technology policy until 1990 when the first National S&T Policy was developed and adopted in 1991. In undertaking this exercise, Malawi sought to address the problems that are commonly encountered in the development of science and technology in Africa identified by CASTAFRICA II held at Arusha, Tanzania from 6 to 15 July, 1987.

The 1991 National Science and Technology Policy outlined broad strategies to address these problems. It is widely accepted, however, that the policy has not been implemented fully and some of the reasons that have contributed to this situation are:

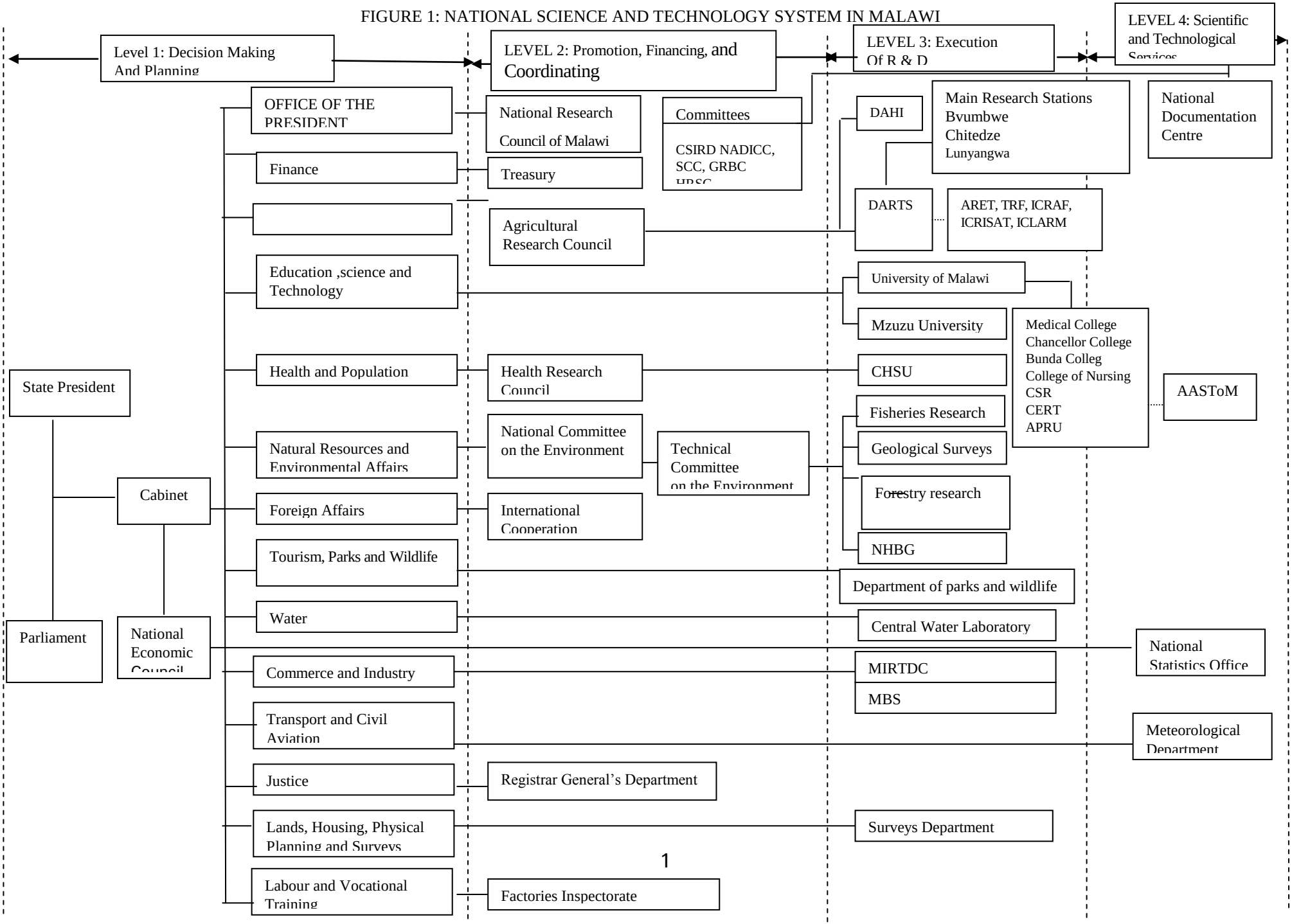
- *The country's pluralistic approach in the management of science and technology;*
- *Lack of integration of the policy in overall development plans of government;*
- *Lack of human, financial and material resources; and*
- *Lack of necessary supporting legislation*.

The structure of the S&T system in the country appears in Figure 1 where the pluralistic approach in the management of S&T becomes evident. Each decision-making body decides the value of establishing research capacity, the issues to be addressed, the degree of consultation to be followed, and the degree of funding without the benefit of a coordinating mechanism. The NRCM was therefore established to play such a coordinating and developmental role. The mandate to "promote and coordinate the development and application of research" by the NRCM was affected by two issues that are always present in all scientific systems in early stages of development.

The first and probably most important obstacle is the inability to coordinate and direct research without the power to influence budgetary considerations. The issue is not unique to NRCM. The National Research Council of Canada in the 1940s and 1950s battled with the same issue and the resolution was the establishment of its own research performing institutions and the abandoning of its coordination mission. The second obstacle has been the instability and uncertainty surrounding the institutional aspects of NRCM. The NRCM was established with a Secretariat in the Office of the President and Cabinet (OPC). Later, NRCM's activities were merged with those of the Environmental Unit from the then Ministry of Forestry and Natural Resources in 1988. In 1991, the Secretariat was elevated to a full Department. In September 1994, the Government elevated the Department to a full Ministry called the Ministry of Research and Environmental Affairs. The

NRCM was reconstituted in July 1997 following the abolition of the Ministry of Research and Environmental Affairs and reverted back to OPC.

FIGURE 1: NATIONAL SCIENCE AND TECHNOLOGY SYSTEM IN MALAWI



The lack of a body with the power and responsibility to develop and coordinate the country's scientific and technological system is reflected in both the inputs and outputs of the S&T system. In S&T manpower development, for example, Malawi is lagging behind its neighbouring countries. Statistics show that Malawi, when compared with Zimbabwe and Mauritius, produces one-tenth of the number of third level students per 100,000 inhabitants. Statistics also show that the scientific enterprise in Malawi contributes very little to global scientific publications and, when publications are issued, medical research appears to dominate the other sectors. Also significant is the observation that the majority of these research outputs are dependent on foreign collaborators. Of the 224 articles that were published during the 1995 and 1996 with a Malawi address, 153 had at least one collaborator from abroad. This means that 70% of the Malawi research output is of a collaborative nature. For comparison, only 19% of the South African output is produced in collaboration with foreign scientists and the international average is in the region of 20%. This dependence is further verified by the finding that research performers are dependent for up to 70-80% of their funding on international donors. As a consequence, Malawi is extremely weak in scientific and technological development and this affects many aspects of national socio-economic development.

It becomes obvious therefore that the lack of coordinating and developmental mechanism for the country's scientific and technological system has resulted in a very small activity, over-dependent on foreign collaboration and over-focusing on a limited number of disciplines. Malawi's current socio-economic status, exacerbated by low level of R&D and technology application, is one of the lowest among developing countries. It is essential that Malawi move fast to intensify the development and application of S&T without which real economic progress would not be realized.

## 1.2 *Integration of Science and Technology into National Development*

The importance of S&T for growth and employment creation in a country is well established in the economic literature. The pervasiveness of science and technology is fundamentally changing the understanding of economic growth and international trade. Based on findings from work in this field, scholars are rewriting some of the fundamental assumptions of classical and neoclassical economics originally based on trading in simple and technologically unchanged commodities. Whiled discussing science, education and development in sub-Saharan Africa the World Bank assets that the case for developing an indigenous scientific establishment rests on many fronts:

1.2.1 There is undoubtedly a minimum threshold of scientific knowledge required for the proficient performance of professionals in the economy. This threshold is rising continuously with the expansion of scientific knowledge and the improvement of technology. To impart this knowledge it is necessary to have a dynamic teaching scientific community that is able to relate to progress in science.

1.2.2 While technological knowledge can be acquired from abroad, facilitating its transfer, requires the availability of individuals who can understand, assimilate, and if necessary transform and adapt this knowledge to local conditions. It is, therefore, necessary to have a minimum quantum of people with a scientific background.

1.2.3. Science, by its questioning nature, influences the way people look at the universe. A modern technological society requires the ability to perform skillfully and a positive

attitude to modernization. This positive attitude towards science can be fostered in the population at large by a local scientific effort.

1.2.4 To keep the morale of those engaged in scientific teaching, be it for developing technology, skills, or attitudes, it is crucial to develop and maintain scientific activities and link the local scientists to the international scientific community.

The case of Japan illustrates well the strategic role of government in shaping industrial and technology policies and moving away from an obvious solution. After World War II, the Japanese government rejected a development strategy based on the short-term comparative advantage offered by low labour costs. Instead, led by the Ministry of International Trade and Industry (MITI) and the Ministry of Finance, government formulated a strategy involving the acquisition, initially from abroad, of technologies with significant long-term world market potential, and progressively adapting and improving such technologies to meet new market conditions. The technological weaknesses of Japanese industry were carefully identified, as was the lack of domestic capability to develop internationally competitive technology. Government set about monitoring technological developments overseas, with a view to buying those judged to have the greatest economic potential for Japan. The chief factor for Japan's success was the great attention paid to research and development by both government and the private sector.

Apart from the important issue of economic growth and development there are theoretical issues that direct governments to get involved in the field of research and development. Traditionally, governments' interference with the market has been justified as a remedy for the existence of public goods, of externalities, increasing returns to scale and informational asymmetries A free market alone will not produce an optimal result thereby justifying the need for the state to intervene.

Government intervention related to returns to scale refers to the investments that need to be made at the outset for the establishment of a new industry, industrial sector or facility for which the costs may be prohibitive from the perspective of any one firm or involve high-risk long-term return potential. Informational asymmetries, for which Government intervention may also be justified, arise in a number of circumstances. Debt and equity finance create informational asymmetries between shareholders and managers and between lenders and borrowers. For example, because of the difficulty to monitor intangible investments (e.g. R&D intensive companies), such investments may not be able to secure debt finance. Government should find a way to accommodate finance if these types of investments are required.

In conclusion, therefore, the advent of competitiveness in a global economy sets the background for a different and additional role for governments. Governments in this context have the responsibility to promote and protect the interests of their industries. Game theory provides a natural way to think about the interactions of nations. As governments from competing countries promote their interests through the introduction of certain policy instruments, other countries have to follow suit in order to maintain their relative competitiveness. Issues of siting R&D facilities by multinationals, of brain drain, promotion of particular cultural values and of adoption of particular methods and techniques can be considered in this context. The issue of R&D is probably the only one that qualifies for government support across all five counts. Governments, independently of their philosophical predisposition, enter the marketplace in order to promote and support R&D activities. It is, therefore, of utmost importance that for Malawi to make progress in her quest for rapid socio-economic development, promotion of the role of S&T

becomes an absolute prerequisite. The Government and private sector should, as a matter of urgency, integrate S&T in their socio-economic development planning.

# 2. GUIDING PRINCIPLES FOR SCIENCE AND TECHNOLOGY DEVELOPMENT AND APLLICATION

## 2.1 *Introduction*

Malawi's development position is a clear case of "rich but poor". Although Malawi is rich in natural resources, the majority of its population lives in abject poverty due, largely, to its inability to process and utilize its natural resources. Malawi has, under this National Science and Technology Policy, set for herself principles through which the country will discipline her development by utilizing her human resources. This policy has put in place strategies that will enable the country achieve a technology-based development in much the same way the newly developed countries in Asia have been able to achieve. The promulgation of this policy underscores the important role Malawi attaches to the development and application of S&T in national socio-economic development. It is also in recognition of the fact that the developed countries maintain their leadership positions in socio-economic development mainly due to their strength in scientific and technological capabilities. Such countries have used these capabilities to provide for better quality of life for their people. The developing countries on the other hand are poor mainly due to low productivity caused largely by the low scientific and technological capabilities. This, therefore, underscores the need for a science and technology policy to which Malawi is committed politically, morally and financially.

## 2.2 *Guiding Principles*

The following principles shall guide the Malawi nation in its quest to develop its full scientific and technological potential:

### 2.2.1 *Assurance of Political Commitment to Science and Technology*

The development and effective utilization of science and technology is essentially a national issue that requires political commitment. The call for political commitment to science and technology for development is one of the key and persistent problem areas addressed by the international financial institutions and the donor community from time to time. The National Commission for Science and Technology to be established under this policy will therefore ensure that, the political establishment is, aware of the role of science and technology in socio-economic development with the view of enhancing commitment to, and provision of adequate resources for the development and application of science and technology.

