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United Nations
Educational, Scientific and
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Lesotho Science & Technology Policy

2006-2011

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Foreword

Fellow Basotho, we are living in the information age. It is a period of unprecedented change, driven by science and technology (S&T). Whether we accept or not, Lesotho is part of this global phenomenon and this means that every citizen and resident needs to be part of our global search for development, durable peace and a progressive as well as sustainable economy. The information age and information highway or what we commonly refer to as the 'Internet' provides us with a common vehicle to advance our pace and prospects. The major challenge facing us is how to engage science and technology productively to generate the goods, services and revenue we need, using first our local resources, talents and skills.

For us in Lesotho, science and technology must be more than just buzzwords in our daily vocabulary. They must take us beyond today's consumption, providing jobs and a good income stream. S&T must underpin our plans, programmes and activities, as individuals and entrepreneurs. This applies whether we manage or operate small, medium and large enterprises or work for others. S&T must help us to improve the living conditions of every citizen, irrespective of gender, age, colour or where they choose to live. This S&T policy is the best key to empower ourselves with the relevant skills, knowledge, competencies, know-how and attitudes. It must give us new capacities to create, innovate, add value, and to develop and produce competitive goods and services while generating meaningful jobs and job opportunities for all our people, in all the districts and regions.

Our nation expects nothing less. In this regard, government has shown its clear intent to engage science and technology seriously. Government is committed to provide resources to facilitate the operations of core S&T institutions, and to assist our citizens - young and old, men and women, rural and urban - to acquire, adapt, integrate and apply appropriate science and technology. This will enable them to harness our natural resources and other endowments and make Lesotho a better place to live in, work and to derive a decent standard of living from the collective wealth of our nation. Science and technology must impact on our actions and attitudes. Through this S&T policy, we hope to boost citizens' respect for the fragile environment, our national institutions, and Lesotho's rich biodiversity and culture. It must help us understand, promote and protect our traditions and community knowledge systems. Pursued in this light, this Policy will be a great stimulus to all citizens, industry and government. It will help us to be creative and grow mentally, industrially and socially.

As the custodian of this science and technology policy, my Ministry would like to assure all stakeholders that we will make every effort to support and work alongside S&T implementing agencies, and with our partner institutions in the public and private sectors. We will broaden cross-sectoral consultations, and fully involve the private sector in all our decision-making systems. In turn, let me implore all stakeholders to use this S&T policy as the tool and key to build up their competencies and competitiveness; and to assist the nation in achieving the highest level of added value, efficiency, quality, and of productivity in what we produce, factor in and service.

Finally, it is my fervent hope that every Mosotho will benefit from this S&T policy. It is also my hope that each citizen will be empowered, equipped and confident to use and share the benefits of our natural, cultural and human resources and to fully utilize the physical infrastructure and public investments to help move the economy forward. Let us resolve today to make this S&T policy work for all of us.

Hon. M. T. Thabane
Minister of Communications, Science and Technology

Executive Summary

Science and Technology (S&T) occupy a unique place in Man's intellectual endeavor. They have not only widened the human horizon, but have profoundly influenced the course of human civilization. S&T has generated new information and value. The importance of the role of S&T in socio-economic development has inevitably been universally recognized. The scientific revolutions of the 20th Century have led to many technological breakthroughs, which promise to herald wholly new eras in many fields. It is our duty, therefore, in the beginning of a new century to ensure the fullest use of these developments for the well being of Basotho.

The National Science and Technology Policy is a consensus view, derived from a long, open consultation process that engaged all key stakeholders from all walks of life.

The National S&T Policy intends to promote the utilization of science and technology as a tool for economic development. It also intends to improve the human physical and spiritual well-being and for the protection of national sovereignty being an integral part of the socio-economic development policies and objectives of the nation.

Accordingly, the S&T Policy reflects the collective aspirations, values, virtues, wisdom, history, tradition and diversity of Basotho nation. Furthermore, the Policy has reviewed the key features in Lesotho's environment including the current pool of S&T personnel, institutional asserts, the challenges and opportunities as well as the status of functioning S&T infrastructures based on objective analysis and Lesotho's current economic capacity. A set of policy measures is also proposed, as well as implementation strategies that will employ a four-phased approach.

The S&T Policy document is represented through the following structures:

1. The **first part** of the Policy document is **the Introductory Chapter** that looks into basic contents which need to be taken into consideration in an S&T policy, such as socio-economic features of Lesotho, in which S&T infrastructure supports and in a way indicates the technological status of the nation. The effectiveness of Lesotho's S&T Policy and research efforts will be meaningful and sustainable if only their interventions will be correctly matched with the national aims and objectives.

II. The **second part** deals with the main thrust of the **Science and Technology Policy**. The chapter is composed of the following features:

The *National Framework for S&T Development,* for which a significant proportion of national resources will be allocated to science and technology education, fight against HIV/AIDS, SMMEs development and support product and export-oriented industries through the application of S&T and recognizing its coordinating role in public S&T funding, education and other relevant institutions including research and development.

Integrating Basotho Core Values:
In terms of its long-term development, Lesotho sees the need for S&T to be closely linked with both tradition and modernism. S&T development should, therefore, reflect this dualism and add value to our values, cultural diversity, history and strong community relationships. The integration of Basotho's indigenous Knowledge Systems and practice for socio-economic development is one of the main areas of focus for the S&T Policy.

National Vision:
This policy provides guidance and catalytic role that enables the country to reach its long-term goal, with particular emphasis on devising strategies that will, by the year 2020, lead Lesotho to a well established technology, as stipulated in the National Vision Statement.

S&T Vision:
Within the context of science and technology, the policy aims to achieve a free, prosperous and progressive economy and society that are sustained through intelligent use of science and technology assets through enlightened citizens, corporations and government.

S&T Mission is to:
Transform Lesotho into a modern state, having enough highly skilled, innovative and technically trained personnel with a competitive S&T infrastructure to support a growing and dynamic economy.

III. The **third part** of the policy document focuses on the framework for implementation. It outlines the **measures that can be taken in order to implement the policy**. They are *inter alia*:

- Re-focusing the *funding framework* of the entire science and technology system, including the management of research and development;
- Develop competitive legislation, infrastructure and adequate institutional arrangement;
- Establish *institutional capacities* and systems to monitor S&T Policy targets, performance and impact. Improve sector coordination and planning in the areas of science and technology.

- The *strategy* for science and technology *policy coordination* is further described with clearly defined roles of relevant institutions, starting from the Ministry of Communications, Science and Technology, which spearheads and coordinate the S&T Policy implementation process.

Furthermore, the role of Sister Ministries and relevant institutions are clearly defined. These are the roles towards promotion of science and technology including how the institutions themselves place S&T in their systems towards boosting their sector performance. Some of the identified stakeholders in this regard are as follows:

- Education and Training;
- Industry, Trade, Cooperative and Marketing;
- Local government and Housing;
- Agriculture, Land Reclamation and Food Security;
- Health;
- National Resources;
- Tourism, Culture and Environment;
- Private Sector and Parastatals;
- Civic Organization and Consumer Association;
- NGO's, Regional and International Agencies.

The Chapter further identifies cross-cutting issues that affect S&T development, therefore need a special attention and intervention. They are:

- S&T Brain Drain
- Standards and Quality Assurance
- Gender Equity in S & T
- New Emerging Technologies

IV. The last part of the policy document is the most critical, which adds on to the existing institutional set up. The policy on S&T further suggests **new institutions** that will be complementary and will revamp the existing ones. The intention is to urgently address the national needs through S&T investment, which will consequently form a vibrant national system of innovation. The new S&T Initiative and Institutions that are dictated by the S&T Policy are as follows:

- Lesotho Advisory Commission on Science and Technology;
- Science and Technology Trust Fund;

Acknowledgements

Science and technology development is complex as a crosscutting issue; as a result, it usually needs joint efforts from various stakeholders. Furthermore, a policy document of this nature needs laborious work, heavily drawn on inputs and sentiments of the citizens of Lesotho and the scientific community (both local and international). It is on this note that the Government of the Kingdom of Lesotho wishes to thank all those who made their contributions by making this document a success.

Our sincere gratitude further goes to government agencies, private sector, civil society and the public at large, with their invaluable inputs into this national document. Our heart-felt thanks also go to the United Nations Educational, Scientific and Cultural Organization (UNESCO) and United Nations Economic Commission for Africa (UNECA) through Dr. Hamel and United Nations Industrial Development Organization (UNIDO) through Dr. Frank Bartley, all for providing support and guidance during the formulation process of this policy. Similar thanks go to the United Nations Conference on Trade and Development (UNCTAD), Division on Investment, Technology and Enterprise Development, particularly to the Chief of Policy and Capacity-building Branch, Dr Mongi Hamdi, who reviewed the draft and facilitated consolidated inputs from the United Nations Commission on Science and Technology for Development (CSTD). Our special thanks also go to the then chairperson of the commission and The Science Advisor to the President of Jamaica Dr. Arnoldo K. Ventura with his invaluable contributions to the document.

We wish to express our appreciation to all other individual contributors, as the list remains longer, for their sterling contributions and making this document a success.

Preface

This document presents Lesotho's first Science and Technology Policy. It is the consensus view, derived from a long, thorough and open consultation process that engaged all key stakeholders, from all walks of life. This policy formulation process was undertaken through various stages namely; needs assessment, S&T situation analysis, sectoral consultations as well as district consultations. The main aim was to build a sense of ownership and to develop a policy that is based on national needs and objectives.

Accordingly, the S&T policy reflects the collective aspirations, values, virtues, wisdom, history, tradition and diversity of the Basotho nation. To assure the successful realization of its several objectives, it is the obligation of every Mosotho citizen and resident to give his or her full weight in supporting the measures and instruments, which have been developed on the basis of the various consultations.

Furthermore, the policy document reviewed the key features in Lesotho's S&T environment, including the current pool of S&T personnel, institutional assets, the challenges and opportunities as well as the status of functioning S&T infrastructures. Based on the objective analysis of Lesotho's current economic capacity, a set of policy measures and an implementation strategy that will employ a three-phased approach are proposed.

List of Acronyms and Abbreviations

BEDCO	= Basotho Enterprise Development Company
CBOL	= Central Bank of Lesotho
COMESA	= Common Market for East and Southern Africa
CSAVE	= Council for Science and Vocational Education
BOS	= Bureau of Statistics
DDC	= District Development Councils
DST	= Department for Science and Technology
GDP/GNP	= Gross Domestic Product / Gross National Product
ICT	= Information and Communication Technologies
LAI	= Lesotho Association of Inventors
LCCI	= Lesotho Chamber of Commerce and Industry
LACST	= Lesotho Advisory Commission on Science and Technology
LHDA	= Lesotho Highlands Development Authority/Water Project
LMA	= Lesotho Manufacturers Association
LNDC	= Lesotho National Development Corporation
LP	= Lerotholi Polytechnic
LCE	= Lesotho College of Education
LTRIC	= Lesotho Technology Resource and Information Centre
LIRC	= Lesotho Innovation and Research Centre
LITF	= Lesotho Innovation Trust Fund
MCST	= Ministry of Communications, Science and Technology
MFDP	= Ministry of Finance and Development Planning
MITCM	= Ministry of Industry, Trade, Cooperatives & Marketing
MNR	= Ministry of Natural Resources
MPWT	= Ministry of Public Works and Transport
MRC	= Multi-disciplinary Research Centre (NUL)
MTCE	= Ministry of Tourism, Culture and Environment
NCDC	= National Curriculum Development Centre
NCIR	= National Centre for Innovation and Research
NDP 7	= 7th National Development Plan
NIC/LDC	= Newly Industrialized Countries / Less Developing Country
NPC	= National Planning Commission
NUL	= National University of Lesotho
OPM	= Office of the Prime Minister
PSIP	= Public Sector Investment Programme

R&D	= Research & Development
RDI	= R&D Institutes
RIC/RDC	= Regional Innovation Centres/ Rural Development Centres
S&T	= Science & Technology
SACU	= Southern Africa Customs Union
SADC	= Southern Africa Development Community
SME	= Small and Medium Enterprise
TIDC	= Technology Incubators and Demonstrations Centres
TVET	= Technical and Vocational, Education and Training
UNDP	= United Nations Development Programme
UNESCO	= United Nations Educational, Scientific and Cultural Organization
UNIDO	= United Nations Industrial Development Organization
VA	= Value Added

1. Context to Lesotho S&T Development

1.1. Capacity to Sustain S&T

Lesotho is an independent country situated within the geo-political border of South Africa and fully landlocked by it. Although Lesotho is a least developed country with limited resource endowment, it has achieved a real annual growth rate of 4.2% between 1980 and 2002 and the national economy in terms of the gross national product (GDP) is now M7.5 billion in 2002 (approximately US $ 1 billion).

Currently, Lesotho's per capita gross national Income (GNI)[1] averages around US $488, while GDP per capita on average is around US $389 pa from 1998 to 2002. Historically, there has been a significant traditional trend of economic dependence on South Africa for jobs (particularly in the mining sector), goods and services. The country is largely agrarian with pockets of fairly high urban density. S&T infrastructure for industry and commerce, especially outside the capital city, Maseru and other urban centres is relatively poor (as shown in Table 2) and subsistence farming provides the main source of livelihood for most Basotho.

Despite this current low economic GDP activity and income level, the country abounds with a variety of attractions and special features. These hold great potential for value added prospecting, and can provide citizens with premium income and employment options. Value chain development is commercially promising in many areas including agriculture, tourism, water, energy, industry and commerce. The integration of science and technology would be particularly important to promote and sustain such developments. The extensive highlands, which often exceed 3,000 metres above sea level, provide Lesotho with tremendous scope and opportunity to build vibrant eco-tourism projects and small export-oriented industries.

As the only country in the world that has all of its territory located 1,000 meters above sea level, the country has several features that make it distinctly unique. Its climate and terrain naturally support a variety of outdoor activities such as snow and water skiing, skydiving, ice-skating, trekking, horse back trailing, car racing and many other

[1] *Gross National Income (GNI) is a more appropriate measure of Lesotho's economic resources than the GDP, due to large net factor income from abroad (remittance from RSA mines) and net transfers from SACU revenue pool. GNI is about 120% of the GDP (GNI: M9,231 mil).*

outdoor eco-tourism attractions. An impressive range of majestic highlands, continental climate, breath-taking scenery and landscape make Lesotho home to a rich variety of foliage, fauna, flora and wild life not popularly seen on the Continent.

Properly organized and marketed, such indigenous assets represent major attractions for aerial sports, eco-tourism, exotic agricultural crops and ultimately a host of small and medium size manufacturing firms. In addition, this mountainous Kingdom provides the source of the Orange River, which permeates South Africa, Botswana and Namibia. Presently, Lesotho's water resources, with the exception of the water sold to neighbouring South Africa, are only partially used. Extensive plans have been developed to harness the hydro-electric potential and to regulate internal distribution for increased farming and recreational purposes.

1.1.1. Socio-Economic Considerations

Lesotho shares membership in a number of regional, economic and political groups, including SACU, SADC, NEPAD and AU, which together offer many opportunities for export and trade development. Besides, there are concessional trade agreements with the European Union, under EU and ACP protocols; and with the United States of America, under AGOA among others. Many of the above concessions are not fully exploited by Lesotho enterprises due to the country's low value adding capacity, and poor infrastructure for S&T, manufacturing, agro-industry and tourism.

In comparison to its SADC counterparts, Lesotho is a small country (30,350 KM^2) and a low economy[2] (**GDP:** US$ 1 Billion, 2002), in terms of GDP per capita and entrepreneurial activities. (see **Table 1**). While in relation to the SACU network, it is the only LDC, and has the least S&T infrastructure to support competitive industries, trade and commerce, when compared to other SACU members.

Box 1: Major S&T Assets

- Base, which with care, is amenable to exotic fairly educated and intelligent population.
- Flexible and trainable labour force.
- Available clean and potable water supply.
- Scenic landscape and temperate climate.
- Breath-taking highlands, and scenery with a rich variety of fauna and flora.
- Rich tradition of culture and variety of indigenous technologies and practices.
- Single national vernacular (Sesotho) with English as a second official language.
- Sources of hydroelectric energy; rich soil agriculture, crop production, and eco-tourism.
- Strategic location within South Africa.

[2] *GDP: M7.5, approximately $1 billion (2002) GDP/per capita: $328.6/ 2.2 mil (2002).*

Table 1: Lesotho's GDP in million Maloti at constant 1995 prices (selected sectors)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Agriculture, fishery	651.5	524.2	513.7	565.4	551.1	524.4	617.3	620.2	617.8	642.5	647.1
Manufacturing	303.7	330.1	363.6	412.7	438.4	469.3	585.1	560.6	542	533.8	581.8
Building & Construction	434.1	568.1	613.9	530.7	553.2	601.5	630.6	657.2	578.6	623	629.3
Transport & Communication.	83	95.1	99.4	106.6	107.7	117.7	122.3	137.4	131	131.1	133.9
Education & Training.	216.3	228.5	239.7	255	259.2	274	281.3	298.6	307.4	312.2	315.8
Health & Social Services.	45.1	38.8	42.9	59.8	60.2	56.4	63.3	59.5	65.1	68.9	69.7
GDP @ Market Price	2771.2	2876.5	3015.8	3129.9	3237.1	3383.7	3720.6	4023.5	3808.4	3884.6	3981.8
GDP in Maloti ('80)	434	452	452	478	536	584	658	681	622	999	
GDP/Capita (Maloti)	249	246	239	245	267	283	312	353	281		
GDP Change % age	3.8	4.8	3.8	3.4	4.5	10.0	8.1	-5.3	2.0	2.5	

Source. Bank of Lesotho Database

Technology infrastructure and international comparators of S&T performance measures such as telephone, cell phone, radio, TV, Internet connectivity, road, rail, cargo port infrastructure, industry, energy and communication networks show Lesotho is lagging behind most SADC states. These factors were highlighted by the 1999 SADC comparative study of S&T infrastructure in the SADC sub-region and also by the UNDP 2000 Human Development Report. These reports also indicate that Lesotho has an average of 119 persons per telephone line; 20 persons to one radio; 40 persons to one TV), 500,000 persons to one ISP[3] and a UNDP HDI[4] rating of 0.54 which support the need and urgency for the science and technology policy.

1.2. Development Challenges

With its current LDC status, Lesotho's development challenges are many and the solutions require firm and innovative leadership, well-coordinated S&T structures, and an effective technical human resource strategy. Some immediate hurdles facing Lesotho's S&T efforts include: the high rate of unemployment, rising poverty level; HIV&AIDS, persistent gap in demand and supply of S&T-trained manpower; soil erosion, poor land use, inadequate drainage, obsolete agricultural practices and technologies, all of which contribute to undue pressure on the country's limited arable land.

Box 2: Development Challenges

- Small domestic market with low consumer purchasing power.
- Landlocked country status, with only one neighbour.
- Poor S&T infrastructure and inadequate technical manpower.
- Low industrial and agricultural value-added activities and linkages.
- High rate of unemployment and rising incidence of poverty.
- High environmental vulnerability (soil erosion and climatic change).
- High incidence of HIV&AIDS, disease and health-related concerns.

Furthermore, Lesotho's industrial and commercial sectors continue to report very low development indices, as they relate to the growth rate of domestic value adding enterprises, sector linkages, export industries and their propensity toward high import content. Table 1 highlights the 10-year average performance of Lesotho's economy and **Table 2** highlights the significant S&T socio-economic comparison, technology diffusion and developmental impact, viewed alongside selected SADC and Non-SADC countries.

[3] *Internet Service Provider or Local Internet Host*

[4] *Human Development Index taken from the UNDP Human Development Report, 2001*

Table 2: A comparative review of S&T policy related indicators in selected countries

Countries	Population (Million)	Literacy Rate %	Labour Force (x1000)	Unemployment rate %	Persons per Tel Lines	Persons per Cell phone	Radio Broadcast in country			Persons per Radio set	TV Broadcast in country	Persons per TV Set	Internet ISP in country	Industry share in GDP	Service Sectors Share in GDP	Import/ Export Index	Land Area (1000 Sq Km)	Arable land (Sq Km per 1000 Persons)	Ports & Harbours		Roadways 1000 Km	GDP Per capita (US$) (PPP	H D Index (UNDP WR 2001)
							AM Station	FM Station	SW Station					Industry Share	Service Sector				AIR	SEA			
							AM	**FM**	**SW**					**IND**	**SER**				**AIR**	**SEA**			
Botswana	1.58	69	235	30	20	N.A	7	15	5	6.6	0	49	2	2070 (46%)	2250 (50%)	.86	600.3	3.8	92	0	5.6	4500	0.58
Ghana	19.5	64	4000	20	97	650	0	18	3	4.4	11	11.2	4	570 (30%)	570 (30%)	.68	238.5	1.46	12	2	13.9	1900	0.54
Jamaica	2.65	86	1113	16	9	58	10	13	0	2.1	7	5.8	8	1825 (42%)	1825 (50%)	.50	10.9	0.58	36	8	13.9	3650	0.73
Mauritius	1.20	84	515	2	8	50	5	9	2	2.9	2	20.7	4	3045 (29%)	6405 (61%)	.81	1.80	0.75	5	1	1.9	10500	0.76
Namibia	1.77	82	505	35	18	88	2	34	5	7.6	8	29.5	7	1290 (30%)	2494 (58%)	.93	825.5	.005	135	2	5.5	4300	0.61
New Zealand	3.88	99	1890	7	2	7	124	290	4	1.0	41	2.0	2000	4002 (23%)	12006 (69%)	.78	268.7	3.54	111	5	55.7	17400	0.91
Lesotho	**2.14**	**83**	**689**	**40**	**119**	**24**	**4**	**4**	**1**	**20**	**2**	**39.6**	**4**	**941 (42%)**	**986 (44%)**	**.33**	**30.3**	**2.6**	**1**	**0**	**1.4**	**2240**	**0.54**
Singapore	4.15	92	1900	3	0.7	4	0	15	5	1.6	4	3.1	10	7784 (28%)	20016 (72%)	.97	.65	,003	9	1	3.3	27800	0.87
South Africa	43.5	85	15.5	30	9	21	14	347	NA	3.1	556	7.3	58	2415 (35%)	4140 (60%)	1.1	1219.2	2.8	744	7	63.1	6900	0.70

Source: Calculations based on statistics obtained from Africa competitiveness Report 2000/2001, World Economic Forum, UNDP Human Development Report 2001, Namibia Human Development Report 2001; US CIA Database. Lesotho Telecommunications Authority Annual Report 2001/2002 Except in few instances, the above statistics are based on 1999 data

1.3. Economic Opportunities and Areas for S&T Focus

Assessment of current capacities and work programmes of S&T-related enterprises and R&D institutions, in particular, identifies existent strengths, gaps and new opportunities in the various sectors. Effective resolutions of these require public and private sector cooperation and convergence. This implies that such institutions need to adopt and implement S&T strategies that:

- Focus research and development efforts on local products and local materials; use optimally, available local skills and technical competencies and seek to transform Basotho enterprises to be internationally competitive. Through this approach, converge S&T institutions and programmes in the national interest; extend domestic linkages sectorally and cross-sectorally; maximize added value in local production and services; raise personal and institutional productivity;
- Enhance Lesotho's GDP and export income and expand job and employment opportunities.Assist Lesotho entrepreneurs and government to focus on S&T budget toward research, science education, technical and vocational training.

The private sector will be encouraged to invest in R&D and to cooperate, where feasible, with publicly funded S&T institutes on common interests. This policy will, therefore, seek to build stronger partnership among research institutions, industry and governments as an essential strategy in driving innovations and industrialization. Public- funded S&T institutes will work cooperatively with Lesotho's investment community to extend, deepen and spread industrial and commercial activities throughout the country.

Box 3 provides an indicative list of key sectors and products identified at the year 2000 S&T stakeholders' conference on S&T policy.

Box 3: Key sectors and Lead products for S&T focus:

- Water, medicine, scents and cosmetics.
- Birds, bees, fish and game.
- Animal products – wool, mohair, meat, bones, skin.
- Fruits, roots, tree crops and horticulture.
- Tertiary manufacturing, including electronic assemblies.
- Semi-precious gems, stone works and carvings.
- Renewable energy: hydro, solar, wind and biomass.
- Traditional & indigenous technologies.
- ICT programmes & bio-technology

1.4. Rationale for Lesotho's S&T Policy

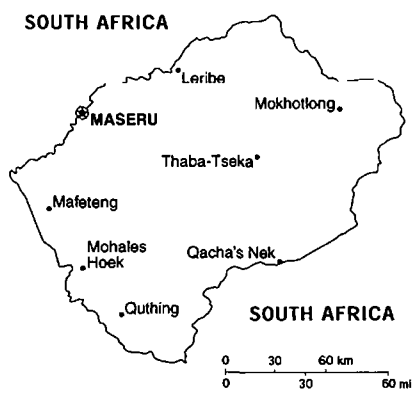
Presently, Lesotho is one of the members of SACU that has least developed country status. Lesotho's infrastructure is built essentially for trade with the RSA and as such, S&T facilities are quite limited, in terms of industries and research.

This LDC status reflects a contradiction, as Lesotho was the first SACU member, outside of South Africa, to have developed a fully functioning education system that included university training. In fact, many SACU and SADC citizens had their university education in Lesotho. Unfortunately, today, Lesotho is lagging behind its SACU and SADC counterparts, in science, technical education, research, manufacturing capacity, and this is shown by Lesotho's low per capita GDP.

In addition, the supply and availability of S&T graduates have consistently been shown to be inadequate over the years, and worst of all, it has been dwindling annually due to outward migration, particularly to South Africa. Brain drain poses a major challenge to future S&T efforts requiring an enlightened policy to promote retention of S&T graduates and to provide better access, mobility and offer differential wages where necessary. To address some of the above concerns, S&T policy objectives must find answers to the following questions:

(I) How can local scientists and technologists be retained in the country?
(II) How can Lesotho best use its S&T resources to boost local employment and income?
(III) How can Lesotho entrepreneurs engage S&T and R&D to diversify the country's economic and employment base?

Solutions to these issues may not be easy. Therefore, the S&T policy must be considered as a core national strategy to boost GDP activities, and to convert domestic savings into real domestic investments, employment and to add local value. Lesotho's latest statistics show a comparatively high functional literacy rate, at 83% (UNDP World Report 2001), which is quite high by the SADC regional standards. Yet this factor has so far neither been effectively used to produce more S&T graduates nor to increase the country's entrepreneurial skill base.



As a result of the past low S&T linkages, real GDP output, employment capacity has been falling annually.[5] This trend has been especially visible during the second half of the 1990's with the effective completion of Phase 1 of the LHDA[6] water projects. The cumulative effect of income losses in the economy precipitated the dramatic deterioration in per capita income, average citizens' purchasing power and the steady decline in public services.

Adding to the weak domestic linkages is Lesotho's land-locked status, and its recurring low GDP performance. Lesotho has grown increasingly more dependent for jobs, income and goods on its only neighbour, South Africa. Given this scenario, S&T planning and development in Lesotho must be done with prudence, purpose and strategy. This implies that S&T policy needs to focus on areas and products in which Lesotho has or can develop natural and competitive advantage. Box 3 suggests a number of S&T related products, in which Lesotho has demonstrated, or could develop competitive advantage.

National and sector planning have in the past tended to underestimate the critical role and impact of science and technology. For example, resource allocation to S&T has traditionally been low and tipped toward trade and consumption. Low priority was accorded to science, technical education, science teaching, and scientific research. Industrial development policy has also been ineffective due to the absence of integrated S&T infrastructure.

The result of all this low S&T activities means that the country's development continues to lag behind its true potential. At the same time, poverty and unemployment have been on the rise annually. For our citizens to cope and be able to participate meaningfully in today's knowledge society, more attention has to be given to information and communication technologies. Citizens and firms need to innovate more, and to increase research outputs. Lesotho's ability to compete globally and to raise its citizens' income levels and living standards can only be improved if the technical skills gaps are closed and the mismatch between education output and market demands are fixed. If Lesotho's S&T policy and research efforts are to be meaningful and sustainable, science and research interventions will need to be correctly matched to the problems faced by Lesotho's citizens, enterprises and entrepreneurs. Therefore, the need for an effective S&T policy is clear. Prudence dictates that the S&T system must adopt a multi-disciplinary approach, which includes:

- Policy research - to determine the conditions for sustainable development, including gender issues, role of the state, market forces and civil society;
- Information systems research - to integrate complex systems such as information, computer and communication technologies and accommodate programmes for

[5] *Central Bank of Lesotho database and Annual Report 2001*

[6] *The Lesotho Highlands Development Authority has plans for various water projects to be undertaken in phases*

enterprise rehabilitation, managing industrial enterprises, renewable resources, health delivery systems; and lastly,

- Investigative research - to focus on specific scientific and technological problems facing Lesotho such as low added value products and services, degradation of the environment, soil, declining agricultural yields, etc.

An appropriate S&T policy is necessary to advance Lesotho's value-added production and services. It is also necessary to improve market data and S&T intelligence, as well as enhance the local technical publications, personal knowledge and to improve our understanding of traditional technologies and indigenous practices.

Equally, it is needed to raise on-farm and in-plant productivity, raw material usage and domestic linkages with informal, small medium and large enterprises within Lesotho and to generate export earnings. This S&T policy is intended to respond to these national needs and to chart a new growth path for local employment and income generation that is sustainable. It will aid our ability to add value in education, agriculture, health, industry, transportation, communication, and tourism, and others.

2. The S&T Policy

2.1. National Framework for S&T Development

Lesotho has new a development planning system that will implement, among other things, new policies such as Poverty Reduction Strategy Paper (PRSP), programmes and projects to address the issues of sustainable development, wealth creation, poverty and disease eradication, human development, food security, environmental security, rural and social balance and gender equity.

Significant proportion of national resource will be allocated to S&T education, HIV&AIDS, SME development and to support production and export-oriented industries. The development planning system hopes to generate higher levels of social and economic services that will be accessible to all citizens. In order to achieve the set objectives, the S&T policy has been accorded high priority, recognizing its coordinating role in public life, S&T funding, S&T education, R&D promotion and its integrating role at sector policy and at programme levels. This being Lesotho's first S&T policy, Government is committed to integrating S&T policies into its macro policy framework and in the rolling sectoral plans in order to boost economic growth and sustain a competitive, progressive and innovative entrepreneurial sector.

Thus, this S&T policy is a fundamental part of the national development planning and implementation framework, and will embrace stakeholders from all walks of life. Embodying Lesotho's collective values, virtues, wisdom, history, tradition and diversity, the S&T policy is a tangible expression of the shared vision and aspiration of Basotho. Addressing the citizens' expectations, the policy seeks to support the national growth targets, in terms of increased contribution to local added value, employment, manufacturing value added, export production and earnings, direct, indirect and self-employment opportunities, gender equity in S&T participation and increased use and integration of indigenous technologies. These S&T-related targets will be achieved through enhanced R&D and S&T innovations, vocational skills development and entrepreneurial training, and the fullest use and beneficiation of our local materials, human and natural resources.

2.2. Integrating S&T with Basotho Core Values

In 1966, Lesotho attained its independence from colonialist Britain. With the undivided determination and foresight of community leaders, Basotho evolved a robust value system forged on the basis of self-reliance, unity, sense of community, and reinforced through their collective strength, resilience and survival instincts.

Box 5: Basotho Core Values:

- Resourceful
- Determined
- Courageous
- Resilient
- Self-reliant
- Enduring
- United
- Patient
- Innovative

Over the years, Basotho matured their vision, and maintained a common native language (Sesotho) that reflects their cultural diversity, heritage and traditions, which link them with the indigenous peoples of Southern Africa. Lesotho 's value system is premised on a functional democracy and a governance system that resembles the Westminster system, with a bicameral legislature, the executive arm with a Prime Minister as head of Government, and the King as Head of State.

As an open economy, Lesotho embraces free markets principles and recognizes the pivotal role of private sector initiatives for the country's sustained development. Accordingly, Lesotho has high regard for human rights, the rule of law and believes in having cordial relations with its regional neighbours. In terms of its long-term development, Lesotho sees the need for the S&T policy to be closely linked with both tradition and modernism. S&T development should therefore reflect this dualism and to add value to our rich diversity, history, values, culture and community relationships.

2.3. National Vision

Lesotho is undoubtedly one of the most homogenous communities in Africa, reflecting one language and a shared common heritage. Accordingly, Basotho's vision is to position Lesotho among the leading nations on the Continent, with a competitive, highly trained labour-force, and an S&T–driven infrastructure that is able to sustain a progressive and prospering economy and society. Its economic policies are geared to deliver meaningful jobs and income levels, as well as to generate new employment opportunities. These outputs are to be sustained by appropriate S&T investments, technical education, and by an innovative, enterprising and competitive population.

Public consensus highlighted Lesotho's core policies, lead economic sectors, and the strategic programmes that will effectively address citizens' needs and concerns. Science and technology was seen as an indispensable component of national develop-

ment strategy, to underpin sector policies but also to enable communities to find new ways and practical solutions to address the increasing level of poverty, disease, foreign and state dependency. Furthermore, it was agreed that S&T investments should reinforce Basotho's desire to see greater organization, integration and commercial linkages amongst economic sectors to boost local enterprises, to generate higher rates of domestic employment, income and services that are competitive, accessible and sustainable.

Box 6: The National Vision:
By the year 2020, Lesotho shall be a stable democratic, united and prosperous nation at peace with itself and its neighbours. It shall have a healthy and well-developed human resource base. Its economy will be strong, its environment well managed and its technology well established.

Government intends to harmonize sector policies and to use the S&T policy to pivot Lesotho's industrial and agricultural infrastructure among others, and to make agriculture, commerce and industry, internationally competitive and attractive to domestic and international firms. This goal is especially relevant for national institutions seeking to develop durable international partnerships to improve market access, and technology links and to link up with our indigenous small and medium enterprises. Within this framework, the S&T policy should enhance our technical human capacity, our public infrastructure and facilitate and support local production, job creation, factor productivity and meaningful value adding and entrepreneurial activities.

Box 7: Key Elements of the National Vision:
- Free, wealthier and more equitable society.
- Healthier society.
- Technologically- wiser and creative society.
- Just, stable, peaceful and caring society.
- Environmental and ecologically-friendly society.
- Prospering and progressive economy.

A fundamental goal of the S&T policy is to ensure the fullest integration of science and technology in schools, school curricula and the daily practices of our citizens in their workplace and homes. If Lesotho is to transform itself into a modern and growing industrial economy, every citizen will need to be well trained, competent, flexible, and equipped with competitive, market-relevant skills. Our human resource development strategy must encourage, produce and improve the competencies of managers, technicians, workers, entrepreneurs and investors. It must induce new attitudes and attributes to management reform, new priorities, focus and direction.

Similarly, our S&T-related ministries, parastatals and executing agencies will be challenged to review and recompose mandates of public-funded S&T institutions, their links with one another, and to forge pro-active relationships with the private sector. Pursued in this context, Lesotho's long term development, including public and private investment projects, will need to be more technology-driven, and our public and private enterprises should work closer and more strategically to better harness their synergies and complementarities.

While the choice of enterprise technologies and business policies will be left mostly in the hands of the private sector, it should be borne in mind that a science and technology policy envisages improved selectivity, choice and application of appropriate technologies. These choices and applications will not necessarily be based only on novelty but they should give equal consideration to prevailing social, cultural, economic and political realities.