### 2.2.2 *Integration of Science and Technology into the National Development Planning*

Science and technology issues are not explicitly integrated into national development planning models in Malawi. Since independence in 1964, economic development planning has emphasized capital formation without paying special attention to the development of a minimum national capability in science and technology. Consequently, Malawi's capability in science and technology, measured against standard criteria for assessing national capabilities in science and technology, is weak. The weakness of the national S&T system; the absence of institutional mechanisms for forecasting and identifying emerging issues and problems with a view to realistically appraising social goals and societal needs to which science and technology is expected to contribute; and the general low level of national S&T awareness have all conspired to weaken the capacity of Malawi to integrate S&T in national economic and social development planning.

2.2.3 *Maximization of Productivity through the Application of Science and Technology*

Productivity improvement has taken centre stage in the priority settings of African leaders. In many of their fora, they have come to realize that creation of wealth is not only highly dependent upon the capacity of a nation to maximize productivity through effective management, but also that the role of scientific and technological development is fundamental and highly instrumental. Malawi will not be an exception in this regard since productivity is still low in most sectors of the economy. Government will, therefore, provide support to productivity improvement programmes in both the public and private sectors.

2.2.4 *Application of Science and Technology to Promote International Competitiveness*

While technologies are being continuously produced in the industrialized nations in order to meet increasing demands and achieve a competitive edge on the international market, Malawi, like most of Africa, seems to be satisfied with an economy that is based on the export of primary goods. These goods require low technological inputs and are sold at prices largely controlled by the developed nations. Goods with high technological inputs have high value added and are, consequently, sold at higher prices. Malawi will encourage the application of science and technology in order to enhance the international competitiveness of her goods and services.

2.2.5 *Creation of a Conducive Policy Environment for the Advancement of Science and Technology*

The political establishment in Malawi recognizes the need for an enabling environment for the development and effective utilization of science and technology. Nevertheless, the country still experiences many problems in the development and effective utilization of science and technology. The major problems it faces include lack of a well-developed industrial environment and lack of well-defined policies and plans for national science and technology development. The capacity of national institutions to undertake scientific and technological research and development in the country is inadequate. The country's fiscal, financial, institutional and statutory incentives are insufficient to promote the participation of the private sector in technological development. At the same time, allocations for research and development from public resources fall below the average for countries at the same level of development. Malawi, therefore, requires a conducive policy environment for the advancement of science and technology.

2.2.6 *Investment in and Development and Retention of Science and Technology Human Resources*

The human resources for science and technology represent the most precious resource available to the nation for the development and application of science and technology in a manner that supports socio-economic development. It is, therefore, in the interest of Government to ensure the continuous development of this resource through education and training at all levels. The retention of the already available resources will be an even more important strategy and this will be realized through the creation of a conducive environment for S&T human resources to remain in their employment in Malawi. This will include, but not limited to, the provision of adequate remuneration and other incentives; and facilities for the development and application of science and technology.

2.2.7 *Application of Science and Technology to Promote Sustainable Socio-economic Development*

Resources used today are borrowed from future generations and must, at all times, be used in

a sustainable manner. To this end, Malawi will, through this National Science and Technology Policy, promote sustainable socio-economic development. This will entail, among other actions, adhering to the sound management of natural resources and the environment; ensuring that all sectors of the economy optimize the use of environmentally friendly technologies; and undertaking mitigation measures against adverse environmental impacts.

2.2.8 *Promotion of Science and Technology Culture among the Civil Society*

The Malawi culture, like elsewhere in Africa, is dominated by superstition, traditional beliefs and ideas some of which retard developemnt. Malawi will, therefore, promote a culture that accepts and supports the development and application of science and technology in national socio-economic development. This requires the involvement of the planning and decision-making level of the national S&T system in order to ensure that society increases its level of awareness and appreciation of the benefits from S&T.

# 3. POLICY OBJECTIVES AND CROSS CUTTING STRATEGIES

## 3.1 *Policy Goal*

The overall goal of the National Science and Technology Policy is to attain sustainable socio-economic development through the development and application of science and technology in order to improve the standard and quality of life of Malawians.

## 3.2 *General Policy Objectives*

The general policy objectives that will facilitate the achievement of the overall goal are to:

3.2.1 Establish and strengthen national capacity to research, evaluate, select, acquire, adapt, develop, generate, apply, and disseminate technologies;

3.2.2 Develop and raise the national productive capacity and improve competitiveness through the efficient application of technologies;

3.2.3 Promote and develop traditional, endogenous, new and innovative technologies; and

3.2.4 Create knowledge and S&T awareness to improve and develop the scientific and technological culture of Malawians.

## 3.3 *Specific Policy Objectives*

Within the context of the guiding principles; overall policy goal; and the general policy objectives, the specific science and technology objectives shall be to:

3.3.1 Establish a National Commission for Science and Technology as the apex body responsible for the effective management and coordination of an efficient and development-oriented S&T policy and strategy;

3.3.2 Build national capacity for integrating S&T into national development programme planning and implementation;

3.3.3 Improve the allocation and availability of financial, human and physical resources to S&T institutions;

3.3.4 Enhance multidisciplinary R&D programmes through the establishment and strengthening of the multidisciplinary research-oriented R&D institutions and programmes;

3.3.5 Strengthen S&T education at all levels;

3.3.6 Promote sustainable human development through the sound management of the environment;

3.3.7 Promote S&T culture;

3.3.8 Promote the role of information and communication technologies for the development of an information-based society;

3.3.9 Promote the development and application of S&T for economic growth and diversification, competitiveness and employment creation; and

3.3.10 Promote the participation of all Malawians in the development and application of S&T with special emphasis on women, youth and other special interest groups.

### 3.4 *Cross Cutting Strategies*

#### 3.4.1 *Institutional Development*

The institutionalization of science and technology has been a problem in Malawi. Currently, however, the Office of the President and Cabinet is, through the National Research Council of Malawi, at the apex of the national institutional structure for science and technology. The National Research Council of Malawi is, according to its constitution, required to provide science and technology advice to Government on all matters relating to scientific research and technological development. This constitution has a weak legal basis. Consequently the Science and Technology advisory function will, under this policy, have a strong legal basis and be based in an executive capacity in the Office of the President and Cabinet. This will constitute a significant restructuring of the science and technology institutional structure in order to strengthen its capacity and will be achieved through the establishment of a National Commission for Science and Technology by legislation. Although R&D institutions will remain under sectoral ministries, they shall have dual reporting responsibilities to their line ministries/departments and the Commission.

#### 3.4.2 *Science and Technology Human Resources Development*

Statistics for S&T human resources in Malawi reveal a low stock of S&T personnel at an estimated figure of 42 R&D professionals per million of population in 1991. This is against the recommended minimum target for African countries of 200 per million of population by the year 1980. Malawi, therefore, needs to make significant strides in improving her stock of S&T human resources. There is a wide range of initiatives already in place to address the shortfall in technical manpower including the re-organisation and strengthening of technical, entrepreneurial and vocational education and training. To this end, Government has adopted a Technical, Vocational, Entrepreneurial Education and Training Policy. In order to achieve these objectives, the following strategies will be adopted:-

3.4.2.1 Strengthen university education in science and technology and increase and diversify post-graduate training programmes;

3.4.2.2 Ensure that the universities offer postgraduate studies leading to MScs and PhDs on an on-going basis;

3.4.2.3 Create institutions constituting an inter-disciplinary bridge between different faculties;

3.4.2.4 Promote the involvement of professional institutions in the training of S&T human resources while ensuring gender equity;

3.4.2.5 Promote an integrated, demand-driven, competency based modular technical, entrepreneurial and vocational education and training system;

3.4.2.6 Monitor gaps between supply of and demand for technically skilled human resources.

3.4.2.7 Ensure the retention of S&T human resources in Malawi; and

3.4.2.8 Undertake national surveys of scientific and technological human resources on regular intervals in order to establish the national stock as a basis for developing human resources in all S&T fields.

### 3.4.3 *Technology Development and Transfer*

A strategy for technology development and transfer in Malawi will recognize the fact that most of the technology required for national socio-economic development is available in the public domain and may be purchased or acquired through training and other modes of technology transfer. It must also note that Malawi cannot develop without creating an autonomous capacity for the endogenous development and application of technology for socio-economic development. A viable strategy for technology development and transfer will, therefore, involve the designation of a national focal point for technology assessment, monitoring and forecasting of foreign technology in order to promote selective development of endogenous technology. This is essentially the classical make-some-buy-some strategy for the development and transfer of technology and the national focal point will be required to adopt this strategy in its operations.

The specific strategies for the implementation of the make-some-buy-some strategy will be taking action to:

3.4.3.1 Assess Malawi's needs and capabilities based on its S&T state- of- the- art and national resource endowment (human, material and institutional) and integrate specific S&T components into socio-economic development planning;

3.4.3.2 Monitor imported technology by establishing national capability to screen technology agreements, search and select imported technology, negotiate, bargain and acquire the technology; adapt the technology; and assimilate and diffuse the technology; and

3.4.3.3 Foster selective development of endogenous scientific and technological capacity in order to undertake or promote the assessment of S&T needs and their prioritization;

3.4.3.4 Promote innovation at the firm level including development of indigenous S&T and introduction of new products and processes and encourage the conduct of R&D and commercialization of the R&D results at the enterprise level;

3.4.3.5 Promote S&T activities in such areas as design and manufacturing, engineering services; and diffusion of indigenous technologies; and

3.4.3.6 Provide adequate S&T services such as information, standardization and certification, quality management and venture capital financing.

### 3.4.4 *Popularization and Utilisation of Science and Technology*

Science and technology institutions in Malawi have in the past taken various initiatives to promote and popularize S&T. The programmes include the mounting of S&T exhibitions at such occasions as the Scientific Revival Day of Africa and African Industrialization Day. The media has made some contributions towards educating the general population on the role of science and technology in development and this will be encouraged. In order to further popularize and promote utilisation of S&T, research and development institutions in

Malawi will focus on both mission-oriented and on discipline-oriented R&D. Mission-oriented research focuses on useful science and on ensuring that the results of R&D efforts improve the quality of life of the society in both general and specific terms. For this to be achieved it will be necessary for R&D efforts to be based on demand rather than supply. This is where society, represented by Government, takes a leading role by identifying its needs which R&D should endeavour to meet. To this end Government and industry will promote and support contract research programmes that address identified needs. Contract research programmes put emphasis on the interaction between the internal system of R&D institutions and the external systems, represented by society, politicians; and the economy in general. In addition, the policy will:

3.4.4.1 Promote increased coverage by the popular media of R&D and S&T activities in Malawi;

3.4.4.2 Encourage local scientists and technologists to publish results of their research work in local journals whose publication would be supported by Government;

3.4.4.3 Establish within the context of the Malawi Business Council or other appropriate mechanisms, a National S&T Colloquium which will be presided over by the State President or Vice President; and

3.4.4.4 Strengthen S&T programmes in the education system

**3.4.5** ***Extension, Diffusion and Commercialization of Technologies***

Technology extension services aim at transferring best practices to end-users at a fee or ex-gratia. Recent developments in Malawi point towards the desire by Government to turn research institutions into corporate entities. This will affect the ability of R&D institutions to provide technology extension services which, under the new environment, would have to be paid for by the end-users. Technology is said to have diffused when it is used in production environments similar to that for which it was originally intended. If the technology was imported from abroad, it is considered diffused if local skilled personnel are capable of operating, maintaining and repairing the technology. The process of commercialization of technology consists of a multiplicity of steps covering the areas of idea generation, experimental R&D, technology generation and development, prototyping and technology marketing. R&D personnel are not well equipped to undertake some of these activities thereby requiring the involvement of other players in the process.

In order to promote the extension, diffusion and commercialization of technology, the following strategies will be adopted:-

3.4.5.1 Promote contracting-out by Government of technology extension, diffusion and commercialization services to local S&T institutions;

3.4.5.2 Encourage tripartite research designed to bring together the research efforts of R&D institutions, industry and Government;

3.4.5.3 Provide assistance for project feasibility studies, engineering consultancy and design services; and

3.4.5.4 Establish venture capital funds to promote the commercialization of technology.

### 3.4.6 *Incentives, Motivation and Use of Local Expertise*

In recent years, notable improvements have been experienced in the utilisation of local expertise especially in consultancy services. More however, needs to be done to motivate local S&T personnel. Malawi does not have a track record for innovation. Documentation at the Registrar Generals' Office reveals the non-existence of a patent for an innovation solely emanating from local R&D. Lessons from elsewhere show that in order to promote an innovation culture requires the identification of national development problems requiring new solutions; the existence of an environment conducive to converting new ideas into successful business ventures; and the availability of awards that recognize individual achievements.