2.4. Principles Guiding the S&T Policy

Lesotho is committed to pursuing a dual development path that carefully combines both indigenous and modern technologies. This commitment obligates S&T policy implementers to effectively address four national concerns, namely:

(1) The rich indigenous cultural heritage that is underutilized. This must be kept alive through positive, intelligent and responsible community leadership and continuous interaction;
(2) A social value system that is deeply rooted in Basotho traditions and which, without adequate safeguards, could disappear with increasing globalization.
(3) An adequate technological infrastructure that is under-funded due to low GDP activity and declining annual revenue.; and
(4) Protection of local and indigenous technologies, practices and community-based knowledge systems that are being lost through non-documentation and poaching.

The impact of S&T policy initiatives will need to be seen and felt in all social and economic sectors. It is important therefore that this S&T Policy provides a catalyst role for the country's long-term development and the strategic links to deepen commercial, industrial and entrepreneurial development activities.

The Lesotho Government is committed to funding national S&T-related activities. In support of this S&T policy, it will annually allocate an ample budget to key S&T institutions, for catalytic R&D programmes, S&T infrastructure, S&T education and basic research. The exact amount is to be defined annually with the appropriate S&T agencies. In parallel to the above support, government will fund strategic studies to establish the need for comparative incentives in order to facilitate business transformations, innovation and assist in their compliance with the S&T Policy regulations.

Box 8: S&T Guiding Principles

All S&T investments and decisions shall comply fully with the country's laws and environmental regulations and duly support Lesotho's conformance to international standards and agreements.

- All S&T investments, decisions and benefits should be gender sensitive and proactively encouraging to women and girls where natural practices and customs limit or restrict their free access and equity.
- S&T programmes and strategies should facilitate technology and industrial process improvements, and provide equal access to all regions, and in particular, assist the growth of small and medium enterprises, especially indigenous entrepreneurs and community enterprises.
- S&T institutions should make special effort to increase their local competencies, and promote the use and integration of information and communication technologies.
- Research output of public-funded institutions shall remain the property of the State and classified accordingly. All public S&T information shall be made accessible to the public with cost recovery fees applied where information use is for private gain.
- All exploration, works, research or manufacturing activities must comply with the country's laws, and apply sound social and environmental practices, whether or not specific local regulations and standards are promulgated. All such practices should respect, preserve and protect the country's fragile ecology, heritage, wildlife, natural habitat and species, indigenous knowledge systems and environmental resources.
- Public good research activities shall be functional and geared to raise the country's technical knowledge, market intelligence, local added value production capacity, product standards, quality and productivity, material use, conversion and storage.
- Public funded S&T initiatives should be well focused, and must consider the needs of and constraints to regions, districts and Basotho enterprises.
- Public good research initiatives should be well coordinated, managed and reviewed regularly to assure cost-effectiveness and relevance.
- Public institutions providing S&T products or services are expected to remove unnecessary bureaucracies and ensure that consumers are served cost-effectively and efficiently. Equally, their private sector customers should be afforded every opportunity to generate maximum jobs, reinvestments, and to create durable linkages with informal enterprises.
- Government expects that the private sector will take necessary actions to ensure compliance with the S&T principles and in undertaking S&T investments and research to respect intellectual property rights and indigenous knowledge systems.

Additionally, government will introduce a number of innovative industrial and commercial policies. These will aim to facilitate enterprise research and capacity reform and enable them to acquire, develop, adopt and incorporate ICT and to apply and dis-

seminate science and technology, especially to SMEs and indigenous enterprises. In order to encourage a positive S&T culture and environment in Lesotho for research, government will continue to devote a high proportion of the national budget to the education, research, training and S&T related sectors. As a component of this, an increased allocation will be made to reinforce science, technology and vocational education.

In line with the above commitment, notwithstanding its limited means, government will allocate 1% of the annual national budget to fund S&T education, research institutions and approved R&D programmes. This allocation is also in line with the 2020 National Vision for Lesotho (2004), SADC Protocol on Education and Training, NEPAD and UNESCO Science Declaration, and other conventions to which Lesotho is a signatory. To ensure that our national R&D programmes and institutions are cost-effective, private sector participation in S&T decision systems will be strengthened to efficiently tap local, bilateral, international and multi-lateral resources for S&T funding. To be able to access the above funds, public-funded institutions, including private S&T research laboratories must comply with the S&T principles indicated in Box 8 and are defined from time to time by the appropriate Science and Technology Authorities.

2.5. Vision for Science and Technology

The vision for Lesotho S&T policy is to create and sustain a progressive and prosperous economy and society through intelligent use of S&T assets. This S&T vision is expressed by five core policy objectives:

(a) Develop a technologically competent and productive labour force (urban and rural).
(b) Create and apply a mix of technologies appropriate to Lesotho market needs.
(c) Generate and market high added value goods, services and meaningful job opportunities for Lesotho citizens and residents.
(d) Sustainably exploit Lesotho's resources and their comparative advantages, using information networks and alliances relevant to Lesotho citizens and enterprises' needs.
(e) Enable indigenous businesses to grow and expand jobs, employment opportunities and export earnings.

Box 9: S&T Vision

A free, prosperous and progressive economy and society that are sustained through intelligent use of science and technology assets by progressive and innovative citizens, corporations and government.

One of the immediate tasks of the science and technology policy is to empower Basotho with market-oriented, relevant science-based, technical, vocational and entrepreneurial skills. To respond to market needs, the S&T policy will establish case for a conducive S&T infrastructure, and a positive environment and culture for production, efficient local business services and job creation. At the same level of priority, S&T policy will need to induce new managerial competencies, boost production options, productivity levels, work ethics, and inspire enterprising attributes in citizens' self-employment.

Box 10: Key Elements of the S&T Vision:

- Technically competent and enterprising labor force.
- Increased science and technology education, vocational & entrepreneurial training and focused research.
- Competitive S&T systems & fully developed ICT skills and infrastructure.
- Fast growing value added production for a stable, prosperous economy and society.
- Efficient and effective national S&T institutions and well-coordinated mechanisms.
- Increased emphasis on local value. adding capacities.

2.5.1. Lesotho Science and Technology Mission

Practical realization of Lesotho's S&T mission charges us "to ensure that every Mosotho is mentally and physically equipped and motivated to engage science and technology in order to have improved and sustainable quality of life. This means that the S&T mission has to "timeously underpin and reinforce national and sectoral programmes with market-relevant research, technical education, effective S&T institutions, public infrastructure and assist individual citizens and enterprises to add meaningful value". Through this approach the S&T policy will help to build and sustain a competitive society with the capacity to innovate, adapt and generate knowledge, processes, products, services, sectoral linkages and jobs. Thus, the country will have the capacity to sustain a fast growing economy through an effective and highly motivated national system of innovation. Equally, rural dwellers and communities will be able toadapt, validate and incorporate indigenous knowledge and practices into their own enterprises for gainful income, and in their traditional communities.

Box 11: S&T Mission

"To transform Lesotho into a modern state, having enough highly skilled, innovative and technically trained personnel with a competitive S&T infrastructure to support a growing and dynamic economy".

2.5.2. S&T Policy Strategic Objectives

This S&T policy is an investment to improve the following objectives. In particular, it emphasizes the link between education, research institutions and industry.

(I) Enhance and foster a strong scientific and technological human resources base.
(II) Develop a culture of innovation for technological production.
(III) Promote employment creation and poverty alleviation through the use of science and technology initiatives consequently, enhance the quality of life of Basotho.
(IV) Built a vibrant information society.
(V) Promote and commercialize Indigenous Knowledge Systems

This policy requires integration of science and technology into school curricula, skills, competencies and services, which its citizens require and acquire from educational institutions that are in line with business demand and market trends. Public S&T initiatives will enable citizens and enterprises to engage their skills and assets and to operate their own ventures.

Taking account of the objectives if this S&T policy, the expected outcomes will, inter alia, include contribution to the economic growth out of the GDP annually between 5-8% during the Short-Medium term of the Development Planning Cycle. Box 11 highlights the S&T mission, while Box 12 details the S&T policy strategic objectives.

Box 12: Strategic Objectives of the S&T Policy: Objectives and Strategies

OBJECTIVES	STRATEGIES
1. ***To foster a stronger S&T human resource base***	• Sustain relevant, visible and accessible S&T programs of learning, practices and advocacy in technical, vocational and science-based disciplines. • Accord high priority to S&T education, funding and research. • Regularly appraise Lesotho's education system and budget and evolve a transparent formula for funding S&T training and research programs. • Realize a consistent provision of critical S&T equipment, supplies, textbooks and journals to schools, colleges and research laboratories to encourage more S&T students and local interest in research.
2. ***To develop a culture of Innovation for technological production***	• Develop and promote an efficient S&T support network and activities that will enhance the capacity of urban, rural, community-based entrepreneurs and SMEs. • Increase in range, quality, VA content and competi-

	tiveness in goods and services produced in Lesotho. • Provide, through S&T institutes, well coordinated and cost-effective technical support to local entrepreneurs and enterprises to enhance local production and social marketing. • Operate an effective S&T innovation system and network throughout Lesotho. • Increasingly provide affordable access by entrepreneurs and local scientists to national, regional and global S&T information networks. • Build up the science, technology and production culture in Lesotho through the establishment of nationally integrated Science and Technology Parks, incorporating museums, libraries, and science centres.
3. ***To create Job opportunities and Poverty Reduction through the use of S&T initiatives***	• Attain maximum synergy, cooperation and coordination between and among S&T users and R&D Institutions. • Undertake Research and Development in areas that affect the quality of life of Basotho. • Develop and adopt appropriate technologies that will address the societal and economic needs of the nation. • Enhance technology development, transfer and diffusion. • Solicit core R&D funds to stimulate S&T innovation in areas of national needs and priorities. • Achieve fullest participation of women in S&T management, teaching, learning, research and development.
4. ***Build a vibrant information society***	• Take initiatives on acquisition of knowledge and dissemination of information in compliance with the information and communication technology policy, geared towards building a strong knowledge driven economy.
5. **Promote and commercialize Indigenous Knowledge Systems**	• Identify and protect the Lesotho indigenous knowledge systems and convert them to innovative products and services that will benefit Basotho, as a niche area for competitive advantage in a global economy.

2.5.3. S&T Core Policy Issues

Taking into account Lesotho's multi-dimensional assets and the identified challenges, this S&T policy seeks to resolve six fundamental questions, namely:

(I) What are Basotho's basic and strategic needs, strengths and resources?

(II) How best can S&T be applied to harness the country's rich material base and wealth?

(III) Which sectors, and in what priority order, should Lesotho stake its limited financial and S&T resources?

(IV) What are Lesotho's most urgent priority areas for technical skills, and which are the best education models and facilities to provide them with?

(V) How can Basotho rationalize the use of scarce arable land and balance its socio-economic imperatives without sacrificing or threatening the quality of our environmental and cultural assets?; and

(VI) What strategies should Lesotho government and private sector leaders employ to enhance traditional links and relations with the Basotho community and our immediate neighbour, South Africa.

Box 13: Core Science &Technology Policy:

- Build, maintain, and actively promote S&T culture, links and infrastructures that are fully integrated with domestic production, markets, the education system and raw material base.
- Facilitate citizens with full access to up-to-date and market-related S&T information across the country and sectors.
- Provide consistent, reliable, cost-effective and well coordinated S&T services to citizens, government and enterprises.
- Fully exploit and beneficiate Lesotho's natural resources, citizens' skills, talents and S&T investments.
- Engender S&T awareness, and equitably distribute S&T benefits among citizens, with special appeal to women, disadvantaged groups and rural dwellers.
- Promote conservation measures and sound management of environmental assets.
- Promote standards and mutual respect for intellectual property, including our indigenous technologies and knowledge systems.

2.5.4. Core S&T Policy Issues

Based on Basotho's response to the above questions, this S&T policy has to enable the entire country – labour force, enterprises and infrastructure - to be competitive, vis-a-vis its immediate neighbour and those within the region such as SADC and NEPAD. Core S&T policies must enable the various sectors to define the parameters and their strategic options for Lesotho's sustained development. Equally, they should outline sector opportunities, lead products and the science-based and technology-driven initiatives that government and private sector should focus their actions on:

- Build, maintain and actively ***promote an S&T culture and an infrastructure*** that is positive, production-based, market-driven and service-oriented. This culture and infrastructure policy should enhance and complement Basotho's traditions, values and indigenous technologies.
- Facilitate access and flow of up-to-date trade and market-related ***S&T information*** across all sectors of the economy. S&T research institutions should be a central resource for science and technology information and provide appropriate links and gateway for citizens and researchers to connect to other S&T networks and databases in the region and outside.
- Be a consistent and reliable ***provider of cost-effective and coordinated scientific and technical services*** through efficiently manned Ministries, S&T institutes and parastatal organizations. S&T policy should support and empower our indigenous entrepreneurs and investors.
- Derive optimal returns from, and seek to spread broadly, Lesotho's scarce natural resource benefits and ***our S&T investments in physical and human assets***. Public investment programmes should enhance public awareness and appreciation of science and technology and be supportive of private sector efforts in production and commercial services, especially for domestic market and exports.
- Engender equity and conservation in the use, management and beneficiation of S&T investments and resources. The policy should seek to encourage and empower ***women, youth and other societal groups*** that would normally be denied equity and access through regulations, customs and practices.

To facilitate the timely translation of Basotho's vision, public institutions are encouraged to deliberate on the appropriate S&T actions to support and boost the private sector. For example, special efforts are needed to retain and motivate Basotho 's skills and competencies, and to maintain and monitor a competitive roster of national S&T skills and infrastructure. This requires timely reform of the aging and ailing institutions in the production system. It requires the incorporation of new methods and appropriate technologies in industry and commerce. The S&T policy will assist domestic enterprises in modernizing and acquiring new capacity, methods of production, marketing and communication. Box 14 identifies the main instruments that will be used by Government to effect the S&T policy.

Box 14: Summary List of Main S&T Policy Instruments:

Policy instruments to build up and modernize our S&T infrastructure

- Reforms to resuscitate S&T Institutions and Programmes for R&D (explicit)[1]
- Reforms to strengthen Manpower Training and Development (implicit)[1]
- Financing of S&T research, and funding innovation activities (explicit)
- Reforms to rehabilitate existing Industries and promote S&T and ICT enterprises (implicit)
- Reforms to Lesotho's Fiscal and Incentive schemes for industrial modernization and improved S&T infrastructure (implicit)

Policy instruments to regulate technology inputs

- Establish Registries of Technology Imports (explicit)
- Establish Registry of Technology Transfer Agents (explicit)
- Operate Registry of Foreign Direct and Indirect Investments (implicit)
- Establish necessary Foreign Investment regulations (implicit)
- Actively promote S&T Joint Ventures with strategic firms/states (implicit)

Policy instruments to stimulate wider use and beneficiation of S&T resources

- Establish schemes to promote Industrial programming (implicit)
- Establish Venture Capital and Financing of SMEs (implicit)
- Develop programmes and schemes to boost public understanding and benefits of S&T (explicit and implicit)

Policy to Promote and Integrate S&T Activities in Basotho Enterprises

- Negotiate Credit Lines with LNDC, BEDCO and Banks, etc for S&T (implicit)
- Develop S&T information and technical advisory networks (explicit)

Policy Instruments to Enhance the Performance of S&T Investments

- Provide technical consulting advice and basic engineering design (explicit)
- Undertake Research assistance and advisory services to SMEs (explicit)
- Operate Technical Information Systems and Interactive Database countrywide, disseminate and facilitate Internet and direct access to S&T Databases (explicit)
- Develop legislation and laboratory facilities to produce and monitor technical specifications & standards on products and to support compliance/enforcement (explicit).

2.5.5. Policy Implementation Logistics

S&T implementation will adopt a three-pronged approach:

- **Phase one** will entail detailed discussion with key S&T institutions in the public and private sectors and their S&T host ministries regarding new mandates, new technical capacities, resource needs, gaps and the necessary reforms to achieve the S&T policy objectives as well as how best to integrate their S&T actions within the Notational Goals, Objectives and Development Plans.
- **Phase two** will involve the detailed preparation, technical and legal debate and the final promulgation of the S&T Act and the subsequent harmonization of the S&T policy with existing sector policies.

- **Phase three** will involve the setting up and operationalizing of core S&T institutions where the needs are demonstrated.

Box 15 shows the types of specific outputs expected from S&T institutions:

Box 15: Specific Outputs for S&T Institutions

- Social and scientific research to be conducted to identify and articulate S&T policy options, best practices and sectoral programmes that can increase employment level by at least 5% annually over the next 5 years;
- Identification and characterization of local and appropriate foreign technologies that are currently being used in the country and how effective they are in promoting sustainable development and use of the country's renewable and natural resources;
- Development of systems, processes and practices to enhance agricultural yields, value chain, sector linkages, production efficiency and product quality in a wide range of sector activities;
- Scientific analyses and investigations to document, categorize and validate intellectual property claims and indigenous technologies and traditional practices;
- Creation of a national registry to record and classify wild life activities; rare plant species; their traditional uses and claims; and known commercial and community applications;
- National registry, classification and commercialisation of local heritage (both natural and human) such as flora and fauna, traditional producers, traditional healers, dealers including their experiences and qualifications;
- Development and demonstration of S&T systems, processes and practices to enhance agricultural yields, value chain linkages, production efficiency and product quality in a wide range of sector activities;
- Produce manufacturing designs, specifications, equipment modifications, commercially-ready equipment prototypes for local production in English and Sesotho;
- Establish regular production of scientific papers, publications, articles, journals, formation of S&T associations for S&T academics, practitioners, professionals and students;
- Acquisition and screening of appropriate technologies to promote efficient and environment-friendly applications to industry, water, energy, agriculture and telecommunication and transport sectors.
- Produce studies, regulations and technical advisories and briefings on biotechnology, bio-safety, biodiversity, and other topics of national interest.
- Build up a national S&T Database that will facilitate direct access through Internet connectivity.