Other than the Malawi Award for Scientific and Technological Achievement (MASTA), there are no other awards that promote innovation. In order to ensure that local S&T personnel are provided with adequate incentives and are suitably motivated, mechanisms will be established for identifying; encouraging; and developing special talents and competencies by taking action to:-

3.4.6.1 Revive the Malawi Award for Scientific and Technological Achievement, and ensure that its range of awards is diversified in order to open it to more recipients and that it is administered annually;

3.4.6.2 Introduce new awards to complement MASTA such as the Outstanding Invention Award, Outstanding Entrepreneur Award and a Presidential Award in order to promote innovation;

3.4.6.3 Provide for an administrative system that enables local scientists who develop specific technology applications to benefit directly from such works through payment of royalties;

3.4.6.4 Encourage and fund participation of S&T personnel in local and international scientific and technological fora

3.4.6.5 Continue and entrench the use of local personnel in consultancy services;

3.4.6.6 Encourage young people in the education system to be innovative by increasing their exposure to national development problems and making the science syllabi more relevant to Malawi;

3.4.6.7 Establish inventors societies based on interest groups in educational and R&D institutions; and

3.4.6.8 Re-introduce "The Most Innovative Stand" at the Malawi International Trade Fair.

### 3.4.7 *Basic and Applied Research*

The so called scientific approach has three stages the first of which is where no agreed scientific theory exists for the discipline concerned and trial and error is permitted. This is followed by a second stage where theory has been developed and agreed upon. The third stage is the finalization stage which, in contrast to the first two stages, allows society to influence the practical application of the theory. The gradual movement from the first stage to the third stage has led to the distinction between basic scientific research and applied technological research. Malawi must carefully balance between basic and applied

research. Whatever mix of basic and applied research finally characterizes Malawi's S&T system, efforts to improve scientific and technological publications will be made since bibliometric publications and citation analysis is one of the most efficient and objective method of evaluating research performance. Strategies to promote basic and applied research will include taking action to:

3.4.7.1 Enhance stakeholder participation in the identification of areas for technological research and development and planning the implementation of specific R&D programmes;

3.4.7.2 Develop innovative methods for ensuring adequate funding for R&D activities focusing mainly on technological research without neglecting scientific research;

3.4.7.3 Promote private sector funding of R&D activities through the provision of specific incentives;

3.4.7.4 Develop science disciplines in the university system that would lead to the establishment of journals specific to those disciplines such as a Malawi Journal of Chemistry for Chemistry as a science discipline; and

3.4.7.5 Establish and strengthen professional associations and societies to enhance discipline-oriented R&D.

**3.4.8** ***Cooperation, Collaboration and Networking***

Cooperation, collaboration and networking at both national and international levels, is essential for successful development and transfer of technologies. International cooperation has the advantage of securing the greater value from expenditure through R&D structures. It reduces unnecessary duplication of efforts and shortens the lead times preceding the operational stage of research. In addition, international cooperation increases credibility of research findings, promotes greater concentration of scientific and technological publications, and makes available skills that do not exist in a given country. At the international level cooperation, collaboration and networking are supported by Governments because of the rapidly increasing cost of R&D endeavours, the limited financial resources and the slow growth of national expenditure devoted to R&D. Extensive cooperation among local scientists using a multi-disciplinary approach, international collaboration through human resources development and networking with the private sector characterized the maize research programme and ensured the success of the program. The situation in Malawi is characterized by low-level cooperation between researchers largely because of the sectoral affiliation of R&D institutions in spite of limited national resources allocated to R&D.

Strategies to promote cooperation, collaboration and networking will include taking action to:

3.4.8.1 Promote the establishment of professional associations such as the Malawi Academy of Sciences;

3.4.8.2 Establish a research funding mechanism that fosters and encourages collaboration and networking among local researchers

3.4.8.3 Evaluate and maximise benefits from Malawi's membership to regional and international groupings that promote coordination and integration in science and technology; and

3.4.8.4 Encourage the establishment of and strengthen mechanisms that promote collaboration and networking for R&D.

**3.4.9** ***Role of the Private Sector***

The private sector has been identified as the engine for economic growth and is responsible for creating demand for S&T programmes and services. Technology, and its judicious application in the productive sector, has the potential of enhancing and accelerating economic growth by, for example, improving productivity and competitiveness. The private sector could also contribute to the development of technological skills by going into contract research arrangements with local S&T institutions in R&D projects aimed at providing specific services to the sector. These services include technology sourcing, transfer, adaptation, assimilation and dissemination. In order to motivate the private sector to play a leading role in creating demand for local S&T services, Government will consider putting in place some fiscal incentives including tax relief. Strategies to promote the participation of the private sector in local S&T development will include taking action to:-

3.4.9.1 Establish legislation that makes private sector investment in local S&T development tax deductible;

3.4.9.2 Encourage the private sector to support skills training under TEVETA;

3.4.9.3 Encourage the private sector to subcontract to local S&T institutions and researchers their technology and research development programmes; and

3.4.9.4 Invite the private sector to contribute towards the development of S&T policies and strategies so that it influences the application of S&T in national socio-economic development.

**3.4.10** ***Women Participation in the development and Utilization of Science and Technology***

The population census of 1998 indicate that 52% of Malawi's population is female. Despite this statistic, the participation in and utilization of S&T by women has not received the attention it deserves. Not many women are motivated to study S&T subjects at secondary and tertiary levels of the education system. The development and transfer of technology often does not focus on the needs of women. The World Summit for Social Development, however, noted that the participation of women in the labour market and their equal access to employment requires, among other actions, improving women's access to technologies that facilitate their occupational and domestic work, encourage self-support, generate income, transform gender-prescribed roles within the productive process and enable them to move out of stereo-typed, low-paying jobs.

Malawi will, therefore, adopt strategies that foster the participation of women in the development and utilisation of science and technology by taking action to:-

3.4.10.1 Encourage research into all gender differentiation in science and technology education and employment;

3.4.10.2 Promote access of women to S&T education at all levels;

3.4.10.3 Foster gender equity in science and technology in education and the workplace;

3.4.10.4 Facilitate the entry of women into employment in the fields of science and technology and their progress within such employment; and

3.4.10.5 Foster socially responsible and gender inclusive science and technology.

### 3.4.11 *Cultural Requisites for Science and Technology*

Malawi's culture, like elsewhere in Africa is dominated by superstition, traditional ideas and beliefs and low levels of literacy. For example, in the village setting, innovative smallholder farmers who follow modern agricultural practices are often suspected and sometimes accused of using charms in order to attain high yields. This poor S&T culture is a serious impediment to socio-economic development. The ease with which technologies may be imported from abroad enables planners and policy-makers import 'comfort' and pay lip-service to the creation of a science culture among their own people. A cultural revolution is, therefore, a requisite if science and technology is to play its rightful role in changing the poverty situation in Malawi. Strategies for achieving this will include taking action to:

3.4.11.1 Inculcate science and technology awareness and appreciation at all levels of Government, especially at the policy-making and planning levels,

3.4.11.2 Elevate S&T awareness and appreciation by including S&T in the educational system through intensifying creative thinking and problem solving skills;

3.4.11.3 Design syllabi that achieve a balance of S&T, the arts and humanities;

3.4.11.4 Increase vocational and technical skills content in secondary schools and intensify efforts at increasing S&T competence to acquire, absorb and disseminate S&T knowledge and skills.

3.4.11.5 Utilize mass media to strengthen public awareness and appreciation of S&T by expanding the S&T content of both the print and electronic media and the training of journalists to improve the standard of S&T journalism; and

3.4.11.6 Demystify science by producing popular science materials for the young both in print and electronic media.

### 3.4.12 *Intellectual Property Rights*

The intellectual property legislation in Malawi comprises the Patents Act, 1958, the Registered Designs Act, 1958; the Trade Marks Act, 1958 and the Copyright Act, 1989. The Patents Act provides for a nationally independent system of patent protection in all fields of technology with a patent term of sixteen years and possible extension. The existing Patents Act and other related acts need to be amended to comply with the Trade-Related Aspects of Intellectual Property Rights (The TRIPS Agreement) that Malawi ratified under the World Trade Organization. The implementation process of the National Science and Technology Policy will follow-up this exercise. In addition, the Trade Description Act, 1987 which deals with the applications of false trade descriptions to goods will also be re-aligned.

Patents form an important indicator of the performance of a national R&D system and find systematic use in economic analysis. Patent documents form an important source of

technological information essential for project identification and commercialization of technologies. Consequently, this National Science and Technology Policy will promote the use of patents for upgrading technology in the economy with special emphasis on the industrial sector. The strategies for achieving this will include taking action to:

3.4.12.1 Set up sound and user-friendly patent information services that would readily exploit patents as a source of technological information for the benefit of the economy;

3.4.12.2 Encourage and follow-up the review of intellectual property legislation in Malawi to make it consistent with international practice;

3.4.12.3 Encourage the establishment of a Malawi Association of Inventors to enhance interaction between Malawian inventors and inventors in other countries;

3.4.12.4 Train staff of selected R&D institutions in the use of the international patent classification in general, and the use of patents as sources of technological information, in particular; and

3.4.12.5Enhance collaboration with regional and international patent offices.

**3.4.13** ***Indigenous Knowledge, Beneficial Rights and Rights of Origin***

Although there are conflicts between cultural beliefs and scientific challenges, a lot can be gained from the indigenous knowledge systems and technologies embedded in Malawi's culture. The indigenous knowledge base in traditional medicine, for example, needs to be understood, preserved, further developed and protected for the benefit of the country. Intellectual Property Rights legislation systems, which cover the body of knowledge that may generally be classified as "Western", are weak at protecting indigenous knowledge because it is owned collectively by extended families, clans and communities and because substantial parts of indigenous knowledge is transmitted orally. This tacit and embedded knowledge needs specialized nurturing and protection. Developments in the fields of broadcasting, cinematography, television and others can easily lead to improper exploitation of the cultural heritage of a nation without due respect to the economic interests of the communities from which it originates. Consequently, this National Science and Technology Policy will provide for the identification, development and protection of the system of indigenous knowledge. The strategies for achieving this will include taking action to:

3.4.13.1 Commission studies into indigenous knowledge systems in order to identify, isolate and document the knowledge;

3.4.13.2 Promote training in indigenous knowledge systems;

3.4.13.3 Promote indigenous knowledge which is known and proven through its dissemination and commercialisation;

3.4.13.4 Establish appropriate incentives that promote the generation and utilisation of indigenous knowledge; and

3.4.13.5 Develop appropriate legislation that protects the rights of origin of indigenous knowledge systems and national genetic resources.

**3.4.14** ***Biotechnology and Biosafety***

Biotechnology is revolutionalizing production systems in agriculture and practices in health delivery systems across the globe. Its applications have led to further increases in agricultural productivity and major advances in medical science and technology. Malawi, however, has not taken full advantage of the opportunities offered by biotechnology. Consequently, there has been no special effort to further develop national competencies in this emerging technology through the development of human and institutional capacity beyond the first and second-generation forms of biotechnology such as fermentation and tissue culture, respectively. The establishment of the Biotechnology - Ecology Research and Outreach Consortium (BioEROC) in Zomba is an important entry point for Malawi to adopt third generation forms of biotechnology such as gene marking which has potential in improving productivity in crop and livestock production. Equally important is the action taken by government to develop a legal framework governing biosafety issues in Malawi. In order to promote the development of Malawi's interests in the field of biotechnology the following strategies will be adopted:

3.4.14 1 Establish and strengthen centers of excellence in specific areas of biotechnology;

3.4.14.2 Increase awareness in biotechnology and its potential impact on socio-economic development through demonstration and training centres;

3.4.14 3 Intensify the development of the human resource capability in biotechnology;

3.4.14.4 Establish a national programme of action for promotion and adoption of biotechnology;

3.4.14 5 Establish capacity to monitor and evaluate biosafety issues in the economy; and

3.4.14.6 Establish programmes of international cooperation in biotechnology.

**3.4.15** ***International Conventions, Protocols and Agreements***

Malawi is a signatory to a number of international conventions, protocols and agreements in the field of science and technology. Malawi has also signed bilateral cooperation agreements in science and technology with some countries in the region and beyond. It is therefore important for the country to maximise her benefits from these arrangements. To ensure that Malawi benefits from such international conventions, protocols and agreements in the field of science and technology, the following strategies will be adopted:

3.4.15.1 Establish national consensus on all international conventions, protocols, and agreements before ratification by consulting expert opinion;

3.4.15.2 Create national awareness of the international conventions, protocols and agreements in the fields of science and technology which Malawi has already acceded to and those that will be acceded to in the future; and

3.4.15.3 Establish practical mechanisms to ensure that Malawi benefits from the international conventions, protocols and agreements already in force.

**3.4.16** ***Information and Communication Technologies***

Information and communication technology involves innovation in microelectronics, computing (hardware and software) telecommunications and optic-electronics –microprocessors,

semiconductors, fibre optics. These innovations enable the processing and storage of enormous amounts of information along with rapid dissemination of information through communication networks.

Malawi like the rest of the world is living in an age of knowledge and information coupled with opportunities and dangers. Enhancement of capabilities in information and communication technologies can bring affluence to us by increasing efficiency. On the other hand, ICT is widening the digital divide between the information technology haves and have-nots. The whole world must cooperate to close the gap and seek co-prosperity. To that end we must take "globalization of information" a step further to "globalisation of the benefits of information". We must make effort so that all of humanity can share the benefits of advanced information and communication technologies.

In order to promote the use of information and communication technologies, the following strategies will be adopted:

3.4.16.1 Encourage and promote the establishment of electronics industries;

3.4.16.2 Enhance use of such technologies in the social sector through the use of satellite based information exchange systems and remote sensing;

3.4.16.3 Strengthen national focal points for information and communication technology issues; and

3.4.16.4 Promote the development and regular review of an information and communication technology policy that would guide developments in the sub-sector.