Box 16 illustrates the kind of S&T databases that are desired:

Box 16: Example of S&T Databases to be promoted

- Up-to-date national S&T personnel and S&T Institutional database.
- Up-to-date listing and database of approved and appropriate S&T equipment, technologies, their sources, suppliers and local technical support that are of specific interest to SMEs, community and commercial farmers; and the educational, agricultural, industrial, health, metrological and environmental sectors.
- Up-to-date listing and profiling of niche markets, active traders, trading standards and entry requirements for existing and potential Lesotho products.
- Listing of appropriate technologies suitable for health, agricultural and agro-industrial production, water and waste management.
- Listing known banned, abandoned, expired and doubtful technologies.
- Listing and profiling of national, regional and international S&T and R&D institutions, R&D funding organizations, S&T database and networks.
- Regular publication of scientific papers, articles, journals, formation of S&T associations, technical fora for S&T academics, practitioners, professionals and students.

2.5.6. Core S&T Sector Issues

It is critically important to articulate and integrate science and technology within the sectoral development plans in order to meet national goals and targets. There is an array of problems associated with the low level of science and technology integration into the productive sectors of the economy. The sectors include among others, R&D institutions, SMEs, human resources development and industrial agencies. Coordination of Sectoral development initiatives is therefore, essential in order to develop an effective and functional science and technology system that is coherent with national goals and objectives.

Box 17: Current Sector Issues To Address

- Modest R&D institutes, outputs and linkages.
- Outdated technology and practices of SMEs.
- Need to upgrade and integrate indigenous technologies and to protect community-based knowledge systems.
- Low factor productivity & local value added production, especially in manufacturing and agriculture.
- Inadequate provision of and access to S&T information and market research output.
- Need to better monitor the use of environmental, ecological, natural and renewable resources and to apply coherent management practices.
- Mismatch in the supply & demand of trained S&T personnel and constant S&T brain drain.
- Low priority and under-funding of R&D institutes and S&T activities.
- Low level of S&T awareness among citizens.

2.5.7. General S&T Sector Strategies

In order to ensure the improvement of Lesotho's economy annually, citizens need to demonstrate a greater sense of purpose, commitment and adherence to the S&T policy. It is also important that individual sectors fully integrate science and technology into their sector policy and planning systems and that such programmes are well designed and coordinated at both sectoral and national levels. While practical implementation of S&T actions will be undertaken mostly by ministries, parastatals, agencies of government, or directly by the private sector, institutions that use or wish to access public funds will be required to comply with the national goals and targets that are established in the National Vision and development plans.

If the country is to assure stable, balanced and incremental GDP growth in the medium to long-term horizon, it is our collective responsibility to ensure that economic policies and programmes, whether executed by public or private sector, are technology-driven, and that these policies, programmes and technologies are conceived and developed in concert with the major development partners, in the public and private sectors.

Government resources will be used to initiate and facilitate the S&T policy. It will not dominate or replace the private sector in the implementation of the S&T policy. As far as it is practical, government resources will be catalytic, i.e. facilitate, support and complement appropriate initiatives of the private sector. Where private capital is scarce, reluctant or unwilling to undertake research of a public good nature, public funds will be used to initiate research in public good research where and when such projects are justified and supported by the private sector. Toward the above ends, eleven key **S&T strategies** have been identified and public funds will be allocated to:

(I) **Strengthen national capacity** (personnel, institution and enterprise) to organize, motivate and to undertake intelligent research; and to appraise, develop, adapt and promote technologies and processes that are appropriate for Lesotho.

(II) **Promote a national S&T awareness campaign** to educate citizens in S&T and to propagate the benefits and results of scientific investigations and their technological applications.

(III) **Register, characterize and commercialize indigenous knowledge** systems and traditional practices, capturing their intellectual property rights, and where feasible, enhancing such practices with modern technologies.

(IV) **Develop and advocate for integration of technology in curricula** to educate, train and develop Lesotho's labour force that will have skills and competencies in technology development.

(V) **Acquire, develop, screen and adapt appropriate technologies** to the specifications and requirements of SMEs, and prepare necessary manuals for their wide scale dissemination, production and propagation.

(VI) **Lead Lesotho's innovation process through targeted R&D programmes** to improve industrial and commercial productivity, quality and local added value, and lead the national drive to develop new and improved products and processes.

(VII) **Upgrade technology based incubators for SME plant and machinery and domestic production capacity**, giving special attention to rural community enterprises and women entrepreneurs.

(VII) **Establish regional innovation centres and S&T parks** to support local entrepreneurial initiatives and enhance local material use, manufacturing and agro-industrial production.

(IX) **Promote, support and upgrade traditional and indigenous technologies** and facilitate their integration and linkages with micro, informal, small and medium scale businesses.

(X) **Establish and operate a modern S&T information resource centre** with up-to-date databases for nation-wide network access by industrialists, producers, traders, researchers, teachers and learners with our national research centres, laboratories, user-producer institutions and suppliers locally and worldwide.

(XI) **Provide and screen research grants, laboratory support to S&T teaching and research institutions** to increase the number and quality of S&T graduates, S&T publications, exhibitions, S&T clubs and associations.

3. Strategic Framework for S&T Policy Implementation

3.1. Strategies for S&T Policy Implementation

Government's commitment to promote science and technology in Lesotho is affirmed by its ratification of the AU charter, the SADC science and technology education 2000 protocol, NEPAD and many others.

To facilitate a positive S&T culture and environment in Lesotho, government will increase public funding through the S&T Trust Fund to sectors and institutions that are engaged in product and material research and development.

Funding will be facilitated through a S&T Trust Fund for Innovation, and accession to this fund will obligate sectors and enterprises to improve coordination and communication among research institutes and their industrial counterparts in public and private sector. In order to avoid unnecessary waste and duplication of resources, R&D projects should be conceived with potential partners and articulated in consultation with private sector interests, local, regional or international agencies.

Box 18: Measures to Implement S&T Policy:

- Improve sector coordination and planning.
- Re-focus fiscal measures and S&T incentives.
- Increase public funding for S&T education, technical training and research.
- Enhance international cooperation and networking with strategic S&T enterprises.
- Strengthen private sector cooperation and participation in S&T decisions systems.
- Develop competitive legislation, infrastructure and institutional arrangements.
- Establish institutional capacities and systems to monitor S&T policy targets, performance and impact.

It is expected that our Public Sector Investment Programme (PSIP) and S&T projects will complement and support private sector investments. As far as it is possible, public and private investments should be well harmonized to ensure that our expenditure in S&T infrastructure is in line with national development needs and priorities. In any case, such investments should take into full account our environment concerns,

availability of local materials and resources, and above all, the need to generate backward and forward linkages with industry.

If pursued in the above spirit, both private and public research institutes will benefit from the S&T incentives and jointly access public funds for specific research. In giving its support to the coordinated approach in S&T, government has agreed to establish at strategic locations throughout the country, technical and vocational schools that focus on science, technology and numeracy skills. Such skills and needs will be identified and verified regularly with industry and commerce. All those will be articulated by education administrators in consultation with business leaders. High priority in funding access will be given to initiatives aimed at incorporating S&T subjects, practices, experiment and laboratories at the basic education level and this policy will be progressively promoted through the tertiary education levels.

Already, there is a variety of choices in S&T models in developing and developed countries. Lesotho S&T policy will draw on the best international practices and, as far as possible, the models that will be encouraged should complement and harmonize with our absorption capacity, and our traditional and indigenous knowledge systems and practices. Government will make every effort to ensure that the technologies that are acquired in the public sector are those that can be serviced within Lesotho, SACU, or in SADC countries. All technologies that are acquired by the country should be enterprise sensitive and relevant to the local conditions and needs.

Notwithstanding the fact that technology decisions will ultimately be made by enterprises, it is government's hope that local and external expertise and technical assistance agencies will be used wisely to complement local S&T investment decisions. Furthermore, foreign resources and foreign skills will be employed only after careful analysis of locally available skills and national competencies.

3.2. Research and Development Prioritization

Research and Development (R&D) is a major activity of this science and technology policy. R&D defines the critical agenda in the Lesotho national systems of innovation and the key role of S&T institutions in the industrial and commercial transformation. R&D is especially critical in the production of new knowledge, new materials, publications and new services. It will enhance the role of and identify links for our indigenous technologies and traditional practices. In this way R&D will induce the base and opportunities for creative applications of business skills and entrepreneurship and provide forums for conceptualization, development and commercialization of goods and services in almost all spheres, location and endeavours of national life.

In the context of Lesotho's S&T policy, R&D will be a fundamental part of the strategic agenda of the tertiary educational institutions; the main activity of research institutes; and the practical expression of industry and commerce. It is expected that the tertiary education sector will use the synergy from their multi-disciplinary skills, laboratories and resources to innovate in areas of academic interest as well as in activities of broad, specific and practical interest to the nation, public and private sectors, and for individual enterprises and entrepreneurs.

3.3. Fiscal Measures and Incentives

While government is reluctant to offer fiscal incentives to specific sectors, it recognizes that in certain limited cases, incentives might be useful to induce, retain and reward S&T investments, talents and skills that will facilitate the achievement of the country's national development goals. In such circumstances, consideration will be given on an ex-post basis to qualified applicants during the initial phases of the S&T policy implementation. Such applicants will be required to provide tangible evidence of innovations and research outputs and to show how these have contributed to areas of national priority. In addition, all approved R&D institutes will have access to the S&T innovation fund that will be operated by the Lesotho Advisory Commission for Science and Technology (LACST).

To encourage S&T culture in enterprises, government will devote a substantial portion of national resources strengthen public-based science and technology programmes, including those that are jointly funded by private sector and those available at the National University of Lesotho, Lerotholi Polytechnic, technical, vocational schools and other approved technical training and research organizations. In turn, government expects that such R&D, training and industrial enterprises will facilitate student work-experience exchanges aimed at exposing students to the practical application of science and technology in sectors and regions.

Public-funded R&D institutions are expected to create functional linkages with their counterparts in industry and commerce and make productive use of local resources. They will adapt technologies appropriate to the needs of SMEs and provide advisory services aimed at raising added value contribution, employment levels, as well as new products and services development. Fiscal incentives will apply equally to all corporations, whether local or foreign, public and private.

3.4. Strategy for S&T Funding

Government recognizes the need to establish an independent financing system to facilitate S&T development in both public and private sectors. Currently, public institutions charged with a research and development responsibility have been sparsely

funded and their collective outputs have tended to be light on innovations. Thus, a Trust Fund will be established to manage a funding system that will be flexible to attract, mobilize and retain necessary funding and to motivate support from donors and development organizations.

The Innovation Fund will focus on national science and technology priorities and to develop Lesotho's innovation system. Government is committed to implementing the internationally accepted minimum[7] level of 1% of GNP towards science and technology-related R&D activities. Accordingly, the 1% of the annual National budget will be devoted to support the national research and innovation system.

To meet this 1% obligation, it is expected that the private sector and the donor community will assist, in cash or kind, to enable the country to achieve its national development targets. The following eight options have been identified as potential sources to fund the science and technology policy.

3.4.1. S&T Funding Options

- An annual S&T grant will be provided to the innovation fund after approval by cabinet.
- Funding will be obtained from special government programmes that are required to implement S&T activities.
- Levy portion of tertiary education institution/sector government subvention for institutional S&T research.
- Toll specific contribution from S&T-related ministries having research institutes, under their portfolio.
- Obligate a percentage of S&T contracts offered by line ministries and departments to local private sector and international firms.
- Levy portion of parastatals' budget for public goods research.
- Private sector research expenditure.

3.5. Legal and Administrative Support

The challenge for global competitiveness, makes it important that Lesotho builds and sustains a national capacity to innovate. This requires long-term commitment not only from government, but also equally from private sector – enterprises and entrepreneurs. To ensure that the S&T environment remains positive for research and innovation, government will reform and advance the necessary legislation to include an S&T Act, and the establishment under it, of core S&T institutions for policy coordi-

[7] *UNESCO World Science Report (2000), Lagos Plan of Action all African Heads of State (1992), SADC Protocol on Education and Training, NEPAD Ministerial Declaration (2003), 2020 National Vision for Lesotho (2004).*

nation, funding S&T research and innovations, and for engaging scientific investigation and research in the public interest.

As a means of reinforcing this commitment, government will propose necessary regulations. Such regulations will be developed in consultation with relevant stakeholders, private sector, umbrella organizations and civil society. In the operation of the civil service, government, through relevant ministries, will identify from time to time scarce S&T skills and introduce provisions for premium packages to encourage such disciplines.

While it is true that legislation alone will not induce and sustain S&T activities, S&T innovations are more likely to occur when incentives and legislation are in harmony. In this light, public funding will be a major strategy to induce R&D institutes, such as the National University of Lesotho (NUL), Lerotholi Polytechnic and others, to produce specific outputs as outlined in Boxes 15 and 16, or as determined from time to time by the Advisory Commission on Science and Technology.

To avoid unproductive duplication of research, and to focus on practical problems and commercial applications, the S&T policy will encourage close working relations between private and parastatal sectors and the sharing of results at cost recovery rates. To ensure that the S&T incentives schemes benefit Lesotho citizens, legislation will be introduced to facilitate local procurement preference, particularly for SMMEs to benefit from national R&D innovations at cost recovery rates.

3.6. Strategy for S&T Policy Coordination (Ministries and Mechanisms)

The Lesotho government and citizens recognize that S&T development is not a cheap option, and therefore, S&T activities need to be fully integrated and well coordinated at national and sectoral levels. The Ministry of Communications, Science and Technology has been mandated to coordinate S&T at national level and is expected to integrate and coordinate S&T sector policies and programmes. With limited resources at its disposal, government will establish core S&T institutions to facilitate an effective system of S&T policy coordination and research delivery. A number of S&T institutions and facilities have been identified in the S&T policy. A brief description of their respective roles is provided in this document and operational details will be outlined in the S&T Act.

3.6.1. Ministry of Communications, Science and Technology

The Ministry of Communications, Science and Technology has been given the mandate to coordinate science and technology development in Lesotho, and to oversee the evolution and operation of an effective S&T policy and a national innovation system. In line with this mandate, the Ministry will establish appropriate instruments to

promote, motivate, guide, fund, facilitate and monitor S&T institutions, including new and on-going research programmes.

To achieve this mandate, the Department of Science and Technology (DST) is charged with the responsibility to spearhead and coordinate the S&T policy implementation process and to establish the legislative and institutional framework in order to operationalize the S&T related strategies. Furthermore, The Ministry of Communications, Science and Technology hopes to promote effective research for the implementation of modern techniques in science and technology, putting in place one of the key criteria for evaluating the viability of an investment destination. Strategic objectives in the communications sector are aimed at creating an environment that is conducive to the development of sustainable info-communications through the formulation of appropriate policies such as ICT, media and postal services policies.

3.6.2. Department of Science and Technology (DST)

The Department of Science and Technology is mandated to formulate and implement policies and programmes that will promote growth of science and technology and create an enabling environment in which technological development will make meaningful contribution to a better quality of life of Basotho.

The Department, which acts as a coordinating body, a focal point for government and a liaison point for various public and private S&T stakeholders, will also review, assess and monitor S&T policy issues of national interest.

As such, the DST will undertake or spearhead necessary studies and technology audits to facilitate the continuous and equitable development of science and technology throughout the country. It will programme resources with the appropriate administrative and technical agencies and monitor regional and demographic impacts of science and technology activities.

Working independently or with or through other S&T facilities, the DST will ensure that all S&T initiatives comply with national, regional and international protocols, and are in line with appropriate national environmental standards, national regulations and take into consideration gender, youth and community concerns, including the indigenous knowledge systems and practices. It is envisaged that DST will also serve as a secretariat for the Advisory Commission of Science and Technology.

The S&T policy also recognizes the Appropriate Technology Section (ATS) as a fundamental tool for government to target public technical support to small-scale, informal, indigenous enterprises including the dissemination of appropriate technologies to the rural communities in the advocacy of addressing their needs. It is on this note that the need to incorporate ATS with the Ministry of Communications, Science and Technology, becomes inevitably important. The S&T policy anticipates that the role of ATS will be expanded to include serving as a National Centre for Innovation and

Research[8] within the context of an effectively operational Lesotho Innovation System (NCIR). The structure shown on Annex 9 provides a guide for the NCIR conception and relations with the rest of the S&T innovation system. Specific objectives and indicative operational goals of the NCIR are shown in Box 19.

Box 19: NCIR Operational Goals

- Achieve an increased volume, range and quality of available S&T-related information and creation of innovative facilities for public access.
- Advance significantly the technical knowledge and competence of individual citizens as well as the collective capacity of enterprise technical and scientific knowledge and know-how to adapt and develop Lesotho's physical, biological and socio-economic and environmental resources.
- Develop and maintain a vibrant culture of science, technology and production and the facilities to harmonize and balance S&T and cultural diversities.
- Develop and maintain an increasing core of locally available technical skills for research and productive use and maintain continuous product and process innovation.

3.7. Policy Facilitation

To complement the coordinating role of the Ministry of Communications, Science and Technology for effective implementation of this S&T policy, the full participation of a number of other key organizations is envisaged. Some of these organizations are currently operating under other Ministries, parastatals, private sector and NGOs. Among others, the key players in the S&T policy are identified below.

3.7.1. Ministry Responsible for Education and Training

The ministry responsible for Education and training has a fundamental role to play in the S&T policy implementation, especially for the effective integration, adaptation, delivery and promotion of science and technology education in the country. The symbiosis between S&T education, traditional values, indigenous knowledge systems and cultural activities makes it necessary to integrate science and technology programmes with cultural initiatives in order to build a strong science and technology culture. There is a number of executing institutions under the ministries, each with specific mandates and organizational arrangements under a statute legislation. Notwithstanding, the reporting ministries will maintain oversight responsibility for their portfolios.