**3.4.17** ***Competitiveness and Productivity***

The 1998 Africa Competitiveness Report put Malawi at rank 21 on a 23 point scale of nations based on an average of six indices namely; openness, government, finance, labour, infrastructure and institutions. Although the state of Malawi's physical infrastructure contributed greatly to her low score, the other indices also contributed significantly to making Malawi less competitive. Improvement in national competitiveness depends on higher contribution from total factor productivity. In addition to an optimal mix of capital and labour, other determinants of productivity include education, training and technology. The application of technology in the productive sector is a basis for innovations. In order to improve her competitiveness and productivity, Malawi needs to develop its national system of innovation which, according to international practice, consists of a network of public and private institutions whose activities and interactions enable the generation, importation, assimilation, modification, diffusion and use of economically useful knowledge. The strategies for achieving these objectives will include actions to:

3.4.17.1 Create fora for interaction between the productive system on the one hand; and the scientific, technological, educational and training systems on the other; to promote productivity and innovation through diffusion and training programmes;

3.4.17.2 Create fora for interactions between the productive system on the one hand and the financial and administrative systems on the other to provide financial support and regulatory incentives for innovative ventures;

3.4.17.3 Develop human resources and, establish and strengthen institutional structures that promote productivity and innovation; and

3.4.17.4 Establish institutional capability for technology monitoring and forecasting at the enterprise level in order to support technology management activities like diagnosis, evaluation and development of enterprise specific strategies and projects.

## 4. SECTORAL OBJECTIVES AND STRATEGIES

### 4.1 *Introduction*

In order for the National Science and Technology Policy to take effect, its specific objectives should be related to the policy objectives and strategies in all sectors of the economy. The implementation of the specific sectoral strategies will, therefore, provide a strong basis for the overall science and technology strategy for Malawi. Sectoral priorities would have to be determined by the respective sectoral agencies provided they are consistent with the overall science and technology policy objectives.

### 4.2 *Education and Training*

The overall policy in the education sector is to expand access at all levels of the education system with particular emphasis on primary and secondary education. Equal attention will be paid to improving the quality and efficiency in the sector and making the curriculum more responsive to national socio-economic development objectives.

#### *4.2.l Objectives*

The major objectives are to:

4.2.1.1 Develop and modernize the education system to enable it supply adequately qualified manpower of various skills in required numbers;

4.2.1.2 Restructure and expand the education system, especially at the tertiary level;

4.2.1.3 Enhance the integration of the results of national science and technology efforts into production of products and the provision of essential services;

4.2.1.4 Provide adequate, secure and attractive employment opportunities and conditions with a view to retaining existing human resources, attracting high calibre personnel and reversing brain drain; and

4.2.1.5 Provide adequate science and technology teaching and learning facilities in schools and colleges as well as suitably qualified, motivated and experienced teachers and instructors.

#### 4.2.2 S*trategies*

The following strategies will be adopted in order to realize the above objectives as they relate to pre-school, primary, secondary and tertiary education.

##### *4.2.2.1 Pre-school Education*

i. Ensure that all pre-schools provide toys and other relevant learning materials with S&T content; and

ii. Give awards for S&T excellence.

##### *4.2.2.2 Primary School Education*

i. Strengthen S&T education through training of more teachers in S&T;

ii. Introduce specialization in the teaching of science subjects;

iii. Review the science curriculum to include practical components;

iv. Provide adequate teaching and learning materials;

v. Introduce computer lessons;

vi. Intensify art, craft and design;

vii. Increase funding through traditional and non-traditional sources such as endowment funds and community contributions;

viii. Strengthen the use of the science curriculum in primary schools as a building block for secondary school science; and

ix. Give awards for S&T excellence.

*4.2.2.3 Secondary School Education*

i. Increase the number of science and technology teachers with at least a bachelor's degree;

ii. Upgrade science and technology curricula to ensure that students completing secondary school attain a good *"O"* level standard and are computer literate;

iii. Train more science and technical teachers;

iv. Provide adequate equipment and materials for technical training;

v. Designate an appropriate institute to train laboratory technicians and assistants to manage science and technology laboratories;

vi. Emphasize applied science by ensuring that school laboratories are adequately equipped and kept in good state of repair;

vii. Establish an independent evaluation unit for S&T education; and

viii. Give awards for S&T excellence.

*4.2.2.4 Tertiary Education*

At the tertiary level, emphasis will be placed on creating a balance between the training of technical and professional human resources and the imparting of life-long skills that support sustainable livelihoods through technical, vocational, entrepreneurial and education training programmes.

i. Expand vocational and higher education especially in the scientific, engineering and technological fields by establishing some of the constituent colleges of the University of Malawi as separate universities and designating at

least one as a University of Science and Technology and strengthen technical, vocational and entrepreneurial education programmes

ii. Review, develop and implement curricula that ensure effective S&T education and culture;

iii. Strengthen university faculties in S&T fields to enable them produce PhD and MSc. graduates on an annual basis;

iv. Strengthen links between industry and the university community through industry involvement in establishment of college-based innovation centers, the design of curricula, and conducting graduate research projects that address local problems and industrial needs;

v. Establish scholarships for undergraduate and postgraduate studies in priority areas of science and technology;

vi. Introduce science and technology awards;

vii. Ensure adequate funding for research and training in tertiary institutions; and

viii. Strengthen R&D in various science and technology fields in the universities.

## 4.3 *Agriculture, Food and Nutrition*

### *4.3.1 Introduction*

The overall policy in agricultural productivity to enhance the social welfare and incomes of farmers and the prosperity and stability of the nation as a whole by improving self-sufficiency in food, expanding and diversifying export receipts from agricultural produce. In nutrition, a further objective is to ensure that families have access to food throughout the year by improving food production, availability, accessibility and utilization. Science and technology should be used for advancing these causes by, in the main, improving overall productivity in the agriculture, food and nutrition sector.

### *4.3.2 Objectives*

The major objectives are to:

4.3.2.1 Increase agricultural productivity and strengthen linkages within and between sectors;

4.3.2.2 Achieve sustainability in agriculture through promotion of efficient use of resources that cause minimal degradation of the environment and promote conservation of natural resources;

4.3.2.3 Achieve food self sufficiency and security so as to improve the nutritional standards of the people;

4.3.2.4 Raise incomes and foreign exchange earnings of the nation through increased agricultural output;

4.3.2.5 Develop farming systems that are suitable for both smallholder and commercial farmers; and

4.3.2.6 Develop an agricultural sector that integrates science and technology to intensify crop and animal production.

*4.3.3 Sectoral Strategies*

In order to achieve these objectives, the following strategies will be adopted as they relate to agricultural research; agricultural productivity and extension; crop and animal production; and food and nutrition:

*4.3.3.1 Agricultural Research*

i. Review the organizational aspects of the agricultural research system in order to enhance its efficiency and effectiveness including the possibility of corporatisation of agricultural research through the establishment of an appropriate parastatal institution;

ii. Develop, through research, high yielding varieties that are pest and disease tolerant or resistant for major food and cash crops while in the case of food crops, integrating nutritional aspects;

iii. Develop stable and sustainable cropping systems that can improve and maintain soil fertility through selective use of fertilizers such as legumes, compost and farm yard manure and chemical fertilizers;

iv. Conduct research into labour saving technologies so as to intensify farm mechanization to improve efficiency of farm and household activities;

v. Strengthen research into the development of low cost crop storage and preservation technologies for a variety of crops to enhance their shelf-life;

vi. Develop appropriate technologies for small-scale irrigation, promote the use of wetlands and saline soils for irrigated agriculture and conduct studies on soil and water management techniques including watershed management;

vii. Intensify research into plant protection measures such as the use of pesticides, development of disease resistant crops; and integrated pest management;

viii. Improve genetic potential of indigenous livestock species for meat, dairy and draught through selecting and cross-breeding with suitable exotic species; and

ix. Intensify research and technology transfer in order to improve animal health including control of major livestock diseases and improvements in laboratory services and disease surveillance.

*4.3.3.2 Agricultural Productivity and Extension*

The raising of agricultural productivity is a high priority issue in Malawi. In order to ensure that the extension system makes the necessary contribution, the strategies to be implemented will include taking action to:

i. Encourage the adoption of technologies from the national research system that improve productivity;

ii. Train and equip extension workers to enable them provide the required services; and

iii. Establish close links between the extension services and the national research system including the parastatal institutions specializing in agricultural research.

*4.3.3.3 Crop and Animal Production*

i. Develop and select affordable and practicable crop management practices including multiple cropping systems for major food and cash crops in order to sustain optimum yields with economic input levels;

ii. Develop and/or introduce more exportable crops which generate foreign exchange income for the country and generally improve crop marketing and packaging technologies;

iii. Develop efficient livestock management systems for all livestock production systems; and

iv. Improve cassava and sweet potato production by ensuring that farmers have ready and adequate access to planting material and the transfer of appropriate technologies for production of cassava and sweet potato to farmers.

*4.3.3.4 Food and Nutrition*

Food security and nutrition are national priorities and science and technology is expected to contribute towards their promotion. The following strategies shall be adopted to achieve this:

i. Increase food production by improving agricultural productivity of the major food crops including cassava, sweet potato, bananas and others;

ii. Diversify the national diet based on a variety of indigenous foods by developing recipes that are research-based and designate a national research institution which, together with a competent marketing agency, would promote a national dietary diversification programme;

iii. Provide surveillance services and education programmes on food and nutrition in order to ensure improvement in the nutritional status of the rural population particularly vulnerable groups such as children, pregnant women, lactating mothers, convalescents and the aged; and

iv. Promote the processing and utilization of food crops and livestock products.

## 4.4 *Water Resources and Sanitation*

*4.4.1 Introduction*

The overall goal of the Water Resources Management Policy also covers sanitation to ensure that every Malawian has equitable access, at an affordable cost, to adequate water for the sustainable development, social and economic welfare, and prosperity of the people of Malawi. In achieving this goal due attention will be paid on needs as they relate to community

services, economic development and the environment.

*4.4.2 Objectives*

The objectives for the water resources and sanitation sector include those to:

4.4.2.1 Achieve sustainable and integrated water resources development and management that make water equitably accessible to and used by individuals and entrepreneurs in pursuit of their human and socio-economic development;

4.4.2.2 Advocate for effective and efficient management and utilisation of water resources and ensure conservation and availability to stakeholders in sufficient and acceptable quantities and qualities;

4.4.2.3 Ensure the existence of strategic and contingency water resources development and management schemes that guarantee availability of water even during droughts and mitigate the impacts of population pressure, floods, droughts and environmental degradation.

4.4.2.4 Advance public health, hygiene and pollution control through the incorporation of safe disposal and wastewater management in the planning, development and management of water supply services; and

4.4.2.5 Optimise the net social, economic and environmental benefits from public investment in water and water related programmes.

*4.4.3 Strategies*

In order to realise the objectives for the water and sanitation sector, the strategies that have been adopted are:

4.4.3.1 Promote and initiate strategic and contingency water resources development and management schemes at national, regional and river basin levels.

4.4.3.2 Continue restructuring, reforming and strengthening the Ministry of Water Development and make it efficient and effective in the articulation of policy, coordination and implementation of water resources management programmes;

4.4.3.3 Strengthen the Water Resources Board to effectively and efficiently manage the country's water resources with a mandate to advise on policy, strategies, programmes and projects on water resources management and administration;

4.4.3.4 Decentralise water resources management to basin level and encourage the involvement of stakeholders in the management of water related industries throughout the country;

4.4.3.5 Promote local resource mobilisation and project financing that supplement and compliment public investments in water resources development and management; and

4.4.3.6 Develop skills, technologies and techniques among the local labour force using local institutions complemented by overseas training.

## 4.5 *Irrigation*

### *4.5.1 Introduction*

The occurrence of droughts and their negative effect on crop production has resulted in increased importance of irrigation development. Consequently, the overall goal of the irrigation policy is to facilitate the increase and stabilization of agricultural production through mobilization of small and large scale irrigation projects. This will be achieved with the human and financial resources from, and full participation of the beneficiaries which include the private sector, NGOs and the public sector. There will also be ample observance of environmental aspects to ensure sustained productivity and equitable involvement across all gender lines in order to ensure food security, effective poverty reduction and national economic development.

### *4.5.2. Objectives*

The broad sectoral objectives for the irrigation sector are to:

4.5.2.1 Contribute to poverty reduction by targeting resource poor smallholder farmers for irrigation development to enhance farm income and supplement the recommended strategies for rain fed agriculture outlined in the Agricultural and Livestock Development Strategy and Action Plan;

4.5.2.2 Increase agricultural production and enhance food security through irrigation, which will ensure some crop production during droughts and the dry season;

4.5.2.3 Extend cropping opportunities and provide a wider variety of crops in both wet and dry seasons to improve nutritional status, especially of children and women;

4.5.2.4 Create an enabling environment for irrigated agriculture; by facilitating and encouraging the private sector to invest in irrigation development and encouraging rural communities to manage irrigation projects in order to fully utilize irrigatable land in Malawi;

4.5.2.5 Optimize government investment in irrigation development by applying principles of cost sharing and cost recovery;

4.5.2.6 Enhance human capacity for irrigated agriculture in the public, parastatal and private sector in order to facilitate effective research in irrigation technology and marketing of irrigated produce; and

4.5.2.7 Create the spirit of business culture in the small-scale irrigated agriculture sector to promote and provide competitive projects financing and improving the marketing system at national and international levels.

### *4.5.3 Strategies*

In order to achieve the broad objectives of the irrigation policy, the following strategies have been adopted:-

4.5.3.1 Identify areas with irrigation potential in order to increase land put under irrigation based on the existing irrigation potential;

4.5.3.2 Enhance technical and administrative capacity in irrigated agriculture in the Irrigation Department, together with improved technical capacity in the private sector and training institutions so that in the next ten years, the private sector is able to take on irrigation/dam design and construction and the training institutions are able to offer diplomas/degrees and short courses in irrigation;

4.5.3.3 Assist smallholder farmers to develop and manage new and existing irrigation schemes through the establishment of local farmer organizations that can assume full ownership of existing irrigation schemes and new pilot schemes;

4.5.3.4 Transfer ownership of existing government schemes to the beneficiaries through participatory methods that will enhance farmers responsibility and obligations towards the management of the schemes;

4.5.3.5 Assist the informal irrigation sector through greater presence of the Irrigation Department at regional, district and community levels to provide irrigation technology advice where it is needed most;

4.5.3.6 Conduct research in irrigation technology in order to promote the use of appropriate advanced and simple technologies in irrigated agriculture with due attention to the efficient utilization of water resources;

4.5.3.7 Facilitate the establishment of a well coordinated marketing system with considerable local processing and better storage/transportation of farm produce; and

4.5.3.8 Address specific problems that women face in irrigated agriculture in order to achieve greater participation of women in the small-scale irrigation sector.

## 4.6 *Health and Population*

### *4.6.1 Introduction*

The overall policy goal of the health sector is to raise the level of health status of all Malawians by developing a delivery system capable of promoting health; preventing, reducing and curing diseases; protecting life; fostering general well being and increased productivity; and reducing the occurrence of premature death. Five supporting health sector policies have been adopted to guide the operations of the sector namely; the establishment of an essential health care package, the Bakili Muluzi Health Initiative, a sector wide approach, decentralisation of health care management and strengthening of cost recovery. Recognising the role of traditional medicine in health services delivery, it will be essential to initiate under this National Science and Technology Policy, programmes that promote research into the use and effectiveness of medicinal plants for the treatment of common local diseases and, through an appropriate institution, establish a National Programme of Action in traditional medicine. The central feature of the population policy, on the other hand, is to ensure that the future growth of the population is kept within manageable and sustainable limits while maintaining the right of each individual and couple to decide for themselves the number of children they wish to bear.

### *4.6.2. Objectives*

The overall policy objectives for the health and population sector are to:-

4.6.2.1 Expand the range and quality of health services focused on maternal health and children under the age of 5 years;

4.6.2.2 Improve the general health status of the population by strengthening, expanding and integrating relevant health services;

4.6.2.3 Increase access to health care facilities and basic health care services;

4.6.2.4 Increase, retain and improve the quality of trained human resources and distribute them efficiently and equitably;

4.6.2.5 Provide better quality health care in all health facilities;

4.6.2.6 Improve efficiency and equity in resource allocation;

4.6.2.7 Strengthen collaboration and partnership between the health sector, communities, private providers and other sectors;

4.6.2.8 Strengthen programmes that increase awareness of the population problem through information, education and communication;

4.6.2.9 Improve the status of women, youth and special groups; and

4.6.2.10 Improve the health care information systems for better planning.

*4.6.3 Strategies*

The health and population sector has outlined a number of strategies for achieving the policy objectives including the following which the National Science and Technology Policy has the potential to contribute towards:

4.6.3.1 Strengthen and integrate reproductive health services;

4.6.3.2 Strengthen and integrate child health services;

4.6.3.3 Strengthen, expand and integrate selected disease control services through a complementary community and facility-based approach;

4.6.3.4 Strengthen and expand environmental health information, education and communication initiatives;

4.6.3.5 Expand coverage of primary health care services and facilities;

4.6.3.6 Re-orient secondary and tertiary health care services;

4.6.3.7 Strengthen primary care by emphasizing on the role of communities in implementing an essential health package and the Bakili Muluzi Initiative;

4.6.3.8 Establish and strengthen training institutions and seek technical assistance for doctors and specialists;

4.6.3.9 Re-orient and train health workers in quality assurance programme;

4.6.3.10 Promote research and documentation in traditional medicine, natural products, and socio-cultural issues; and

4.6.3.11 Promote collaboration between traditional medicine and orthodox medicine.

## **4.7** ***Energy***

### *4.7.1 Introduction*

The overall policy for the energy sector is to ensure adequate and sustained supplies of energy for continued economic growth and development. The energy policy recognizes the dependence of Malawi on imported energy sources especially petroleum products and the importance of developing and utilizing indigenous energy resources especially renewable energy such as bio-mass, solar, wind, mini/micro hydro and geothermal energy.

### *4.7.2 Objectives*

The major sectoral objectives are to:

4.7.2.1 Minimize the impact of the high cost of the incentives in the supply of imported oil and coal;

4.7.2.2 Develop a sustainable programme to meet wood-fuel needs of the population;

4.7.2.3 Develop electric power supply in a least cost manner to meet the demands of economic and social development of Malawi; and

4.7.2.4 Develop and utilize renewable and alternative energy resources such as solar and wind.

### *4.7.3 Strategies*

The major strategies for achieving the above objectives are to:

4.7.3.1 Improve the procurement and distribution of petroleum products;

4.7.3.2 Promote more efficient use of energy in transport through promoting production and use of ethanol for blending with petrol;

4.7.3.3 Explore for and undertake coal mining activity;

4.7.3.4 Encourage conservation of wood-fuel resources including conversion of forest thinnings to softwood charcoal and electricity generation;

4.7.3.5 Introduce and encourage the use of efficient wood, coal and charcoal-burning technologies for private, institutional and industrial use;

4.7.3.6 Electrify the flue-cured tobacco growing areas, where economically feasible, as a means of allowing more efficient use of solid fuels; and

4.7.3.7 Promote the development of renewable energy technologies through the implementation of the National Sustainable and Renewable Energy Programme.

## 4.8 *Industry*

### *4.8.1 Introduction*

The Government's overall policy for the industrial sector centres on the creation of enterprises that are export-oriented so as to increase the volume and diversify the range of manufactured exports and broaden the industrial base while focusing on the development of small and medium scale industries. It also aims at improving the development and application of science and technology to enhance domestic and international industrial competitiveness and the development of a support structure for industrial growth especially now that labour intensive industries are phasing out in most countries.

### *4.8.2 Objectives*

The major objectives for the industrial sector are to:

4.8.2.1 Intensify investment promotion efforts to attract an increased flow of capital into the manufacturing sector from domestic and foreign sources;

4.8.2.2 Promote strategic industrial sub-sectors and product groups on the basis of their potential to maximize economic and social benefits;

4.8.2.3 Promote industrial linkages within the manufacturing sector and between the sector and the rest of the economy;

4.8.2.4 Optimize the exploitation of natural resources;

4.8.2.5 Promote linkages between R&D institutions and industry;

4.8.2.6 Promote export oriented industrialization; and

4.8.2.7 Enhance environmentally sustainable industrial development.

### *4.8.3 Strategies*

In order to realize the objectives for the industrial sector, the following broad strategies will be adopted:

4.8.3.1 Establish a National Productivity Centre;

4.8.3.2 Encourage industrial research and technology development;

4.8.3.3 Strengthen the institutional capacity to support industrial research and technology development as well as standardization and quality management;

4.8.3.4 Establish, in partnership with the private sector, a Technology Development Fund;

4.8.3.5 Encourage the designation of an existing institution into a National Design Centre that will put emphasis on the development of export products; and

4.8.3.6 Promote the development and utilization of science and technology in the industrial sector

through the following specific strategies: -

i. Enhance linkages between R&D institutions and industry through encouraging contract research fully or partially funded by the industry;

ii. Promote tripartite research designed to bring together the research efforts of R&D institutions, industry and Government;

iii. Provide assistance for project feasibility studies, engineering consultancy and design services;

iv. Establish an S&T information system for the industrial sector in order to enable policy and decision makers to continuously evaluate national technological capabilities and regularly assess national industrial technological needs and foreign suppliers of industrial technology;

v. Promote the diffusion of indigenous technologies through appropriate channels such as demonstrations, exhibitions, provision of industrial extension services and establishment of special prizes and awards for innovators and inventors;

vi. Promote the acquisition of foreign technology through direct investment in a manner that enhances vertical transfer of technology. This will require the development of capacity to screen transfer agreements;

vii. Develop local engineering services that support activities at pre-investment, investment and post-investment stages of industrial project planning and implementation to facilitate unpackaging of technology and develop local skills;

viii. Develop an Industrial Technology Development Action Plan which addresses leadership in industrial technology development and R&D in the private sector;

ix. Build competence in key emerging technologies such as biotechnology, advanced materials, information and communication technology, and electronics; and

x. Establish schemes that promote development and utilization of S&T in the industrial sector including special tax incentives to firms that commercialize new technology, preferential treatment for users of indigenous technology, and provision of venture capital and risk financing schemes.

## 4.9 *Commerce*

### 4.9.1 *Introduction*

Tobacco, tea and sugar, account for 80 per cent of Malawi's total foreign exchange earnings while high value manufactured goods contribute less than 10 per cent. There is national realization that if the economy is to improve, continued reliance on agricultural exports is limiting. This has revealed the need for a well thought-out programme of product development and adaptation, and the importance of increasing the local content of manufactured products through the use of local resources. Research and development will play a vital role in achieving these ends. This national science and technology policy shall

support the development of the sector by enhancing the use of information and communication technology to promote trade between Malawi and all her trading partners.

4.9.2 *Objectives*

The main objectives for the commerce sector are to:

4.9.2.1 Ensure the supply of essential goods and services throughout the country through efficient distribution and procurement;

4.9.2.2 Consolidate existing and diversify export markets to generate foreign exchange;

4.9.2.3 Diversify and promote alternative export products;

4.9.2.4 Promote effective use of information and communication technologies; and

4.9.2.5 Develop a conducive trade environment.

4.9.3 *Strategies*

In order to achieve these objectives, the following strategies have, among others, been identified and documented in the Integrated Trade and Industry Policy:

4.9.3.1 Accord priority to the creation of a trade and industrial information infrastructure in Malawi and ensure that relevant information is disseminated to users;

4.9.3.2 Accord priority to human resource development with specific reference to the needs of the trade and industry sectors;

4.9.3.3 Emphasize export market development and product diversification;

4.9.3.4 Promote the processing of raw materials into value-added manufactured products;

4.9.3.5 Introduce an "exporters first" strategy to target enterprises with capacity of exporting goods and services; and

4.9.3.6 Implement the World Trade Organisation Agreement and others to which Malawi is a signatory.

## 4.10 *Environment*

4.10.1 *Introduction*

The overall goal of the environmental policy is to promote sustainable social and economic development through the sound management of the environment. The policy seeks to promote efficient utilization and management of natural resources, facilitate the rehabilitation and management of essential ecosystems and ecological processes. In addition, the policy will enhance public awareness on the importance of sound environmental management; and promote cooperation between Government, local communities, women groups, NGOs and the private sector in the management and sustainable utilization of natural resources and the environment.

4.10.2 *Objectives*

The major objectives for the environmental sector are to:

4.10.2.1 Improve human welfare through effective environmental management;

4.10.2.2 Ensure that individuals and economic entities are given appropriate incentives for sustainable natural resource use and environmental protection;

4.10.2.3 Increase public and political awareness and understanding of the need for sustained environmental protection, conservation and management;

4.10.2.4 Provide training needed to implement a national programme of environmental protection, conservation and management and carry out basic and applied demand-driven research to support sustainable management of the environment;

4.10.2.5 Conserve, manage and utilize in a sustainable manner the country's biological diversity for the preservation of the national heritage; and

4.10.2.6 Promote sustainable use of land resources of Malawi, primarily but not exclusively, for agricultural purposes by strengthening and defining security of tenure over land resources.

4.10.3 *Strategies*

The major strategies for achieving the above major objectives are to:

4.10.3.1 Enhance agricultural productivity for farmers in order to promote sustainable use of natural resources;

4.10.3.2 Offer land users a reduced land or property tax or rents for practicing soil and water conservation methods, agro-forestry techniques, good husbandry practices, development and maintenance of wood-lots, or use of appropriate livestock stocking rates;

4.10.3.3 Encourage and finance research programmes on environmental management;

4.10.3.4 Identify valuable areas of bio-diversity outside protected areas in consultation with local communities, explore means of protecting such areas, purchase of land-use rights and conservation easements;

4.10.3.5 Develop a land use policy to guide and ensure sustainable land utilization and development;

4.10.3.6 Develop and implement a national programme to rehabilitate highly degraded areas.

## **4.11** ***Construction***

4.11.1 *Introduction*

The construction industry in Malawi is guided, at the policy level, by the National Construction Industry Act, (1996) which established the National Construction Industry Council. The Council's main responsibilities are promoting and developing the construction industry, registering persons engaged in the construction industry, and coordinating training of persons engaged in the construction industry. The construction industry covers various

sub-sectors such as housing, roads and related works and is generally recognised as a potential source of economic growth and employment creation. It is ideally suited for the application of technologies for the benefit of the community, hence science and technology has a key role to play in its development.