[8] *The National Center for Innovation and Research will be a multidisciplinary research laboratory operating under the aegis of DST. Highly professional scientists that are well vested in research and development will man the center. The center will further demonstrate and diffuse the appropriate technology applications as an extension service. It will undertake scientific studies and investigations of important nature in the national interest and in areas of research not being undertaken by other R&D institutions within the national innovation system*

In the case of Education, there are several agencies including NUL, Lerotholi Polytechnic, Technical and Vocational Education and Training centres (TVETs).

- **The National University of Lesotho**

The National University of Lesotho (NUL) is at the apex of Lesotho's tertiary education system. Operating under the National University of Lesotho Act of 1976, NUL is an autonomous institution under the general direction of its governing council reporting to the Ministry of Education. NUL 's multidisciplinary science facility provides an ideal structure for spearheading Lesotho's science teaching and research efforts.

With reasonably well-equipped laboratory facilities, the university 's S&T departments do not currently operate as a homogenous unit for teaching and research. S&T staff complement is modest, and this will need to be substantially augmented if it is to effectively undertake both full time teaching and research in an on-going manner. Plans are being developed to launch a multidisciplinary research unit comprising intra-faculty teams in science, technology, social, political and economic sciences to integrate these two sets of research outputs.

To respond to national development priorities as envisaged in the S&T policy, NUL 's budget will need to be boosted and rationalized to support an expanded S&T curriculum, and the required teaching and research staff complements. The institution has a pivotal role to play in preparing and developing the nation 's high-level technical and professional manpower, and to reduce the S&T manpower gap presently existing in the business and government sectors. Its contribution, in terms of functional research outputs, technical advisory and investigative services to industry, commerce and government, needs to be packaged and marketed. In doing this packaging, NUL needs to appraise its current S&T programmes, courses and research outputs to align them with the skill needs and trends of the Lesotho job market.

Greater emphasis and more incentives are needed to spur S&T innovation at NUL, and to increase the impact of multidisciplinary and inter-faculty S&T teaching and research. This will also facilitate NUL 's leadership in local publications, entrepreneurial and management training to S&T professionals and business leaders, as delivered by national and regional centres of excellence. The S&T policy envisages that NUL will continue to facilitate student mobility between S&T programmes and courses offered by itself and sister training institutions, including the polytechnic and other training colleges. Similarly, the university is expected to provide proactive leadership in S&T matters of national concern to government and industry.

Within the framework of the S&T policy, NUL is expected to be an active player in the national S&T innovation system to reduce areas of not only potential conflicts, but also unproductive duplication and overlaps in teaching and research.

- **Lerotholi Polytechnic**

As an autonomous Institution in terms of the Lerotholi Polytechnic Act of 1997 under the general direction of a governing council, the polytechnic is a principal science and technology institution with the special mandate of training and developing Lesotho's technical, commercial and vocational skills base in technical and professional competencies. Its programmes will have direct functionality to work place requirements in technological areas as well as practicals for research and innovations in science and technology and commerce.

As one of the tertiary level educational institutions in the country, providing market-based competencies with multi-level and multi-disciplinary outputs, since it is seen as the country's future university of technology, the polytechnic is particularly tasked to provide programmes that are practical and have direct impact on the various communities it serves. This requires it to work closely with industry, commerce and government to deliver a wide range of disciplines and skills to match the competitive dynamics of Lesotho 's labour market. Lerotholi Polytechnic will also assist as required in the accreditation of technical and vocational programmes, with the national quality assurance bodies.

The Polytechnic will focus its attention on building citizen 's competencies in engineering, technological, commercial and other functional areas of relevance to the market. Lerotholi Polytechnic will also develop and strengthen links with the technical, vocational and tertiary institutions and industrial enterprises locally and regionally. As an institute approved for research, the polytechnic will have full access to the Science and Technology Trust Fund for innovations.

- **Technical and Vocational Education and Training (TVET)**

As a leading agency on technical and vocational training within the Ministry of Education, TVET is charged with the development of training of persons for skilled occupations to meet poverty alleviation and socio-economic development needs.

TVET in Lesotho will be successful if it is creative and responsive to the requirements of the labour market through research and development initiatives in order to provide competent, effective and efficient labour force.

TVET system in Lesotho shall develop and assess the achievement of national technical and vocational standards to meet both industrial and educational requirements. The main strategy for TVET is to introduce technical and vocational education at all levels of education and training, in order to produce a more skilled labour force that will be competitive nationally, regionally as well as internationally. Emphasis has to be put on the incorporation of science, technology, research and development in the curricula.

Technical and vocational training is a powerhouse of skills development. Hence it can be regarded as a vehicle for technologically based entrepreneurship and industrial development process.

3.7.2. Ministry Responsible for Industry, Trade and Marketing (MITM)

The MITM spearheads one of Lesotho's leading economic sectors, contributing between 16-20% of the country's GDP. The Ministry and its various agencies including Basotho Enterprise Development Corporation (BEDCO), Lesotho National Development Corporation (LNDC), is responsible for the efficient promotion of industry, local and foreign direct investment, trade and the development of market for Lesotho's commodities and services. In line with government poverty reduction and employment creation objectives, the MITM is especially tasked to build Lesotho's added value capacity, content and inter-sector linkages through focused attention on the use of R&D output, vocational and entrepreneurial skills toward the competitive development of SMEs and micro enterprises and for their practical utilization and integration of science, technology, R&D and ICT in production and commercial activities.

As the main benefactor of R&D outputs, it is envisaged that the MITM will spearhead the country's transition into a modern and technology-driven economy and for Lesotho to realize its dream of reaching newly industrialized country status by 2020. For this transition, the role of BEDCO and LNDC will be critical in the creation and maintenance of competitive industrial and commercial infrastructures. The S&T policy takes cognizance of other important initiatives of the Ministry including quality and standards management. The S&T policy expects the ministry to be a leading actor in Lesotho 's science and technology innovation system.

3.7.3. Ministries Responsible for Local Government and Housing

Local governance initiatives are within government policy framework to increase citizens' participation in policy making and policy implementation at district level. The S&T policy will support the decentralization process by strengthening the technical capacity of local governance structures through training, research and advisory services, as well as improving the S&T infrastructure, flow of S&T information and greater use of local materials and indigenous technologies.

The S&T policy will strengthen district administrations' capacity to promote rural development, through the introduction of Regional Innovation Centres (RICs), which will work closely with the local governance structures. Through this approach, S&T policy aims to improve rural community access to S&T resources and increase local value added materials, rural employment and income earning options.

With over 70% of Basotho living in rural and suburban Lesotho, the ministry is shouldering a heavy task to provide guidance and balance between local and regional development. The dual pressure from urban and rural residents for better livelihood and welfare requires increased spread of production activities throughout the coun-

try and fullest utilization of Lesotho's human, natural and physical resources. Thus, a sustained solution to poverty must integrate science and technology to provide citizens with functional skills to create their own employment and to beneficiate local resources and indigenous technologies.

- **Appropriate Technology Services (ATS)**

The ATS currently operates as a division within the Ministry of Local Government. Initiated as a small workshop to provide extension services to small-scale enterprises, the ATS was expanded to facilitate designs, research and development as well as demonstration of appropriate technology applications to small and medium size Basotho enterprises.

One of the immediate tasks of the ATS is to improve production methods, plant productivity and enterprise linkages with domestic raw materials, markets and employment creation options. The S&T policy recognizes the ATS as a fundamental strategy of government to target public technical support to small-scale, informal, indigenous businesses, rural and community-based entrepreneurs.

In its present form, the ATS capacity to give effect to the S&T policy is limited to training, prototype design and demonstration. Under the S&T policy, the ATS is envisaged to be a major player especially in the area of SME development. An effective functioning of ATS can be nurtured through incorporation of the division to the Ministry of Communications, Science and Technology. This will not only prevent duplication of efforts and resources, but will also build the institutional capacity towards effective implementation of the S&T policy by providing a proper home for ATS.

The role of the Appropriate Technology Services (ATS) in the new Ministry of Communications Science and Technology will be crucial for the advancement of SMEs, especially in their quest to acquire, understand, transfer and unpack imported technologies as well as the development of technology incubators for entrepreneurial development. The ATS will need to expand their provision of advisory and skills upgrading services across the various districts and for this reason; the ATS is envisaged to be a major actor in the implementation of the S&T policy.

3.7.4. Ministries Responsible for Agriculture, Food Security, Forestry and Land Reclamation

Lesotho's agricultural sector is characterized by erratic rainfall patterns, severe and recurrent droughts, periods of frost, soil infertility, high acidity and severe land degradation. In addition, there is constant erosion and encroachment on the limited arable land. Combining this situation with poor land management, poor agro-technological practices, high post-harvest losses due to pest/diseases, inadequate production and storage capacities, it is not surprising that agricultural output and productivity (mainly crop and animal husbandry) have both shown declining trends since the early 1990's. Thus, the demand for agricultural research is substantial. Current

research capacity is quite limited owing to acute shortage of trained personnel, field research laboratories and extension staff.

Given the fact that the bulk of Lesotho's rural population (close to 70% of total population) derives its livelihood from agriculture and land use, yield and farm productivity have been inadequate over the years. This negative impact has resulted in poor farm practices, monoculture cropping, poor road and communication infrastructures in rural areas, few value adding linkages, few manufacturing enterprises, few distribution and marketing outlets for local products, aged or obsolete equipment and technology. Besides the above, there are the perennial problems of land erosion, soil degradation and unsustainable human encroachment on the limited arable land.

For any significant positive change to occur in this sector, and in the livelihood of rural citizens, greater use and mix of science, technology and research will be necessary. Lesotho has a wide variety of crops; roots, tubes, plants, shrubs, other flora and fauna, and these assets are currently only partially exploited.

Local research activities are often uncoordinated, ill focused and lack domestic funding and support. The sector's research agenda should also make use of the excellent and under-utilized facilities at the National University of Lesotho, Lerotholi Polytechnic and other technical and vocational institutions. The Ministry of Agriculture, through its research and outreach facilities, will be a major participant in and beneficiary of the S&T policy.

3.7.5. Ministry Responsible for Health and Social Welfare

The health sector is largely technical, science-based and multidisciplinary. The successful operation of this sector and the ministry depends on both the availability and mobility of trained, qualified, competent and highly motivated personnel.

Equally, its functionality depends on well-serviced, modern equipment, laboratory facilities and affordable medicines. As the Institution is primarily responsible for citizens' health care provisions, it will, together with the various implementing agencies, organs and alliances in public and private sector, be a major participant and beneficiary of this S&T policy.

The Ministry of Health's role in training, community education, research and outreach is also crucial and represents a major S&T concern. Its role and responsibility in leading research in HIV&AIDS and other communicable diseases should be addressed through comprehensive Health policies.

3.7.6. Ministry Responsible for Natural Resources

The Ministry of Natural Resources is one of the stakeholders for applications of science as well as technological development with major emphasis on the formulation and implementation of appropriate policies for the sound management and exploita-

tion of water, energy and mineral resources of the country. The Ministry also ensures that the exploitation and preservation of these natural resources are achievable in a sustainable manner for the socio-economic development of Lesotho. It is, therefore, inevitable that the role of the Ministry of Natural Resources is critical for the support and implementation of the S&T Policy through the following agencies;

- **Water sector**

S & T Policy creates an environment whereby science and technology are available and accessible for application and promotion of water sector. The Policy further supports water sector in integrated water resource development and management. It forms an integral part of the 1999 Water Resource Management Policy, which provides direction in sustainable development for water as a resource, also in adequate supply of water, particularly in times of drought including proper assessment and protection of water resources.

There is potential and scope of improvement for water resources to provide more contribution and support to the economy of Lesotho, but a substantial investment is required. The Water Sector plays a significant role in Lesotho's economy through the Lesotho Highlands Water Project (LHWP), which contributes 5% of the Gross Domestic Product (GDP). The emphasis on the water export from the LHWP is counterbalanced in importance by the necessity for decisive action to develop the water resources and supplies in the densely populated lowland region of the country.

The government of Lesotho adopted a Water Resources Management Policy (WRMP) aimed at improving the management and overall co-ordination of water resources and improved access to water supply and sanitation services. The national Water Policy includes a commitment to ensure a sustainable development of water, as a resource; adequate supply of potable water even in times of drought; proper assessment and protection of available water resources. It further states government's commitment to ensuring access to potable water by all the people of Lesotho, and that every citizen is entitled to potable water for basic human needs and any requirement beyond this basic need will be paid for by the user.

There is a need to rationalize the roles and responsibilities of the agencies, i.e. government departments, parastatals and the private sector, that are currently involved in the water sector activities in the country. These include other sectors, which have impact on water resources such as the National Environment Secretariat (NES), which works in close collaboration with the water sector. NES will implement Strategic Environment Assessment (SEA), which ensures that environmental issues are incorporated into programmes and policies, including those of the Forestry Division in the Ministry of Forestry and Land Reclamation.

The role players in the sectors are: WASA for urban and peri-urban water supply; LHDC (Lesotho Highlands Water Commission) for the implementation of the Lesotho High-

lands Water Project; the Department of Rural Water Supply for rural water supplies; and the Department of Water Affairs will house the directorate, carry out resources assessment and management.

A new directorate of water, whose sole responsibility is water, will be created in order to facilitate effective coordination of the water sector. The office of Commissioner of Water (COW) is now established with the Ministry of Natural Resources to strengthen the coordination of water and sanitation services by all sectors, and provides guidance in fulfilling the government commitment stated in the WRMP. A PPSU is also established to provide capacity for the implementation of WRMP to support the office of COW.

The Lesotho Highlands Development Authority (LHDA) is a statutory organization in Lesotho charged with the responsibility of implementing all components of the Lesotho Highlands Water Project (LHWP) within the borders of Lesotho. The LHWP is a bi-national project between the governments of South Africa and Lesotho. The LHWP's objectives are: to divert and sell excess water from the Lesotho highlands to the industrial heartland of South Africa – Gauteng Province – and for Lesotho to obtain income in the form of royalties for the water so transferred; to generate sufficient hydro-electric power for Lesotho's own needs at 'Muela and finally to undertake ancillary development in both countries.

The LHWP was envisaged to be implemented in five phases over a 30 to a 50-year span, based on the projected growth in water demand in Gauteng Province. Upon completion of all the five phases, the LHWP would deliver some 70 cubic metres per second (cumecs) from Lesotho to South Africa. The main structures of the LHWP basically consist of a series of interconnected storage reservoirs on the Senqu river and its major tributaries, connecting tunnels, pumping plants and a hydropower generating facility at 'Muela. Extensive infrastructure in the form of all weather roads, power systems, telecommunication networks and residential villages had to be built for the project. All these greatly contributed to Lesotho's infrastructure and helped open up access to the heartland of Lesotho.

The LHWP is a complex multi-disciplinary project that has generated several studies during its implementation. It has played a key role in technology transfer to Basotho and in arming locals with high level professional skills for future water resource developments in Lesotho. In adhering to international standards, the LHWP has had to undertake several comprehensive scientific, environmental and social studies to assess the impact of the project on both human and non-human environment. A major study, the in-stream flow requirements (IFR) has recently been completed and subsequently an IFR Policy and Procedures was developed for the operation of the LHWP has been used in developing a policy for the operation of the LHWP reservoirs, to mitigate the impacts of the project on downstream riverine ecology. Extensive continuous evaluation and monitoring measures are being implemented as part of the approved IFR policy.

In this manner, the LHDA is, and will continue to be, a crucial partner in the development of Lesotho's S&T resources and its technical capacity.

- **Mining Sector**

The Department of Mines and Geology under the Ministry of Natural Resources is the institution responsible for disseminating basic geo-scientific data, facilitating and monitoring the private sector participating in the exploration and exploitation of the mineral resources of the country in an economically, technically and environmentally efficient manner for the benefit of the nation.

The Department administers all mineral development legislation. The regulatory framework comprises: The Mines and Minerals Act (2005); The Precious Stones Order (1970); The Mine Safety Act (1971) and The Explosives Proclamation (1958); the last three as amended.

The geochemical and material testing laboratories provide analysis support in the exploration section of the department. The exploration section utilises geological, geochemical, geophysical, mineralogical and petrographic methods to locate and assess mineral resources for their exploitation. Mining inspectors uses instrumentation to monitor pollution in a mining environment.

405 kimberlite bodies have been recorded in the country. There are two commericial diamond mines. There is still an opportunity to develop some of these kimberlite bodies. Sandstone has been utilised for constructing buildings for decades and at present there are three (3) mechanized sandstone quarries in the country. There are also three (3) mechanised sandstone quarries in the country. There are also three (3) commercial aggregate quarries. There is an opportunity for developing further sandstone quarries in the Clarens Formation and aggregate quarries over the numerous dolerite dykes.

The sector is focusing on building its institutional and human resource capacity to facilitate the monitoring of the industry as it expands.

- **Lesotho Meteorological Services**

The mandate of Lesotho Meteorological Services (LMS) is to apply the science of meteorology for sustainable and environmentally friendly social and economic development of Lesotho. This is to be achieved through harmonising developmental activities with weather and climate. The LMS activities include observing the weather and building the climate data bank, analysing this data to derive products for use by various socio economic sectors and predicting the future climatic trends particularly in view of the changing climate. Thus some of the LMS products include scenarios under the emerging climate. LMS also monitors the condition of the atmospheric environment and advises on measures to be taken in order to preserve the natural balance in the atmosphere.

As a primary science application department, and based on observed meteorology data, LMS issues daily weather forecasts, advises air navigation, transport, recreation, public safety activities among others. Further analysis of the historic data yields advices to be used for planning and design of water resources development, agriculture, civil works and infrastructural development.

To cope with the changing climate, Lesotho has to adopt some new technologies that are friendly to the environment by way of reducing greenhouse gases which are responsible for global warning. The LMS raises awareness on climate change and leads Government's activities in pursuit of the country's commitments under the United Nations Framework Convention on Climate Change. These include reduction of greenhouse gas emissions primarily through use of new technologies and adoption of cleaner energy sources such as hydropower, solar, wind and others. LMS also monitors use of ozone depleting substances and coordinates activities for their phase out in the country.

LMS leads in satellite science, hosting the satellite reception centre with a potential for application in other areas such as agriculture, water management, flood and soil degradation monitoring. It coordinates a national committee tasked with ensuring maximum benefit by the country from the satellite derived information.

Meteorological operations in particular local and international data exchange depend on sound, modern and efficient telecommunication linkages. The Department thus needs to keep appraised of global telecommunications developments.

LMS is committed to enhance its role and relevance to national development. Its ability to satisfy this ambition depends on its maturity to apply the science of meteorology and related technologies. Recognising this part, the departmental growth strategy encompasses development of sound human resources capacity through a pool of well trained specialised meteorologists and technicians.

• Energy Sector

Department of Energy's key responsibility is to secure energy supply in the country, in order to achieve universal accessibility and affordability in a sustainable manner, with minimal negative impact on the environment. From the demand perspective, energy is used in the following economic sectors; household, industry, commerce, agriculture, transport and construction. Consequently, the situation calls for adequate technologies to address this demand.

While the merits of securing international and regional experts to undertake research and analysis in the energy sector are clear, the Government is also of the view that the national capacity to undertake this same work must be strengthened The energy policy, therefore, has clearly stipulated measures to be undertaken in the areas of research and development. The draft policy on energy, commits Government to con-

tinuously improve knowledge around energy use patterns, customer energy requirements, energy supplies and distribution chains, energy technologies, energy balances, regulations and standards.

Among others, the key role players for realizing these tasks, are Lesotho Electricity Authority (Regulator), Rural Electrification Unit, Lesotho Electricity Corporation LHDA (Muela Hydropower Plant) and other public and private entities with relevant activities to the sector.

3.7.7. Ministry Responsible for Tourism, Culture and Environment

It is often said that Lesotho is an environmental miracle. It is the only country in the world to have all its landmass situated over 1 000 metres above sea level. Lesotho has an ecology that is unique, offering both positive and negative prospects for eco-tourism. This mountainous country presents a variety of opportunities for further exploration and beneficiation by Lesotho citizens and investors. Equally, there are areas of vulnerability that must be managed, controlled and monitored to ensure balance and sustainability in the use of rare and renewable resources. Thus, the Ministry of Tourism and Environment will be one of the key stakeholders in the implementation of the S&T policy.

As a small, open and trade-driven economy, the Lesotho S&T environment is exposed to natural, external and exogenous forces. Given its high mountainous terrain, poor S&T infrastructure, and the current low economic capacity, the country is especially vulnerable to environmental abuse i.e. poor waste management, poorly applied technologies, pollution, soil degradation and water erosion.

NES has the responsibility to oversee, regulate and safeguard Lesotho's environmental and ecological resources, be it working with other agencies or independently. The S&T policy recognizes the key role of this agency as an S&T watchdog to protect, preserve and promote the balanced use of our natural and renewable resources.

Environmental management provides a complementary function to the DST for a sustainable S&T policy. NES provides oversight to the management and monitoring of how the country's ecological resources are used, including the use and disposal of S&T resources. It maintains technical and environmental records, standards, and through well-equipped technical laboratories enforces national regulations. UNESCO 's 2000 World Report suggests that there is a close link between poverty and environmental degradation.

Lesotho's environmental resources include, among others, rich biodiversity (flowers, exotic plants, herbs and wildlife) as well as the scenic mountain ranges and landscape. Lesotho's rich cultural heritage and unique continental climate fit ideally to the country's quest to develop eco-tourism and rural employment.

The Department of Culture is responsible for the protection, promotion and dissemination of the national cultural heritage through specialized programmes within the established national cultural institutions and the privately run organizations. This department comprises National Archives, National library, National museum, History, Arts and the Crafts Sections, all of which serve as depositories of our indigenous knowledge systems and practices. Hence, this rich heritage of skills and artistry can be considered as niche areas for the production of value-added goods and services for competitive advantage in the global market.

The Ministry for Tourism, Culture and Environment, is a major stakeholder of S&T, and its role is critical to the success of the S&T policy.

3.7.8. Private Sector and Parastatals

In principle, Lesotho takes great pride in being an open economy that is private-sector friendly. It supports the concept of a private sector-lead economy. However, in practice, there are many gaps in the present private sector structure, especially in the areas of industry and in the composition of large private sector corporations, and the priority and compensation package provided to locally employed technical and skilled personnel.

This situation has led to skill migration, and an unhealthy dependence on South Africa for consumption imports, business capital, technical equipment, sourcing and equipment servicing. It has also produced scant supply, and often marginalizes the roles and capacity of our fledgling indigenous businesses and entrepreneurs.

To a large measure, the private sector and parastatals have been more preoccupied with the financial viability of their enterprises, and are involved mainly in research activities that relate to their operations. Such research outputs are undertaken for proprietary gain, or to sustain the firms' competitive edge, and which outputs are normally of immediate commercial impact.

The private sector and the general consuming public have tended to exhibit a strong bias against local production, and a strong propensity toward inward trade. Despite attempts to construct positive industrial policies, the economy continues to show recession in real value added goods and services. This dilemma represents a major challenge for S&T efforts to boost employment and stem poverty. Therefore, the private sector and parastatals, as the major engines for value added development in Lesotho, face tremendous challenges and shoulder responsibility for the generation of jobs, income, efficient services, and exportable products.

- **Lesotho National Development Corporation**

Operating under the general guidance of the Ministry of Trade and Industry, the LNDC is the major parastatal organization in the country charged with the responsibility for investment promotion and infrastructure development. As such, it operates as a kind

of development finance institution to promote the development of industry and commerce. It is expected that the LNDC will be a principal player on behalf of the public sector in the development and facilitation of S&T policy.

- **Basotho Enterprise Development Corporation**

BEDCO operates as a subsidiary of the Ministry of Trade and Industry. Its primary task is to promote and facilitate the development of local small and medium entrepreneurial activities across the country. Its main focus is to improve the status and range of Basotho entrepreneurs and strengthen their capacity to process and use more local materials and resources. As a small enterprise development corporation, BEDCO's role represents a critical link in the S&T development process, especially to support rural and community-based initiatives.

Properly integrated within the industrial and S&T sectors, it will be a major vehicle for fostering entrepreneurial development, and to assist commercial links between small scale, medium and large manufacturing and commercial enterprises. BEDCO is expected to be a primary instrument of the S&T policy, and an immediate outlet for R&D, business advisory, S&T information, S&T training and outreach.

- **Lesotho Communications Authority**

The Lesotho Communication Act of 2006 established Lesotho Communication Authority (LCA) to restructure and develop the ICT sector in Lesotho, to provide universal service/access and a predictable, investor-friendly ICT regulatory framework for the country. Following the privatization of Lesotho Telecommunication Corporation (LTC) to the present Telecom Lesotho, LCA has issued operating licenses to one fixed network operator Tele-com Lesotho (TL) and two mobile operators Vodacom Lesotho (VCL) and Econet Ezi-Cell Lesotho (EEL).

There are ongoing efforts to upgrade the capacity and quality of the communications network and to progressively expand coverage to rural communities for basic and value-added services such as e-mail, voice-mail, video conferencing, radio paging, audio text services, videotext and postal services. The significance of Internet connectivity is becoming more and more apparent while the use of cellular and mobile phones, is making great strides.

These information and communication technologies form critical links and pillars for the development of science and technology. These new technologies need to be considered parallel with the development of the national S&T system for innovation. Coordinated approach is needed for the country to integrate and derive maximum benefit from the advancement of ICT. As an implementing agency of the ICT policy, LCA will take the necessary steps to foster the growth of the sector and the infrastructure to support the implementation of S&T initiatives. As an implementing agency of the national ICT policy, LCA will take necessary steps to facilitate the growth of the sector and the infrastructure of S&T initiatives.

- **Lesotho Electricity Corporation**

For Lesotho entrepreneurs and scientists to operate competitively in a global environment, information and communication technologies must be recognized as the key sectors that must be strategically linked to education, industry, commerce, and other key economic activities. For these services to be widely accessible, a parallel expansion is needed in the electricity grid and supply system, since electricity is currently confined to less than 8 per cent of the population.[9]

Lesotho Electricity Corporation (LEC) operates as a parastatal under the Ministry of Natural Resources. Its major responsibility is to generate, transmit, distribute and supply electricity to the public. The supply of electricity is largely confined to the urban centres to the exclusion of the rural areas. The current situation contributes to low S&T development, biomass depletion and poor economic linkages in rural areas. Therefore, urgent steps need to be taken to improve electricity supply across the country through rural electrification.

- **Private Industrial Enterprises**

The private sector in Lesotho is relatively small. Its major economic expressions are predominantly in the trade and commercial sector. Indigenous Basotho do not feature prominently in private sector activities, although much local effort is being made by the LCCI and LMA, with support from the Ministry of Trade and Industry to improve the small and medium entrepreneurial status of Basotho in trade and manufacturing. The SME sector is in great need of technical assistance, venture capital financing and value-added linkages with local manufacturing, trade, commerce, tourism, construction and agricultural sector development.

3.7.9. Civic Organizations and Consumer Associations

As a way of democracy, the government of Lesotho provides ample space, scope and legislation to promote and facilitate the positive and proactive operations of a host of civil organizations including the media, professional bodies, trade unions, employer associations, consumer advocacy groups and a range of national and international NGOs. All these civil groups have their responsible roles in the articulation, development implementation of the national S&T policy. In particular, their individual and collective synergies will be required to facilitate a smooth delivery of science and technology programmes and outputs to the Basotho people, and the mobilization of resources and technical assistance to the various S&T facilitators and partners.

3.7.10. NGOs, Regional and International Agencies

NGOs and international agencies are playing the important role in Lesotho of addressing the burning issues connected with poverty alleviation, HIV&AIDS, the management of ecology and the environment, among others. In these efforts, a greater role

[9] *Source: Access to Electricity Study, MNR, November, 2001*

and concentration will be necessary not just to provide the urgently needed goods and services, but also to assist with the tools and training to build local capacity and support sustainability. This implies a greater role and visibility for the technical agents and projects of NGOs, bilateral and multilateral agencies.

3.8. Cross Cutting Policy Issues

The Science and technology sector is a dynamic one, in which changes occur constantly. In implementing this S&T policy, government and R&D institutions will have to contend with known and unpredictable issues, such as epidemics, natural disasters, wars, emigration and immigration. Lesotho being an open market economy, there is a number of crosscutting strategic issues that the S&T policy has to address. Some of the main ones are identified in the sections below, including some proposals for their possible solutions.

3.8.1. Biotechnology

Biotechnology is one of the 'key technologies'. These together form a toolbox of many technologies, which has the potential to provide very substantial benefits to society in a wide range of sectors, such as *Agriculture, Health Care, the Processing Industry and the Environmental Sector*. Biotechnology can benefit society in many ways, but more so the very needy, for instance by increasing the availability and enhancing the nutritional value of food grains, by eliminating the use of harmful pesticides, facilitating the manufacture of cheaper, safer and more effective drugs, by improving the quality of livestock, by increasing tree cover in the country and by treating material in a safe and eco-friendly manner.

The Government of Lesotho through the Department of Science and Technology, will strive to facilitate the development of biotechnology in the country by erecting high quality infrastructure through the strategy of encouraging research activities, developing human resources and establishing links between research institutions, academia as well as industry, and initiate biotechnology curricula in schools, colleges and the university.

By embracing biotechnology, the Government of Lesotho will enhance the implementation of its developmental goals of *Poverty Alleviation, Food Security, Improving Human Health and Job Creation.*

On the other hand some applications raise the question of whether everything, which is technically possible, is also desirable, safe and acceptable in social and ethical terms. These questions have become increasingly pressing in recent years as the products of biotechnology are now appearing in the market, it is against this background that the importance of the safe and responsible application of biotechnology cannot be over- emphasized in order to derive all the benefits that this technology can

bring, while at the same time minimizing all potential risks. The possible adverse effects need to be monitored and guarded against, hence the importance of a clear policy and strategy on biosafety.

3.8.2. S&T Brain Drain

Lesotho is a landlocked country, hence Basotho are obliged to move, trade and study within the borders of South Africa. The differential in living conditions, wages, investment, educational and employment options will provide strong incentives to attract Lesotho's trained S&T skills and entrepreneurs. This is a reality that requires intelligent human resource management if temptation to outward skill migration is to be reduced or stemmed.

The S&T policy requires government and the business sector to be particularly sensitive to this issue and to design jobs and training programmes that are market relevant and provide incentive schemes to attract and retain S&T skills.

This challenge affects all educational, training, research, industrial and commercial institutions in the country and places an urgent obligation on government, public and parastatal organizations to set positive examples in recruitment, promotion and remuneration practices.

Private businesses are expected to exercise sensitivity in employment and to apply affirmative action wherever possible. Working visa and residential permits will also be responsive to temporarily attract trained S&T personnel from within the sub-region or abroad, while at the same time Lesotho will be facilitating, training and retaining local S&T personnel.

3.8.3. Standards and Quality Assurance

Applications of standards and quality assurance are issues that go far beyond national control and jurisdiction. They engage both import and export products and services. Since Lesotho currently lacks testing, validation and verification capacity, it relies on South Africa for screening, testing, health and safety verification, and to a lesser extent, phyto-sanitary standards.

For Lesotho to comply with national and international regulations, agreements and protocols, there is a need to develop a minimum technical facility and necessary technical competence, in terms of laboratories and skills. The Ministry of Industry, Trade and Marketing has established a division to monitor and regulate quality and standards. The S&T policy envisages new facilities to be added or established to validate and protect indigenous knowledge systems and to monitor phyto-sanitary regulations, and where feasible undertake product compliance, verification tests and other scientific investigations.

3.8.4. Gender Equity in S&T

Women constitute over 51.3 percent of Lesotho's active labour force[10] and population. They also account for an increasing, if not the larger portion of breadwinners and students in science and technology-related studies. Bearing in mind the outward movement in the male population in search of employment opportunities, the role of women in household management and family planning has been significant over the last 20 years and this warrants critical reform in traditional thinking and practices, and a stronger affirmative action drive for women in the field of science and technology.

The S&T policy, from time to time, will assess our progress in the S&T affirmative actions, and enterprises will be encouraged to pro-actively facilitate women's access and mobility into occupations requiring mathematics, natural sciences, engineering and in science and technology management. It follows logically that they would also be attracted to formal positions in the industrial sector. Hence forming a strong human resource base for Lesotho to meet her technological capability.

[10] Lesotho's Central Statistics 2000 Labour force estimate shows that female comprise 29% of the 14-64 age population and consequently of the labour force where as male account for 27%.

4. New S&T Institutions

Considering the citizens' expressed need for an effective S&T innovation system in Lesotho, there is some urgency to revamp existing S&T institutions and, where necessary, establish new S&T infrastructures.

These institutions will focus on, and address national needs. In this regard, many inadequacies in Lesotho's S&T innovation system were recognized and a broad consensus was reached during the S&T consultations. It was, therefore, recommended that new S&T institutions be established, respectively to:

(a) Lesotho Advisory Commission on Science and Technology (LACST) to manage S&T policy Implementation.
(b) Lesotho Innovation Trust Fund (LITF) to mobilize funds for R&D.

Box 20: New S&T Initiatives & Institutions

- Lesotho Commission on Science and Technology (LCST);
- Lesotho Innovation Trust Fund

These new facilities will work closely with line ministries, tertiary institutions and other key S&T executing organizations within the public, private and NGO domains.

In line with the national objectives, particularly to enhance economic growth and reduce poverty through competitive private sector development, and induction of maximum private sector investments, public-funded S&T institutes will be expected to undertake studies, scientific investigations and research in priority areas and further turn those research results into goods and services. Government, through the LCST will determine from time to time, the relevance, scope and timing of the S&T initiatives to meet the societal needs.

4.1. Lesotho Advisory Commission on Science & Technology (LACST)

The first core S&T institution to be established by the Minister under this policy is the Lesotho Commission on Science and Technology (LACST). See Annex 5-10. The LACST

will be an overarching, high-level S&T policy ***advisory*** body reporting to the Minister. It will manage the S&T policy and innovation process, provide S&T advice to government and oversee the S&T policy implementation.

The LACST shall be broadly composed of competent S&T-related personalities and representatives drawn from the private sector, parastatals, government ministries and other S&T-relevant organizations. Specific details relating to its function, composition, terms of reference and legal arrangements will be discussed in the Act. The structures shown on Annex 2-4 provide a guide for the LACST conception and relations.

4.2. Lesotho Innovation Trust Fund

The Lesotho Innovation Trust Fund (LITF) will be an essential component of the S&T policy instrument to be established and supervised by the LACST. It will support the implementation of Lesotho's S&T development (see Annex 8).

The Fund will be responsible for administering the S&T activities and to develop the mechanisms to solicit, receive, mobilize and oversee the efficient allocation of and accounting for the funds earmarked and provided for research, science and technology projects.

Allocated funds will be used strategically to support public good research[11] and other S&T-related activities. Legislation will be introduced after consultation with major S&T benefactors, to put in place rules, procedures and criteria for accessing, allocating and accounting for the S&T funds. Specific details relating to its LITF function, composition, terms of reference and legal arrangements will be discussed in the Act. The structure shown on Annex 5 provides a guide for the conception and relations with the Lesotho innovation system.