4.11.2 *Objectives*

The major policy objectives for the sector are to:-

4.11.2.1 Improve the mechanism of planning and execution of public sector construction and civil engineering capital investments and maintenance projects so as to ensure stability and continuity of the industry.

4.11.2.2 Improve arrangements for consultation within the industry and between the industry and Government and other interested bodies in order to review, monitor, and evaluate progress towards sector objectives;

4.11.2.3 Review the respective roles and responsibilities of the various component parts of the industry and how these change over time;

4.11.2.4 Introduce a long term training programme for the professional, technical and managerial skills of the industry;

4.11.2.5 Stimulate the growth and development of an efficient Malawian owned consulting and construction civil engineering firms through training;

4.11.2.6 Encourage the formation and development of small scale construction firms; and

4.11.2.7 Improve the operational productivity of the public sector component of the industry.

In the housing and roads sub-sectors, the specific objectives to which S&T could make direct contribution include the following:

i. Expand the supply and use of alternative building materials;

ii. Improve the quality of rural housing; and

iii. Encourage environmental and energy conservation in road construction and transport projects and programmes.

4.11.3 *Strategies*

In order to realize the broad policy objectives in the construction sector, a wide range of strategies have been outlined in the specific policy statements including the following towards which Science and Technology should make direct contributions:

4.11.3.1 Conduct research on and promote the development and use of competitive local materials;

4.11.3.2 Promote and facilitate, where possible, the construction of affordable low-cost houses;

4.11.3.3 Promote safety standards in the construction industry;

4.11.3.4 Conduct and coordinate training of persons engaged in the construction industry within Malawi to promote the development of local skills;

4.11.3.5 Support the commercial production of local building materials;

4.11.3.6 Develop sustainable technologies for rural users;

4.11.3.7 Train local building material producers and suppliers in quality control and provide facilities for quality control and certification; and

4.11.3.8 Provide for Environmental Impact Assessment (EIA) and energy conservation in the planning and construction of roads and buildings.

## 4.12 *Communications*

4.12.1 *Introduction*

Information has become a tradable commodity and a communications system governs the way information is transferred. The communications sector; which is driven by rapid technological innovation, increasing globalization, stiffer competition and huge capital requirements; has recently been deregulated by Government. The sector consists of three key sub-sectors of telecommunications, postal services and broadcasting. The communications policy has outlined specific policy objectives and strategies for these sub-sectors.

4.12.2 *Objectives*

4.12.2.1 *Telecommunications*

The key objectives for this sub-sector are to:

i. Increase the number of working telephone lines;

ii. Ensure that the quality of service meets acceptable international standards;

iii. Liberalize the market in respect of the provision of services such as internet, e-mail, data and paging;

iv. Reduce the price of telecommunication services in real terms;

v. Ensure extension of modern telecommunication services to rural areas; and

vi. Allow private sector participation in the provision of telecommunication services.

4.12.2.2 *Postal Services*

The key sectoral objectives for the postal services sub-sector are to:

i. Re-orient the sector into a viable and sustainable venture that is capable to cover its operational costs after an initial transitional period; and

ii. Create a postal service which will be reliable and efficient and which will

provide services at affordable rates to the majority of the people.

4.12.2.3 *Broadcasting Services*

The key sectoral objectives for the broadcasting services sub-sector are to:-

i. Ensure that the full range of broadcasting services are made available to the people; and

ii. Reconstitute the Malawi Broadcasting Corporation so that it meets the aspirations of the people under the new political dispensation.

4.12.3 *Strategies*

The main strategies for realizing the policy objectives outlined in the National Communications Policy are as follows:-

4.12.3.1 Establish a Malawi Telecommunications Company as a national operator capable of modernizing telephone services and meeting annual roll-out targets for installation of new telephone lines while ensuring priority for public services, schools and commercial enterprises;

4.12.3.2 Seek a strategic partner for the national operator whose contributions would include the transfer of technology and development of human resources;

4.12.3.3 Allow the establishment of other local operators, cable TV networks, non-basic telecommunications service providers, mobile and radio service providers, VSAT networks and telephone service providers;

4.12.3.4 Outline a postal development plan that focuses on training of staff in all aspects of postal services;

4.12.3.5 Commercialize the operations of Malawi Broadcasting Corporation; and

4.12.3.6 Regulate telecommunications, posts and broadcasting services; and manage and monitor the radio frequency spectrum with due respect to international conventions.

**4.13 *Transport***

4.13.1 *Introduction*

Transport is considered as a service sector whose role, in addition to stimulating economic growth, includes meeting effective consumer demand. Since Malawi's economy depends heavily on international trade, the availability of external transport links is considered as crucial. Although there have been a number of policy reforms in the sector aimed at promoting the operation of a competitive and efficient transport system, the need for continuous policy reform has been recognised. The transport sector in Malawi consists of four main sub-sectors of road, rail, air and water.

4.13.2 *Objectives*

With the overall goal of providing a coordinated transport environment that fosters a safe and competitive operation of commercially viable, financially sustainable and environmentally friendly transport services and enterprises, the major sectoral objectives on which the National Science and Technology Policy will impact are to;

4.13.2.1 Meet economic demand and socio-political needs while minimizing cost to the economy;

4.13.2.2 Minimize negative impacts of transport sector activities on the environment;

4.13.2.3 Strengthen institutional capacity of the transport sector through human resource development;

4.13.2.4 Improve transport safety;

4.13.2.5 Provide meteorological services and products to suit individual transport mode so as to realize maximum benefits and minimize losses; and

4.13.2.6 Develop and disseminate improved technologies to target groups.

4.13.3 *Strategies*

In order to realize the sectoral objectives, a number of sub-sector specific strategies have been adopted including the following that require the support of the National Science and Technology Policy:-

4.13.3.1 Use and enforce appropriate road design standards and specifications;

4.13.3.2 Vigorously enforce vehicle weight limits and vehicle dimensions in order to protect road infrastructure;

4.13.3.3 Facilitate availability of appropriate low-cost transport;

4.13.3.4 Promote environmental protection and resource conservation through the use of more energy-efficient and less pollutant modes of transport;

4.13.3.5 Enhance transport safety through improved road infrastructure, policing and maintenance of vehicle safety standards;

4.13.3.6 Establish a Rural Access Roads Technology Unit to serve as a centre for technology research and development; and

4.13.3.7 Develop and retain human resources to service the S&T requirements of all transport sub-sectors.

**4.14** ***Natural Resources***

4.14.1 *Forestry*

4.14.1.1 *Introduction*

The goal of the National Forest Policy of Malawi is to sustain the contribution of the

national forest resources to the improvement of the quality of life in the country by conserving the resources for the benefit of the nation. The Forestry Research Institute of Malawi is the focal point for R&D activities in the forestry sub-sector. The mission of the Institute is to provide timely information to the private and public sectors. The institute aims at developing technologies for silviculture management and multiple land use systems for sustained wood production, reduce risk of losses from timber and tree pests and diseases; and providing advice on the best use of forest products following sound ecological conservation and management principles.

4.14.1.2 *Objectives*

The general objectives of the National Forest Policy are to:-

i. Allow all citizens to have regulated and monitored access to some forest products;

ii. Improving the quality of life in the rural communities and providing a stable local economy, in order to reduce the degenerative impact on the environment; and

iii. Establish appropriate incentives that will promote community-based conservation and sustainable utilisation of forest resources as a means of achieving sustainable self-sufficiency in wood and forest-derived products.

4.14.1.3 *Strategies*

The Forestry Policy outlines clearly the range of specific strategies that will be used to achieve the sectoral objectives including the following towards which science and technology has the capacity to make specific contributions:-

i. Undertake endogenously, well designed and relevant research programmes in collaboration with local and external organisations to generate usable technologies or adapt to local conditions exogenous technologies, in order to improve and achieve sustainable management and utilisation of forests and tree resources;

ii. Develop and disseminate to target groups improved technologies for the development and management of trees and forests optimal harvesting including silvicultural and protection measures to ensure sustainable production of wood and non-wood products;

iii. Reduce dependence on wood-fuel as a source of energy; and

iv. Develop requisite high quality human resources through education and training in order to strengthen the institutional capacity required to effectively manage forest resources.

4.14.2 *Fisheries*

4.14.2.1 *Introduction*

Malawi has a significant quantity of fish resources that provide a larger portion of animal protein intake of the population. The overall goal of the National Fisheries Policy is to

sustain the contribution of the national fish resources in order to uplift the quality of life in Malawi by conserving the resources for the benefit of the present and future generations. The Department of Fisheries, which has the responsibility of implementing the policy, undertakes research and development through a network of fisheries research institutions. The research programmes aim at generating information and technologies required for the management, conservation and sustainable utilisation of fish resources in the various water bodies of Malawi.

4.14.2.2 *Objectives*

The general objectives of the National Fisheries Policy aim at monitoring and controlling fishing activities with a view to increasing productivity within sustainable yields. The policy also aims at enhancing the quality of life to the fishing communities and promoting aquaculture as a source of income and as a supplement to fish supplies from natural waters. The specific objectives towards which science and technology would make a contribution are as follows:-

i. Create the capacity of the local communities, in partnership with the Department of Fisheries, to manage and regulate the utilisation of fish resources in Malawi and to promote aquaculture;

ii. Provide the information necessary for sustainable exploitation, management, conservation of biological diversity and investment in the fisheries sector through appropriate biological, technological, sociological and environmental research programmes;

iii. Establish and sustain the co-management of fish resources between the Department of Fisheries and key stakeholders in order to achieve sustainable aquatic resources management for the artisanal fisheries;

iv. Increase and sustain fish production from smallholder and large fish farming operations in order to improve fish supply in Malawi;

v. Develop capacity by providing appropriate training programmes for the Department of Fisheries and user communities in Malawi; and

vi. Promote sustainable utilization of fish resources in the riverine and adjacent floodplains and wetlands in recognition of the commitment of Malawi to maintain biodiversity.

4.14.2.3 *Strategies*

The strategies that have been put in place to achieve these policy objectives, in relation to science and technology, include taking action to:

i. Improve the effectiveness and efficiency of the extension service;

ii. Review research priorities to address actual fishing community needs/problems and make use of indigenous fisheries knowledge;

iii. Promote the implementation of demand driven, service-oriented research

focussing on problems identified with the stakeholders in the fishing industry;

iv. Provide reliable information on the status of exploited fish stocks, economic and environmental parameters including information on noxious aquatic weeds in all water bodies and under-exploited resources to the fishing sector;

v. Establish an information system to quantify the impact of pollution on the fisheries resources;

vi. Develop and maintain the capacity to monitor, support and conduct research in participatory fisheries management within the Department of Fisheries;

vii. Solve problems related to fish farming and the management of small water bodies through bio-technical research;

viii. Develop adaptive/appropriate recommendations for fish farming;

ix. Encourage farmers to adopt fish farming as a source of subsistence and income;

x. Develop and provide adequate broad range demand-driven training courses for fisheries, co-management and aquaculture to support user communities;

xi. Encourage collaboration at national, regional and international levels in areas of training, research and consultancies for the fishing sector; and

*xii.* Manage fisheries in the riverine and adjacent floodplains and wetlands based on sound understanding and knowledge of the biology of target species and the impacts of harvesting to the eco-systems.

4.14.3 *Wildlife*

4.14.3.1 *Introduction*

The National Wildlife Policy provides insight into the management of wildlife as a renewable resource with the potential to provide a multitude of utilitarian benefits to the people of Malawi. The goal of the policy is to ensure the proper conservation and management of wildlife resources in order to provide for sustainable utilisation and equitable access to the resources and fair sharing of the benefits for both present and future generations of Malawians.

4.14.3.2 *Objectives*

In order to achieve the policy goal, the policy seeks to meet the following set of objectives:-

i. Ensure the adequate protection of representative ecosystems and their biological diversity through promotion and adoption of appropriate land management practices;

ii. Enhance public awareness and understanding of the importance of wildlife conservation and management and its close relationships with other forms of

land use;

iii. Take the necessary legislative steps as well as pertinent enforcement measures to curtail the illegal use of wildlife;

iv. Create an enabling environment for wildlife-based enterprises; and

v. Develop a cost-effective legal, administrative and institutional framework for managing wildlife resources without compromising the special ecological attributes of the resources.

4.14.3.3 *Strategies*

The National Wildlife Policy recognises the importance of research, monitoring and adaptive management of wildlife resources and the need for conservation activities based on sound knowledge of the ecosystem in order to maintain an ecological balance with respective biotic communities as well as the potential for their sustainable use. Consequently, the following strategies for wildlife research have been outlined in the policy:

i. Strengthen capacity of the Wildlife Research Unit;

ii. Improve communication and co-ordination links between the Research Unit and other units of the Department of National Parks and Wildlife;

iii. Design flexible wildlife conservation and management activities to allow for monitoring, evaluation and adjustment where necessary;

iv. Determine and regularly review research priorities;

v. Establish, review and/or update monitoring procedures for management activities in order to allow for the incorporation of research findings;

vi. Strengthen data collection capacities within the Research Unit and outside including communities;

vii. Establish collaborative links with external researchers and research institutions; and

viii. Determine guidelines and fees, as appropriate, for external research in the wildlife sector.

4.14.4 *Mineral Resources*

4.14.4.1 *Introduction*

The policy goal with regard to mineral resources is to maximise the economic benefit to the nation that can be realised from the exploitation of its mineral resources, from both existing and possible new ventures, in an environmentally friendly manner. The overall implementation of the policy rests with the Ministry of Natural Resources and Environmental Affairs but is delegated to the Department of Mines and the Department of Geological Survey. The Department of Geological Survey undertakes applied research on the utilisation of industrial minerals in the local industry.

4.14.4.2 *Objectives*

In order to achieve the policy goal, the following general policy objectives have been adopted:

i. Promote mining by the private sector to promote diversification of the national economic base;

ii. Promote local utilisation of indigenous mineral resources in order to enhance value-addition;

iii. Increase the contribution of the mining sector to GDP, Government revenue; and foreign exchange earnings;

iv. Ensure that mining activities are conducted in an orderly and environmentally friendly manner;

v. Promote and encourage fossil fuel utilisation in order to reduce deforestation;

vi. Intensify and accelerate the exploration and evaluation of mineral resources; and

vii. Monitor and maintain records on occurrences of natural geological hazards.

4.14.4.3 *Strategies*

The strategies for achieving the policy objectives involve taking action to:-

i. Revise the Mines and Minerals Act to make it more competitive and favourable and strengthen the capacity of support institutions;

ii. Conduct, where necessary, research in the utilisation of indigenous minerals and enhance institutional collaboration;

iii. Monitor and enforce the Mines and Minerals Act;

iv. Encourage and promote the exploration and exploitation of high value export-oriented minerals such as gold, diamond, dimension stone and gemstones;

v. Create an Environmental Unit within the Department of Mines and maintain an updated mineral cadastre database;

vi. Intensify coal and petroleum exploration and exploitation and promote the production of coal briquettes;

vii. Maintain an up to date database on the geology and mineral resources of Malawi and encourage joint exploration work with the private sector; and

viii. Conduct geotechnical and seismological studies.

## 4.15 *Urban and Rural Planning*

### 4.15.1 *Introduction*

The overall policy governing urban and rural planning relate to spatially balanced development; human settlements and service centres; spatial coordination and development; and the use of land. This national science and technology policy will support this sector by advocating the development of human resources capable of utilizing science and technology to further enhance achievements already made in urban and rural planning.

### 4.15.2 *Objectives*

The major objectives are to:

4.15.2.1 Integrate all aspects of physical planning into national programmes of development so that physical development of Malawi is accomplished with the optimal use of all national resources both, human and physical;

4.15.2.2 Provide a spatial framework for the coordination and implementation of sectoral programmes and development projects;

4.15.2.3 Facilitate the promotion of a more spatially balanced economic growth that will ensure an optimal distribution of productive activities and population;

4.15.2.4 Provide the development of a system of urban and rural settlements and hierarchy of service centres that will be in conformity with the location of natural and human resources and permit the provision of infrastructure and other facilities on an economic basis;

4.15.2.5 Provide guidelines for the development of a transportation network to strengthen the functional links between rural and urban settlements with respect to the movement of people, commodity flows, the delivery of services, and general socio-economic activities;

4.15.2.6 Provide a spatial framework for the provision of physical infrastructure and social services in relation to the distribution of productive activities and population; and

4.15.2.7 Rationalize and promote the optional use of land and, in particular, the preservation of the best arable land.

### 4.15.3 *Strategies*

The strategies for achieving these objectives include taking action to:

4.15.3.1 Promote the most efficient use of national resources;

4.15.3.2 Encourage the participation of physical planners at an early stage of implementation of national development projects and programmes;

4.15.3.3 Provide incentives that would attract economic activities to be located at designated centres nationally;

4.15.3.4 Encourage the establishment of land settlement schemes and undertake land policy reform measures from time to time; and

4.15.3.5 Diversify external transport corridors, further develop the national road network; and improve the mobility of people and their access to rural and urban service centres.

## 4.16 *Defence*

4.16.1 *Introduction*

The Ministry of Defence has the overall responsibility for the development and implementation of the National Defence Policy. Although there are no written policies that guide military research and development, the Ministry of Defence is aware of the need to regulate the management of military equipment. The Ministry of Defence is also aware of the need for such policies to address the objectives stated below.

4.16.2 *Objectives*

The main Defence Policy objectives towards which this national science and technology policy would make contribution are to:

4.16.2.1 Promote basic level research and development aimed at identifying appropriate military technology for Malawi; and

4.16.2.2 Guide adequately the planning for procurement of new equipment, replacement and maintenance.

4.16.3 *Strategies*

The strategies relevant for achieving these objectives are to:

4.16.3.1 Assess the level of modernity of military technology to be maintained considering the limited financial resources and capability of the defence forces in the neighbouring countries;

4.16.3.2 Determine the point at which military technology would be considered obsolete and how such equipment should be handled; and

4.16.3.3 Promote the establishment of enterprises that assemble basic military equipment in Malawi.

## 4.17 *Internal Security*

4.17.1 *Introduction*

The Malawi Police Service has the constitutional mandate for the protection of public safety and for the rights of persons in Malawi. The major focus of the Malawi Police is the prevention and reduction of criminal activities, the maintenance of public order and internal security, detection of crime, apprehension and prosecution of offenders and the promotion of public safety on roads. In fulfilling its mandate, the Malawi Police depends significantly on various forms of technology.

4.17.2 *Objectives*

The objectives include:-

4.17.2.1 Promotion of the development and application of S&T capabilities for internal security;

4.17.2.2 Improvement on the application of information and communication technologies for internal security; and

4.17.2.3 Development of forensic science capabilities for internal security.

4.17.3 *Strategies*

The strategies for achieving these objectives include taking action to:

4.17.3.1 Promote education and training in S&T;

4.17.3.2 Promote training in forensic science and other specialized areas for internal security;

4.17.3.3 Modernise information and communication technology installations for internal security; and

4.17.3.4 Develop S&T research capabilities for internal security.

**4.18 *Disabilities***

4.18.1 *Introduction*

Science and Technology has the potential to reduce the suffering of persons with disabilities. Therefore, the state should assume an ultimate responsibility for the collection and dissemination of information on the living conditions of persons with disabilities and the promotion of comprehensive research on all aspects including obstacles that affect the lives of persons with disabilities.

4.18.2 *Objectives*

The objectives include to:

4.18.2.1 Ensure that disability issues have been incorporated into the country's socio-economic development planning;

4.18.2.2 Conduct regular prevalence studies on persons with disabilities by gender and age in order to collect information on their living conditions;

4.18.2.3 Conduct studies that develop, evaluate and adapt technologies that aim at reducing the suffering of persons with disabilities; and

4.18.2.4 Enable persons with disabilities have access to all information that affects their lives.

4.18.3 *Strategies*

The following strategies will be used to realise the above objectives:

4.18.3.1 Integrate disability issues into general research and training through the establishment of a forum where researchers and the disability sector can exchange information;

4.18.3.2 Develop a national database on disability-focused research that should include statistics on available services and programmes as well as on the different groups of persons with disabilities;

4.18.3.3 Develop national guidelines and minimum norms and standards for disability related research;

4.18.3.4 Promote and facilitate disability-focused research by the research community disaggregated by gender and age;

4.18.3.5 Collect data on persons with disabilities during national censuses and household surveys in collaboration with universities, research institutes and organisations of persons with disabilities; and

4.18.3.6 Facilitate better co-ordination of research, science and technology pertaining disabilities.

# 5. FINANCING OF SCIENCE AND TECHNOLOGY

## 5.1 *Introduction*

Science and Technology is seen by many countries to be an essential political function warranting careful and clear-sighted choices. An examination of the ways in which S&T is funded shows that, in a very large number of countries, the highest proportion is financed indirectly, by institutions belonging to the public sector and for that reason comes under the national budget. The national budget is, therefore, one of the essential instruments of Government S&T policy. Unfortunately, the conventional budgeting procedures in Malawi, as is the case elsewhere, do not easily permit the explicit and appropriate identification of funds allocated to S&T in the national budget. The procedures make it difficult to analyze the amount, distribution and purpose of such funding and this accordingly precludes any evaluation of their relationship to national development goals.

Generally the majority of African countries spend far less on R&D/S&T than other developing countries in Asia and Latin America. UNESCO has advised that a country should spend at least 1% of the GDP on R&D, and has, in specific case of debt relief fund outlined guidelines on how governments can use debt relief funds for S&T.

The ability of Government or the National Commission for Science and Technology to coordinate national S&T activities will be determined, mainly, by its ability to fund S&T activities. Consequently, sectoral institutions which are to benefit from financial resources under this national science and technology policy will prepare budgets for submission to the Commission which will, in turn, approve the provision of funding on the basis of agreed programmes of work. The institutions shall have the capability to generate and retain additional funds from their operations.

## 5.2 *Minimum Allocation to Science and Technology as a Percentage of GDP*

In view of the important role S&T plays in the development of economies, Malawi will under this national science and technology policy, allocate from public resources not less than 1.0 per cent of GDP to R&D and adequate funding to S&T activities by the year 2005. The advantage will be taken for debt relief fund so as to earmark a significant proportion of

these funds for S&T.

### 5.3 *Fund for the Advancement of Science and Technology*

In order to raise and allocate sufficient funds for scientific and technological activities, the Government of Malawi will establish a Fund for the Advancement of Science and Technology under an Act of Parliament. The sources of income for the fund will include:

5.3.1 Such sums as may be appropriated by Parliament aiming at being not less than 1 % of GDP for the previous fiscal year of Government;

5.3.2 Levies and an appropriate cess on the sale of S&T products and services;

5.3.3 Any sums or properties as may, in any manner become payable to or vested in the Fund by virtue of the operation of any law or as a result of its administration; and

5.3.4 Any sums of money donated to the Fund by any person, body or institution.

### 5.4 *Foreign Funding for Research, Science and Technology*

Foreign funds form an essential source of financing of R&D and S&T activities in Malawi. The higher than normal international collaboration in R&D also means a high level of foreign funds for R&D. While this will continue to be encouraged, Government should provide adequate funding for the execution of critical programmes. In order to ensure that this policy objective is attained, a matching grant mechanism will be established and allocated from the Fund for the Advancement of Science and Technology.

### 5.5 *Endowment and Trust Funds*

In order to expand the sources of funds for S&T activities, Government will establish endowment and trust funds. The Trustees Incorporation Act (Cap 5:03) already provides the legal framework for the establishment of endowment and trust funds which sector specific S&T institutions may use for this purpose.

### 5.6 *Private Sector Funding*

Private sector funding for science and technology, especially funding for technology research and development, will be encouraged. Linkages between the private sector and R & D institutions through contract research programmes, for example, will complement public funding for R & D programmes and, thereby, improve Malawi's R & D capacity.

### 5.7 *University Funding*

Universities are institutions where most of R&D work covering a wide range of socio-economic disciplines is undertaken. Presently, there is no separate funding for R&D work in the Universities in Malawi. The universities allocate some of the subvention for R&D work besides teaching and operating the universities. This means that there can never be adequate funds for R&D since the bulk of what is given has to support the entire administration of the institution. In order to promote R&D work in the universities, the Government will, through the National Commission for Science and Technology, provide separate funds under a dual support system for R&D work to universities and other science and technology institutions.

# 6. INSTITUTIONAL AND LEGAL FRAMEWORK

## 6.1 *Establishment of the National Commission for Science and Technology*

Evidence shows clearly that the economic development of a nation is directly related to the level of development in science and technology. The natural resource endowment of a nation is no longer a strong factor in determining the economic development of the nation as the case was before. Consequently, it is essential for Malawi to elevate the role of science and technology in her socio-economic development. To this end a National Commission for Science and Technology (NCST) will be established as a key strategy for enhancing both the development and application of science and technology in socio-economic development endeavours of Malawi.

The Commission will be a Government body established by a Science and Technology Act. It shall derive its authority from the Office of the President and Cabinet to ensure that it reaches out to the highest levels and all sectors of economic and social development of the Government.

The general and specific functions of the Commission will be as outlined below.

## 6.2 *Functions of the Commission*

### *6.2.1 General Function*

The Commission shall be the principal body providing S&T advice to the Government and other stakeholders on all science and technology matters in order to achieve a Science and Technology-Led Development Strategy.