[11] *Public Good research refers to research activities and approved technical or scientific investigations whose direct or ultimate outcome is of public interest and which results are available to the general public.*

5. Annexure

5.1. Sector Strategies to Integrate Science and Technology

Lesotho's long-term development is linked to its capacity to integrate science, technology, education, production, commerce and trade. If science and technology is properly incorporated into the various economic sectors, it will enhance the pace, content, performance, consequently improving income levels, welfare and living standards of Basotho.

The S&T policy will encourage and produce paradigmatic changes in citizens' attitudes, skills, and in the range and quality of domestic products, prices, processes, practices and outputs. Given the relevance and catalytic effect of science and technology to building and sustaining a growing economy, the following core sectors have been identified for specific focus in the S&T policy. It is important to ensure that every effort is made to integrate science and technology in order to achieve the maximum returns, benefits and utility from our limited investments.

1. EDUCATION, CULTURE AND HUMAN RESOURCES

1.1. Sector Dynamics

Science, technical and vocational education and research will be the main instruments in Lesotho to stimulate citizens' interest in innovating, and to propelling enterprises towards greater value added productivity and competitiveness. Through the S&T policy, it is expected that Lesotho will adopt the new culture of production. Emphasizing the links between education, culture, heritage and community-based knowledge systems will serve as prominent reminders to S&T policy to relate traditional values with competing demands of modernism. Equally, the role that science and technology plays will be crucial in maintaining the essential balance between economy and culture and between modernism and tradition, both of which are fundamental to Basotho's development and identity as an independent and progressive people.

1.2. Sector S&T Policy Focus

To develop an adequate level and quality of national personnel with appropriate technical skills, competencies, capacity and motivation to innovate, research, adapt and

to generate and apply science and technology to better use local resources, imported materials and equipment and to raise the content of domestic value added.

1.3. Sector Strategies

a) Increase the content of theory and practice of science and technology for subjects in the education curriculum of schools from basic to tertiary levels through positive curricula reform and development.
b) Improve on the number and quality of teachers trained and in science, technology, mathematics and computer literacy, and facilitate their equitable spread throughout the country 's education system.
c) Promote wide interest in science and technology learning and teaching through a mix of classroom lectures, laboratory practice, work experience attachments, research and community outreach opportunities for creative Interactions and innovations.
d) Procure or facilitate the acquisition and maintenance of appropriate scientific and technological instruments and facilities for science teaching, demonstration and learning,
e) Provide technical and financial support for the local publication of science and technology teaching materials, books and other ventures aimed at creating or stimulating a science and technology culture.
f) Maintain vigilance on public policy, especially those impacting on education and curricula development and initiate policy analysis, policy reform to integrate and harmonize S&T education programmes and delivery strategies.
g) Study, enrich and validate indigenous and traditional technologies through scientific investigations and integrate their documentation and applications to academic and commercial acceptance.
h) Engage academic research in areas of national development priority to increase community benefits, and add to the general body of local and scientific knowledge.
i) Increase the number and content of S&T education programmes and their availability and affordability to distant communities and various age groups.
j) Undertake research in language, culture and Basotho tradition aimed at developing materials for Sesotho as appropriate instruction medium for S&T teaching and learning.
k) Facilitate the implementation of a national qualification and certification system to boost quality and orderly progression of the S&T professions.

2. AGRICULTURE, LAND RECLAMATION AND FOOD SECURITY

2.1. Sector Dynamics

Lesotho's agricultural sector has to cope with considerable climatic and environmental change - ranging from low to high temperatures, periods of drought to excessive rainfall, high windshield factor; desertification tendencies; low to high incidence of solar radiation, praedial larceny and disease. The combination of land erosion, soil

degradation and solar variation constitutes a major challenge to agricultural productivity, and implications for food security and effective land use planning. At the time, un-regulated housing developments and un-enforced regulations with respect to the appropriate use of agricultural land by citizens pose another constraint on arable agricultural land, which is estimated at 11% of the total land space.

On the other hand, the soil in most places is naturally rich holding great potential to grow a variety of durable tree and root crops, fruits, regular and ornamental plants and flowers, seasonal vegetation and industrial forestry with and without irrigation. Irrigated land is limited to commercial farms, estimated currently to cover just 30 Square Kilometres.

Many fruit crops propagate themselves in the wild. In addition, there is a number of exotic plants and shrubbery that are unique to the highlands of Lesotho existing without adequate protection or scientific study. Antiquated agricultural practices as well as poor and mono-cultural eating habits dominate the rural diet. Science and technology has had little impact by way of innovation to traditional practices. Land over-grazing is common and inter-cropping is rare and accentuates the urgency for focused S&T interventions.

2.2. Sector S&T Policy Focus

To support the acquisition and transfer of technical skills, the adaptation, better integration and utilization of these skills and appropriate technologies for improved agricultural productivity, crop diversity, agro-industry linkages and land utility.

2.3. Sector Strategies

a) Acquire, develop and disseminate appropriate technologies to enhance commercial and community farming systems, practices, yields and crop and livestock diversity.
b) Undertake research to adapt and actively promote appropriate technologies for household and on-farm applications, and industrial processes to add value and shelf life to agricultural products.
c) Conduct biotechnological research, and undertake scientific investigations and socio-economic studies initially aimed at categorizing and eventually beneficiating Lesotho's plant stock for food, feed, medicine, etc, and their industrial applications.
d) Promote and strengthen agricultural research facilities, manpower mobility and technical competencies to extend advisory services to rural, community and commercial farms.
e) Explore and evaluate options for national and imported genetic resources, materials and germplasm.
f) Provide technical support, incentives and advice to householder groups, small and communal farmers for environmentally sound farming and good agricultural practices, for quality management systems and international standards compliance.
g) Investigate post harvest issues dealing with production, storage, losses, pest and disease prevention and control.

h) Improve breeding practices and tools for breeding (including the use of modern technologies) for desirable traits: quality, resistance to biotic or abiotic stress and improved storage characteristics.
i) Develop/acquire/transfer techniques for cost-effective and environmentally benign pest and disease management, using integrated approaches.
j) Introduce agricultural practices for improved production, such as fertilisation and irrigation techniques, intercropping and crop rotation, agro-forestry, biological nitrogen fixation and the use of mycorrhiza.
k) Use afforestation techniques for the restoration of woodland and enrichment of degraded stands.
l) Develop and transfer environment friendly and more efficient processing technologies for storage, quality, use and marketing of products.

3. HEALTH, SANITATION AND POPULATION PLANNING

3.1. Sector Dynamics

Health and sanitation are basic fundamentals for a growing educated, productive, competitive and promising population. Lesotho subscribes to the International Human Rights Charter, the UN Charter on the Rights of the Child and to its citizens' right of access to basic health care. Accordingly, the national development plan accords high priority to health services, and fully recognizes their impact on population planning and manpower development and retention.

In all activities relating to health care, health delivery systems, sanitation and population planning, science, technology and research are fundamental strategies to ensure effective resource management, proper nutrition, disease prevention and control; extended use, shelve life and for the development and promotion of indigenous technologies and medicines. Current demographic practices in Lesotho show a mixture of success in the use of indigenous herbs in treating ailments in the rural and suburban communities, but much disappointment with their integration into commercial applications.

While average literacy levels have been impressively high at above 70% for males, and 75% for females, sanitation and environmental management practices have hardly changed due to unemployment and unproductive rural-to-urban drift. This has resulted in overcrowding in the major cities, towns and suburban areas and excessive stress on limited public urban infrastructures. More than half of Lesotho's resident labour force is caught in unemployment or underemployment status, which pushes the poverty trap to families covering more than half of the population. In a population of some 2.2 million and an active labour force approaching 700,000, there is tremendous scope and hope for science and technology to open new windows of opportunities for citizens to improve health, diet, nutrition, sanitation and their ability to control, prevent and manage diseases.

3.2. Sector S&T Policy Focus

To provide on-going technical support in scientific research, training, supply logistics, product and equipment information, education and deployment of competent human expertise to facilitate Lesotho's health and population planning initiatives country-wide.

3.3. Sector Strategies:

a) Facilitate efficient training and deployment of skilled technical personnel in all related fields of health and sanitation.
b) Provide technical and advisory support, and provide professional journals.
c) Supply publications and logistics to upgrade facilities and personnel in health care delivery institutions.
d) Enhance the human resource capacity of the health and sanitation sector at all levels and locations.
e) Maintain and modernize existing medical technologies, equipment and treatment practices in hospitals, clinics and laboratories throughout the country.
f) Raise technology awareness, team research capability, and Lesotho's technical competencies to use, adapt and develop indigenous practices and medicines that are appropriate for and affordable by the citizens.
g) Undertake scientific research on traditional medical practices, herbs and treatments aimed at integrating them with modern medical practices.
h) Promote awareness in schools and workplaces on basic hygiene and on household sanitation measures and best practices.
i) Conduct social and scientific research on best practice techniques for the treatment of vulnerable groups and physically challenged citizens.

4. ENVIRONMENT, WILDLIFE AND TOURISM

4.1. Sector Dynamics

Environment, wild life, tourism and natural resources are closely interlinked, and in Lesotho they define the main economic activities and livelihood of the nation. As such, Lesotho development policy places much emphasis and great pride in positively promoting these sectors, and underscores the absolute care and concern required for protecting, conserving and preserving them.

Being a mountainous and high altitude country, the land is prone to constant erosion and wide variability in weather and climatic conditions. However, these environmental features also represent major attractions to the travel, sport and tourist industries which together offer tremendous capacity and potential for added value domestic production and services. These sectors hold unlimited prospects for enhancing Basotho's livelihood, not just for urban dwellers, but especially for rural and suburban citizens.

Lesotho's environment is exposed to high incidence of solar radiation and periods of intense rainfall including regular snow formation. The attrition of the land, resulting from the combined and perennial impact of solar, wind and water erosion leaves visible and ugly evidence of shallow and deep canyons.

Taking this concern together with the increased human encroachment on available arable land and forestry resources, the environmental challenge is both urgent and significant. As the economy ekes its livelihood through informal and formal exploits, there is need for high-level citizens' environmental awareness to curb and avert the increasing tendency of water and air pollution, and to ensure practical ecological balance in economic and social welfare. Thus, the promotion of science and technology in environmental management and natural resource sector policies is critical to facilitate environmental balance.

It is equally important for the best practice of industry, commerce and householders. Appropriate monitoring systems for water and effluent disposal and quality management are necessary as well as the practical technologies and processes to encourage greater and wider use of irrigation, land drainage, crop diversity and yield, soil preservation and recovery.

4.2. Sector S&T Policy Focus

The S&T Policy in the environment and tourism sectors will stress the need for improved national management and integration of our environmental, ecological and cultural resources. It will seek the expansion and extension of the electricity and water grids to cover the rural areas as a way of easing population pressure on the limited forestry assets, and put potable water at the disposal of citizens. Emphasis will be given to the development of water resources beyond the current limited coverage and use. Particular focus will be given to effluent recycling, the disposal of industrial and agricultural waste, as well as on consumer education to boost conservation practices and build capacity for eco-tourism as a full industry.

4.3. Sector Strategies

This S&T policy will:

a) Promote and facilitate the maintenance of a comprehensive national environmental policy that embraces all natural resource sectors, enterprises and households.
b) Maintain an up-to-date quality monitoring system and a database on environmentally sound technologies and processes that are appropriate for Lesotho's needs and development objectives.
c) Participate actively in regional and international fora for the promotion, advocacy and ratification of environmental standards, water quality and their legislation, regulations, protocols and management systems.
d) Undertake and support scientific research and investigations in areas such as biodiversity, CFC reduction and environmental impact, conservation and environmental risk audits.

e) Promote the use of indigenous technologies and community knowledge systems in education, industry and household practices.
f) Initiate training, documentation and educational programmes in schools and communities in areas relating to water conservation, use integration of indigenous plants and traditional knowledge systems for medicinal and other purposes.
g) Develop, support and promote exclusive zones, parks, cultural heritage, products and technologies for eco-tourism expansion.
h) Establish laws to regulate and protect fauna and flora that are unique to Lesotho and systems to monitor practices and compliance.

5. METEOROLOGY

5.1. Sector Dynamics

A major feature of the climate of Lesotho is its high variability on all time scales, be it day to day, month to month, season to season or year to year. Both temperature and rainfall vary from one extreme to the other with a prolonged drought often followed by intense rainfall, snowfall followed by high temperatures within a matter of weeks. Also, performance of primary production systems in water and agriculture is closely tied to prevailing weather per season. Annual economic performance as indicated by the Gross Domestic Products follows the climate behaviour, Eco-tourism also is tied to the prevailing weather.

Timely and accurate weather and climate information is vital to the performance of key elements of life and the economy. The ability of LMS to carry out its mandate is very critical to the industrial and economic development of the country.

5.2. Sector S&T Policy Focus

The policy will focus on institutional building for the LMS as a service provider to the other sectors. Major products being meteorological satellite derived and for the protection of both physical and atmospheric environment. The department will continue to focus on strengthening the human capacity and communication network and skills.

5.3. Sector Strategies

a) Facilitate the continuous training of technical manpower.
b) Provide technical support and critical funding for the establishment, strengthening and maintenance of meteorological infrastructures in the key catchment areas and regions.
c) Provide research assistance and S&T information to the various MET services facilities and enable them to operate an intelligent database for the study of local, spatial and regional environments and to facilitate their compliance with regional and global standards and reporting requirements.

6. INDUSTRY AND COMMERCE

6.1. Sector Dynamics

Industry presently constitutes about 40 percent of Lesotho's GDP, dominated by processed food, clothing, footwear, wool products and mohair. After several attempts in the area of industrial development Lesotho industrial policy has tended to underplay the role of science and technology. Thus, the importance of science and technology will be emphasized in the reform and implementation of industrial and commercial policy. This initiative will require a new type of engagement for science and technology and for public investments in order to provide coherent and competitive infrastructures, export quality products, services and manufacturing processes.

With increased output of technical skills and managerial competencies, an integrated S&T policy will induce local research and technical assistance to support indigenous and production-oriented entrepreneurs, and to develop value added linkages with agriculture, commerce and to beneficiate our local raw materials and resources. The Increased availability of technical manpower and entrepreneurial skills will facilitate and complement other government initiatives to attract and boost local equity, venture and working capital into competitive production of goods and services. To a large extent this development will reduce the current high propensity for and dependence on imports.

Conscious of the above challenges, Lesotho has a variety of industrial options provided by its excellent and strategic location and proximity to South Africa. Many commercial opportunities exist for Lesotho's exotic plants, fruits and crops that are unique and yet commercially under-exploited. The traditional technologies and cultural diversity represent potential feedstock for small and rural-based industries. The country 's water resource with potential uses in hydro-electricity and its downstream application to the generation of small and medium scale industrial activities are examples of the diverse industrial base.

6.2. Sector S&T Policy Focus

To provide and sustain a modern industrial and commercial infrastructure and conducive policy environment, that is technically and technologically serviced by trained and skilled personnel. Through tailored interventions, S&T services will be provided in terms of product and market intelligence, research and scientific support, technical and vocational education, training and advice to the Ministry of Trade, Industry and Marketing (MTIM), and through MTIM or directly to entrepreneurs and institutions engaged in the delivery, support or facilitation of value added production and services in Lesotho.

6.3. Sector Strategies

In order to address the weaknesses identified above and to harness Lesotho's collective strengths, science and technology will be integrated in the industrial development policy to:

a) Maintain a national system for public policy vigilance and analysis, especially those policies that impact on Lesotho's industrial development, and where necessary initiate policy analysis and reform studies aimed at integrating and harmonizing S&T policy and strategies.
b) Provide tangible support to science, technical and vocational training institutions and programmes for improved teaching and learning, work experience acquisition, laboratory and project research exposure in the skills and competencies that are required now and in the future by employers, or by individuals to operate their own ventures.
c) Undertake research in cooperation with large and SME clients to create forward and backward linkages in the product/service value chain for optimum local value added contribution and for exports.
d) Facilitate enterprises to diversify outputs, production and technology processes, raw and intermediate supply and sources through joint engagements.
e) Undertake scientific research and investigations to assess the verity, utility, social, cultural and economic applications of indigenous technologies and traditional knowledge systems.
f) Increase public and enterprise awareness of indigenous technologies and community-based knowledge systems with high value added content and commercial potential.
g) Provide technical support, advice and training to rural and community enterprise initiatives, small and micro enterprises, citizen contractors, new and potential indigenous entrepreneurs.
h) Provide research support, advice, training and technical assistance to women entrepreneurs and associations to overcome traditional barriers to local production, marketing and export development.
i) Be a reliable source and provider of up-to-date S&T information, and to assist SMEs in the simplification, unpacking of adaptation of appropriate technologies.
j) Provide a consistent source of funds for science and technology innovations and to assist in the identification of technical partners and alliances.
k) Develop a fair and accessible system for patent and quality development and for the promotion and protection of intellectual property rights.

7. WATER AND SEWAGE

7.1. Sector Dynamics

Surface and ground water constitute one of Lesotho's major natural resources. Managed well, it represents Lesotho's main renewable resource. Besides having direct utility in meeting domestic needs, it is also a major input into agriculture, industrial

development and an income source of substantial proportion to the nation[12]. Through the Lesotho Highlands Water Project (LHWP) the water resources provide Lesotho with a contractual source of revenue from raw exports to South Africa. As a renewable resource, it has strong potential for hydroelectric energy and rural electrification, and for strategic expansion of tourism and other job-creating projects.

Taking into consideration the need to maintain ecological and environmental balance, our water exploitation, use and beneficiation have to be strategically planned, harmonized and managed to ensure sustainability. Science and technology must facilitate efficient exploitation, use and beneficiation.

7.2. Sector S&T Policy Focus

The S&T policy will be used to:

a) Promote and facilitate the integration of S&T applications directly into the water producing and management enterprises, and into water storage and distribution facilities. This is to ensure the constant availability of safe, high quality water to users.
b) Introduce appropriate technologies and systems in user sectors and enterprises to ensure receipt of high water quality, reliable service and supplies, and
c) Monitor the water quality, use, conservation, recycling and disposal.
d) Ensure rational exploitation and management of Lesotho's Water Resources.
e) Ensure access to portable water by all people of Lesotho.
f) Involve stakeholders in every stage of design and implementation of water resource development projects and water supply systems that are demand driven.

7.3. Sector Strategies

To ensure that Basotho obtain maximum value from this resource, the S&T policy will promote and support the following strategies:

a) Promote, explore and maintain an active map of ground water presence throughout the country and the resource levels, using appropriate technologies.
b) Maintain continuous vigilance on the supply-demand and draw-off levels and the ecological balance.
c) To develop a national intelligence capacity to predict weather patterns and changes in climatic conditions that will impact on Lesotho's water resources, supplies, quality and availability.
d) Maintain continuous vigilance and record of water quality, and disseminate the findings to control authorities.
e) Initiate training, education and awareness programmes in schools and communities to convey and encourage good water management and conservation practices, and facilitate effective waste disposal and commercial recycling.
f) Build scientific and technological capabilities through research, development and training programmes that are related to water resource management.

[12] *Current estimate provided by the Central Bank of Lesotho places the Water sector contribution to GDP at 5%*

g) Utilise information management systems and communication technologies in the coordination of water sector activities.
h) Introduce scientific and technological mechanism in supporting sound environmental watershed management, development of water storage and conveyance system for sustainable water supply.
i) develop appropriate sanitation technologies.
j) provide innovative technologies for water quality analysis and treatment processes.
k) Utilise scientific and technological knowledge in the development of among others water storage (dams) safety instrumentation, dam operations and water releases.

8. ENERGY

8.1. Sector Dynamics

The energy supply of the country is met through the following resources; - Biomass, Petroleum, Coal, Electricity and Liquefied – Petroleum gas (LPG). The biomass, in all its different forms is the main source of energy for majority of households.

In the electricity supply, Lesotho has relatively high potential for hydropower resources. The country is believed to have a potential of 450MW, but only 76MW is currently being exploited. The generation plants are; Muela (72MW), Mantsonyane (2MW), Mokhotlong (0.67MW), Tsoelike (0.4MW) and Semonkong (0.18MW). Since the completion of Muela, Lesotho has been largely self-sufficient in electricity except during the peak periods that have matched by imports from ESCOM (RSA). As grid infrastructure and connections are expanded, however, level of self-sufficiency will decline. The country has abundant solar resources. Solar energy is thus an important potential source of energy. It is therefore highly imperative that suitable technologies are developed in order to harness this potential.

All fossil fuels are imported as the country does not have any proven resources. The major technological challenge is proven the efficiency on the use of this resource.

8.2. Sector Strategies

a) Improve the choice of affordable energy options for households.
b) Provide information on different energy sources.
c) Promote thermally efficient building design and construction techniques.
d) Reduce pollution from vehicles.
e) Promote the efficient use of energy in all sectors of the economy.
f) Promote sustainable use of biomass.
g) Generating data on status and use pattern of biomass.
h) Commit to power sector reforms.
i) Increase the level of electrification.

9. INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)

9.1. Sector Dynamics

Information, and Communication Technologies (ICT) industries are among the fastest growing sectors both nationally and worldwide. In Lesotho, the telecommunications and information sector present new opportunities for Basotho, not just in facilitating domestic and international connectivity, but in opening up a wide range of value added, intellectual and productivity applications for industry, tourism, agriculture, medicine, commerce, travel, information, news, broadcasting, entertainment and education development.

Lesotho's ICT infrastructure is currently lagging behind, with main telephones lines estimated at 6.1 per 100 persons. Personal computers are primarily confined to urban areas and estimated in 2000 to be less than 30,000. The pace at which Basotho absorb computer training, programming and systems literacy will determine how quickly we can engage our national capacity to use, apply and benefit from these rapidly emerging technologies. In order to catch up with our regional and international trading partners, development in ICT has to be accorded top priority with urgent financial and infrastructural implications for our schools, training and research institutions as well as for businesses and government.

9.2. Sector S&T Policy Focus

To provide and maintain a state-of-the-art ICT infrastructure that is adequately supported by well-trained and competent personnel, citizens should be able to constructively and responsibly use the system to improve internal and external communication, education delivery, news, entertainment and to cost-effectively offer ICT-related value added products and services.

9.3. Sector Strategies

a) Identify and indicate key ICT issues, policies and programmes relevant to the growth and development of the various sectors including agriculture, water, energy, tourism, meteorology, industry and commerce.
b) Urgently device strategies to address the challenge of digital divide the country faces between the rural and the urban areas on the one hand, and between itself and the international communities on the other.
c) Improve the common pool of knowledge and expertise available in this area,identify relevant projects and expertise that could assist in defining and effecting ICT strategies.
d) Provide mechanisms throughout the country for training, motivating and mobilizing the citizens in ICT applications and for monitoring technical developments in the country, regionally and globally.
e) Review new technologies developed by the sector that are directly applicable to the expansion of ICT infrastructure (such as Satellite Communication, Power-line Communication) and publish and distribute documents to relevant stakeholders.

f) Ensure training for research on content creation and management, especially on the Internet.

10. TRANSPORTATION, CONSTRUCTION AND PUBLIC INFRASTRUCTURE

10.1. Sector Dynamics

Being a landlocked country, efficient transportation and harmonized public infrastructure are critical to the social and economic well being of Basotho. In terms of SADC standards and international practice, Lesotho prides itself in having a fairly impressive road and transportation system. Rail is limited to 26 km owned and operated by South Africa. Being largely a mountainous country, the arterial network, estimated at some 14,000 km, is currently limited to highways linking the main urban, industrial, commercial and tourism centres. The inland transportation arteries covering some 6,000 km are, in per capita terms, quite extensive, although in the main, they are of agricultural grade. There are also vast areas and rural communities, in the mountainous districts that are still operating with inadequate and irregular transportation service.

10.2. Transport Sector S&T Policy Focus

To develop and maintain a comprehensive national transportation system that is well integrated with public infrastructures and investments, and providing efficient connections and linkages to all communities within Lesotho, and with our neighbour and international trading partners.

10.3. Sector Strategies

a) Maintain an up-to-date database on road use, road accidents and their causes.
b) Engage scientific research in developing local road and building construction materials.
c) Develop and maintain database on road construction materials and on vehicle contractors' performance.
d) Maintain and undertake regular scientific road testing to ensure high standard road surface drainage, appropriate road signals and engage appropriate technologies to facilitate road user compliance.
e) Undertake and facilitate regular training for road and building construction technicians in the industry 's best practices.

Notwithstanding its high priority, given the limited technical and S&T manpower base, and taking into account available resources, implementation will be done in three phases. The logistic diagram shown in Annexes 2 and 3 provides a summary of work plan implementation logistics.

5.1. Table of Contents for Annex I

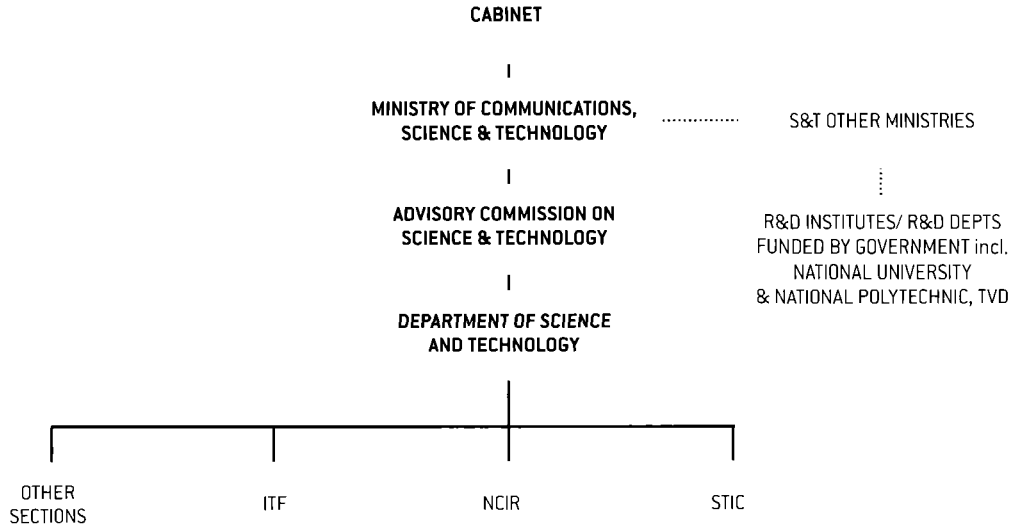
5.2. Proposal For Lesotho's S&T And Rdi's Responsibilities

S&T Policy, Legislation Infrastructure Coordination and S&T Management	R&D Systems Reform and Institutional Development & Cooperation	Production, Process, Technical & Advisory Support	Product, MARKET and Material Development for SME & Rural Growth	S&T Manpower Development, Technology Transfer and National Capacity
	• Value Analysis of Current Production • Detailed Audit of Technologies in current use • Appraisal of Technical Systems & Competencies • Appraisal of Performance of current and emerging Technologies • Upgrading & rationalizing Indigenous Technologies • Adapting new Technologies and practices • Promoting & diffusing locally developed & emerging appropriate technologies	• Product/Service, Market/ Portfolio, Rationalization • Productivity and Process Analyses • Organization, Management and Methods Studies • Productivity enhancements & improvement in systems and competencies • Screening out of inappropriate Technologies and practices • Development & maintenance of an up-to-date S&T Database; to Disseminate S&T research & information on Products, Processes Practices & Worldwide S&T trends	• Profile of current & potential export production output • Assessment of market niches, demand, trend & preferences • Profile of the competition in the domestic and export markets • Determination of Product list, Services and Markets in which Basotho producers and providers presently offer, or can develop at competitive cost & market prices to raise SME output & product range	• Value added research, training & technology transfer to SMEs • Water & Energy VA Research • Life Sciences Research • Food & Agricultural Research • Mining, Mineral & Environment Research • Appropriate Technology Research • Industrial Research • Social and Economic Research
MCST/DST MEP/MOF LACST/DST MINISTRIES Private Sector	CST DST NCIR STIF LTRIC TETIARY	NCIR STIC RDIs/RICs TETIARY Private Sector NGOs/IGOs	NCIR LTRIC RDIs/RICs TERTIARY Parastatals SMME Network	TETIARY NCIR STIC DST RDIs/RICs Private Sector

5.3. Agenda For Research-Oriented S&T Institutes

R&D Institutes	Primary Research Objectives	Specific Research Outputs	Main providers/supplier of R&D services
NCIR	R&D and innovation	Research, product innovation & S&T advice	All RDIs receiving/using public funds
NUL	Teaching, research, material and product development.	Management and S&T Skills, Technical Publications, Technical Advice, Laboratory Support, New materials & process innovations	Science & education Faculty Agriculture Faculty Social sciences & Health
LP	Process & procedure and Product Improvement; Training, extension service and technical advice	Technical and vocational skills, technical publications, community outreach services and appropriate technology solutions	Science & Engineering Schools Agriculture, Domestic Sciences and Arts
MA	Increased on-farm productivity, Better marketing facilities & higher value added output and income	New processes, New products, New uses for products, new and appropriate technologies and improved farm practices	Research Divisions in the Ministry and all outstations and extensions offices
MET	Increased life and occupational skills; Business, vocational and entrepreneurial training	Enlightened educational policy & programmes, certification, new courses & teaching materials methodology, and new publications	All tertiary level teaching and research institutions, technical, trades and vocational Training centers.
ATS	Higher rate of acquisition, use transfer and popularization of appropriate technologies for steady SME growth	Procurement, development & demonstration, of appropriate technology choices, designs and prototypes. Skills upgrading & technical advice.	All Divisions of the ministry dealing with labour and community-related activities, All ATS divisions and RICs/RDCs attached.
MTCE	Increased local use and management of natural and environmental resources. Increased & more reliable & regular S&T and environmental information	Stronger domestic linkages, value added output & more trade & market intelligence & information. Daily forecasts and record of S&T information, environmental impact and risk assessments	All Divisions and outreach offices of the Ministry of Environment. All Divisions dealing with environment & all Meteorology divisions and outstations
RICs	Better use of local plants, materials & indigenous skills and technologies	Practical workshops, demonstration and training sessions for rural-based SMEs.	All established RIC and RDC offices

5.4. Proposed Science & Technology Institutional set-up in Lesotho



Legend:

NCIR = national centre for innovation and research
ITF = innovation trust fund
STIC = science & technology information centre
TDV = technical & vocational training
—— = indicate lines of coordination and/or reporting
..... = indicate lines of communication and/or cooperation

5.5. Glossary

Glossary of technical and unusual terms used in this S&T policy document

• **Appropriate Technology** as used here, differs from the conventional approach commonly understood and applied in international settings. There are different terms of reference and definitions for "appropriateness" If we view these terms as the choice of variables to be maximized by a firm or country, we will redefine "appropriate technology" as that type of choice that is more apt for us to maximize such variables as the employment of human labour, the use of national (or sector's) product or stock taking into account the relative prices of factors of production.

• **Beneficiation** is a term frequently used by scientists, especially in experimental research, to describe the series of processes and steps to extract and derive the full use, utility and benefit of products or raw materials. It refers to the down-line or up-line benefits. To beneficiate... Means to derive the full use, utility and benefits and purpose.

• **Biomass** refers to all of the living materials in a given area. It often refers to vegetation or organic non-fossil material of biological origin, such as trees, plants.

• **Biotechnology** refers to techniques that use living organisms or parts of organisms to produce a variety of products (from medicines to industrial enzymes) to improve plants or animal health or stock or state of fitness or to develop micro-organisms for specific uses such as removing toxins from bodies, from water, to counteract bacteria, viruses, or as pesticides. In more recent times the techniques is used to make genetic alterations to plants and animals, the end use of which could be either good or bad.

• **Catalytic** activity is used here to define an action that is intended to launch, kick off or give a push start to a process that will develop subsequent longer term and multiplied benefits.

• **Chlorofluorocarbons** or CFCs refer to the a family of inert, nontoxic and easily liquified chemicals used in refrigeration, air-conditioning, packaging, insulation, or as solvents, paint, pesticides, and aerosol propellants. Because CFCs are not destroyed naturally in the lower in the lower atmosphere they drift into the upper atmosphere where their chlorine components destroy the ozone layer, which protects life from over exposure to radiation and its consequences.

• **Deforestation** refers to the process or practice that results in the change of forested lands to non-forest uses, achieved through excessive burning, grazing or cutting.

• **Desertification** refers to the progressive destruction or degradation of existing vegetative land cover with long exposure to direct radiation, heat, or chemicals resulting in a desert

• **Ecology** refers to the natural balance and relationship of living things to one another and to the natural habitat and environment, or to the study of such relationships and natural balance.

• **Executive order** is a term that is currently used in government circles to reform ministries, government departments or parastatal enterprises. The reformed institutions perform their functions and deliver services using the same strict criteria as commercial operators. The entity under executive order is obligated to operate within its own or given to resources and to

make statutory returns to the Government, as well as profit to its shareholders like a private firms. In case of non-tradable services the entity is expected to breakeven, that is, its costs should be contained within the approved budget.

• **Gross Domestic Product (GDP)** is the market value of all final goods and services produced by the country during the financial year. The main components of GDP are *consumption, investment, government purchases*, and *net exports*, which are exports minus *imports*. This sum is often represented by the equation Q (or Y) = C + I + G + (X - M). In macroeconomics, GDP is the main measure of output. In the U.S., GDP is part of the *National Income and Product Accounts*.

• **Gross National Product (GNP)** is the market value of all the goods and services traded in and by the country irrespective of the source or final destination of the goods and services. It differs from GDP by the extent to which the country's export receipts exceed or lags its merchandise imports.

• **Inflation** is the instability that occurs when prices of a majority of goods and services (average consumer goods basket) consumed by the public show significant rise over time (a month or year). It reflects the rate of change in prices and is measured by (in the case of Lesotho Central Statistics Office, the Planning Commission or central Bank of Lesotho through regular assessment of the Consumer Price Index and its movements. (CPIM). A high rate (over 50%pa.) of change is described as super inflation and it is usually observed when there is excess in the supply of money relative to the supply of goods.

• **Productivity** refers to content and quality of output obtained from engaging labour, management, technology and capital in converting inputs to products and services. It is a good measure of efficiency of labour and capital. Partial measures are expressed by labour productivity, capital productivity and the total measure is expressed by total factor productivity.

• **Public Policy** refers to Government's broad base economic framework. It represents a harmonized set of measures designed to influence the country's long-term growth prospects and stability and to moderate economic fluctuations. i.e. in the rates of growth, inflation, employment, level of taxation, etc. It is initiated by the ruling government and requires setting the level of taxation as well as amount and distribution of public (government) spending.

• **Public Good Research** refers to research activities done with public funds, using public resources and whose outcomes are intended for use by, or to the benefit of the general public or sections of the public.

• **Value added** refers to the additional value created or realized by the contribution of labour, management, process innovations, use of capital or from a combination of the above. It is said to be effective (effective value added) when the cost of the local inputs (domestic resource cost) used result is a price that is equal or less than the price of the finished goods of the equivalent import

• **Waste** refers to unwanted materials from animals and human beings, unused, burnt or insufficiently burnt materials producing refuse of liquid, solid or gas, as from industrial and manufacturing processes.

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Graphic Design **Link (www.studio-link.it)**

Printing **Stella srl, Trieste, Italy**

October 2006