### *6.2.2 Specific Functions*

(a) Create science and technology awareness at the political and other levels of society and thereby obtain their commitment towards the value of science and technology as integral parts of national development strategies;

(b) Establish mechanisms to solicit support from the executive and legislative branches of Government, policy-makers and the private sector in order to promote the formulation and revision of policies, strategies, laws and regulations for science and technology and the monitoring of the implementation of science and technology development activities;

(c) Source funding from within and outside Malawi to finance the national research and development effort and allocate the funds to research institutions based on set priorities;

(d) Chart out national direction and establish national priorities in science and technology development in relation to socio-economic development needs;

(e) Appraise, review, monitor and evaluate priority research and development programmes, plans and projects of research and development institutions and

undertake independently or in collaboration with any appropriate person, body or institution surveys and research investigations considered necessary;

(f) Promote and advocate for the development of science and technology human resources by building capacity in science and technology education and training programmes and providing assistance in the development of appropriate science and technology curricula for the various levels of the education system;

(g) Create a conducive working environment for science and technology personnel in order to retain them and attract those outside Malawi to return through, inter-alia, providing appropriate science and technology infrastructures and facilities,

(h) Encourage the use of local expertise in science and technology matters through use of professional standards, ethics and guidelines and support professional science and technology associations;

(i) Encourage the establishment of research institutions that undertake research and development activities, which promote national socio-economic development and other specialized research, and development activities in a manner that enhances cooperation and collaboration among national and international science and technology personnel and institutions;

(j) Organize national science and technology fairs and open-days so as to promote science and technology awareness and culture; document, consolidate and disseminate relevant science and technology information and promote the role of information and communication technologies;

(k) Promote the transfer of technology through various methods and training, purchase and licence agreements and joint venture agreements with foreign partners, establish and maintain national capacity for negotiating, monitoring and regulating technology transfer agreements;

(l) Promote and encourage the patenting and commercialization of research results to enhance economic diversification, competitiveness and employment generation;

(m) Promote sustainable socio-economic development through the generation and application of environmentally friendly technologies in order to protect and conserve natural resources;

(n) Develop and synthesize science and technology indicators covering such aspects as research and development statistics, bibliometrics, technology balance of payments statistics, patent data, human resources and innovation data using internationally accepted procedures and standards;

(o) Conduct an inquiry into any matter being investigated by the Commission;

(p) Sponsor such national and international scientific conferences as it may consider appropriate;

(q) Promote and maintain cooperation in science and technology with similar bodies in other countries and with international bodies connected with science and technology;

(r) Prepare, every two years, a State of Science and Technology Report for presentation to the National Assembly; and

(s) Perform any other function or activity related to science and technology.

## 6.3 *Structure of the Commission*

### *6.3.1 Commissioners*

Commissioners, appointed in accordance with the Science and Technology Act, shall form the body that will exercise management and control of the Commission in a manner that is in common practice in Malawi. The President of the Republic of Malawi shall appoint a competent and high-level personality to be the Chairperson of the Commission. The composition of the Commission shall be broad-based and multi-disciplinary in nature covering the strategic sectors of the economy. It shall comprise eight members from industry, academia, R&D institutions or individuals prominent in S&T issues and members of the civil society.

### *6.3. 2 Parliamentary Committee responsible for Science and Technology*

There should be a Parliamentary Committee responsible for Science and Technology whose functions would be to provide a voice for S&T matters in the National Assembly. The Committee shall ensure that S&T is integrated into the national budget by the time it is approved by Parliament and that S&T is applied in socio-economic development processes of Malawi. The Committee shall also consider the biennial "State of Science and Technology" report before it is presented to Parliament.

### *6.3.3 Cabinet Committee responsible for Science and Technology*

There should be a Cabinet Committee responsible for Science and Technology whose overall function would be to monitor the development and application of science and technology in national development processes. The Committee shall also preview the "State of Science and Technology" report before it is sent to Parliament.

### *6.3.4 Director General*

A Director General who shall be the Chief Executive and serve as Science and Technology Advisor to the Minister shall head the Commission. In order to ensure that the Director General performs to the high expectations of both the scientific community and the general public, he/she shall be a competent person of high standing in a science and technology field with good management skills and appointed through competitive interviews on a renewable contract of five years based on an agreed set of performance indicators.

### *6.3.5 Secretariat*

There shall be a Commission Secretariat which will be headed by the Director General. The Secretariat shall be responsible for implementing the programmes of the Commission and shall perform the following specific functions:

6.3.5.1 Provide technical and administrative backup services to the meetings and other functions of the National Commission for Science and Technology and the Sectoral Committees;

6.3.5.2 Prepare and present to the Commission S&T programmes for their approval in accordance with the policy provisions of the Science and Technology Act;

6.3.5.3 Manage and coordinate S&T funds in accordance with general and specific directions of the Commission;

6.3.5.4 Maintain liaison with national and international agencies that provide financial and technical support for the implementation of the S&T policy;

6.3.5.5 Coordinate all science and technology related issues in the country;

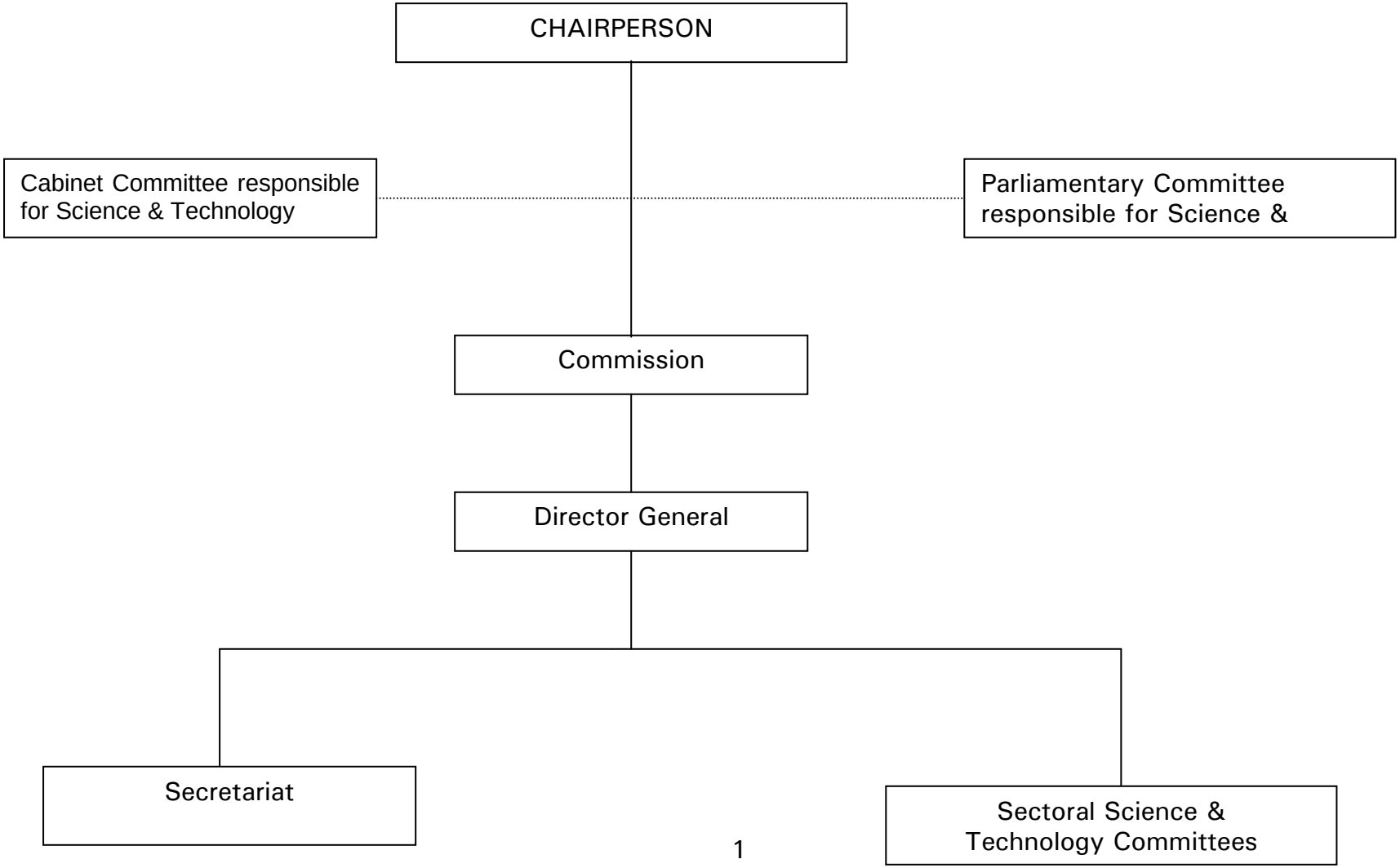
6.3.5.6 Prepare annual reports on the progress made for consideration by the Commission; and

6.3.5.7 Perform such other functions assigned by the Commission from time to time

*6.3.6 Sectoral Committees*

There shall be Sectoral Committees which shall have direct reporting responsibilities to the Commission through the Director General. The Sectoral Committees shall, among other members, comprise of Science and Technology Directors who shall be appointed in each relevant Ministry as a link between the sectoral Ministry and the Commission. The Science and Technology Directors shall have the overall responsibility of coordinating S&T issues in their respective Ministries.

## FIGURE 2. STRUCTURE OF THE COMMISSION



## FIGURE 3. STRUCTURE OF THE SECRETARIAT

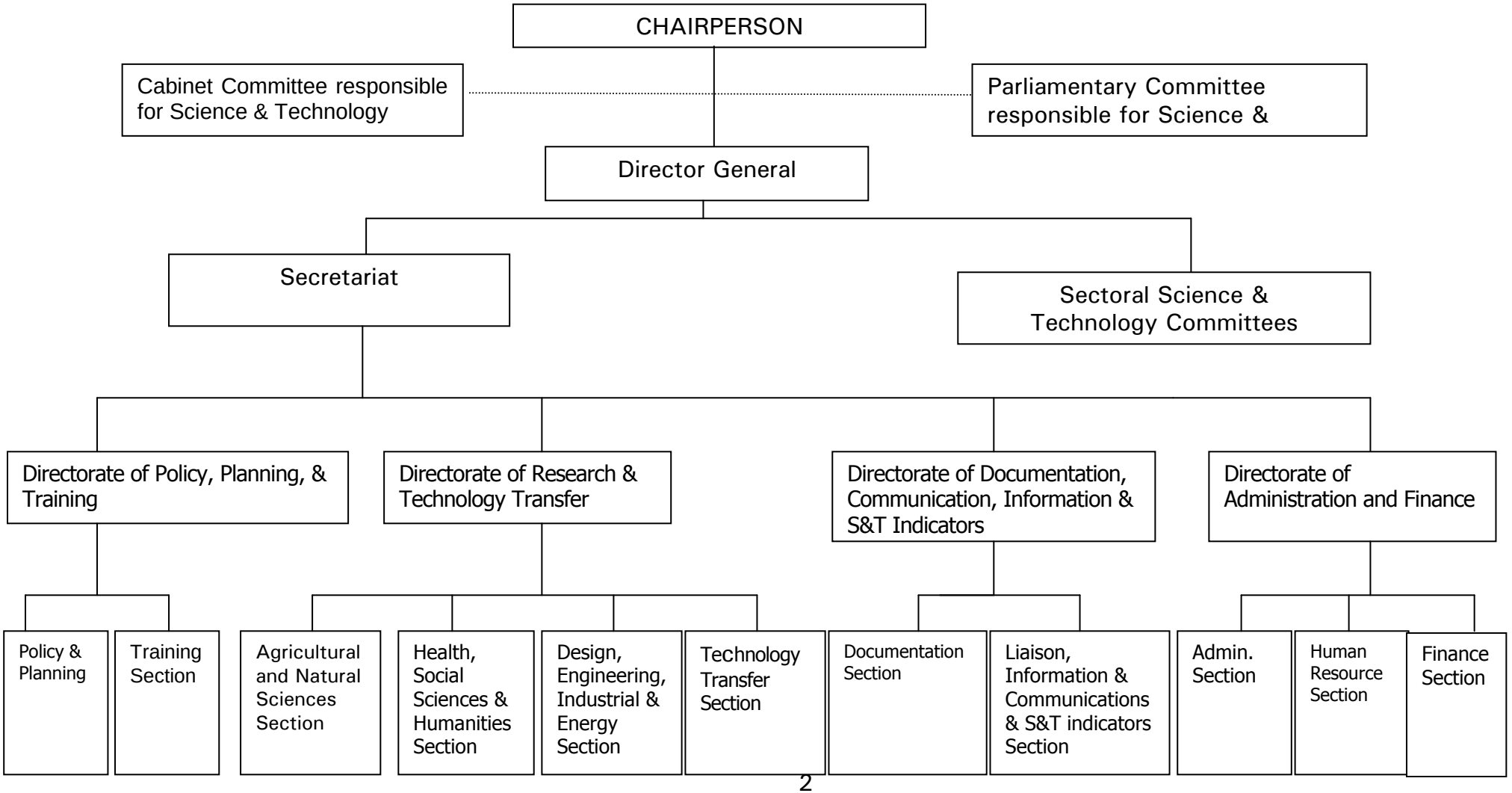


**FIGURE 4. STRUCTURE OF SCIENCE AND TECHNOLOGY COMMITTEES**