

Research and Innovation Policy



Lesotho government

Ministry of communications, science and technology.

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Foreword

The Citizens of the beautiful mountain kingdom, the only way to keep up with the dynamic world is through research and innovation. The world keeps on facing different obstacles, drastic changes and there is also a need for efficiency in our daily operations. Drastic climate changes and the Covid 19 pandemic among others have revealed significant need for innovative minds and intensive engagement in Research and Development (R&D). We are on the mission globally towards the Sustainable Development Goals (SDGs) and towards the African agenda 2063, 'the Africa we want' among others. The above-mentioned obstacles will not make it easy for us to accelerate towards these goals, for instance, it is not easy to eradicate poverty with the current climate changes for a country whose economy has been known to be dominated by agriculture sector. This can only be dealt with through innovative ideas leading to climate smart agriculture.

As Lesotho, we must be heavily engaged in R&D, from the government, Private sector, Academia and higher education institutions the participation should be enormous for better innovations and informed decision-makings. The lives of Basotho should be improved through support of SMMEs and indigenous capabilities. This Research and Innovation (R&I) policy along with other Science and technology policies and the Science and Technology ACT 2021 are key frameworks offering guidance on technical expertise for research and innovation activities, national and international collaborations. R&I if effectively implemented will bring about; improved infrastructure, competitive economy, more job opportunities and ease of doing business in Lesotho.

From the commitment shown by the Government of Lesotho to invest more on research, innovation and technology through the National Strategic Development Plan II, I foresee efficient implementation of this document and a turning point for lives of all citizens of Lesotho. The Ministry of Communications, Science and Technology through the Department of Science and Technology (DST) as the coordinator, overseer and curator of Science, Technology and Innovation (STI) activities including this policy and others, guarantees efficient implementation of the activities in the policy and never-ending collaborations with all stakeholders.

Hon Tšoinyana Rapapa

Minister of Communication Science and Technology

Acronyms

ACP	African, Caribbean and Pacific
ASTII	African Science, Technology and Innovation Indicators
AU	African Union
BBCDC	Bethel Business and Community Development Centre
BEDCO	Basotho Enterprises Development Corporation
BERD	business enterprise expenditure on R&D
BoS	Bureau of Statistics
BOU	Botswana Open University
CBR	Country Background Report
CHE	Council on Higher Education
CoE	centre of excellence
DST	Department of Science and Technology
FTEs	full-time equivalents
GBARD	government budget allocations on R&D
GDP	gross domestic product
GII	Global Innovation Index
GoL	Government of Lesotho
GTIPA	Global Trade and Innovation Policy Alliance
HE	higher education
HEI	higher education institution
HIS	health information systems
I&C	innovation and commercialisation
IKS	indigenous knowledge systems
IP	intellectual property
IPR	intellectual property rights
IS	innovation system

KPA	key performance area
KPI	key performance indicator
LDC	least developed country
LNDC	Lesotho National Development Corporation
LRA	Lesotho Revenue Authority
M&E	monitoring and evaluation
MCST	Ministry of Communications Science and Technology
MDAs	ministries, departments and agencies
MoET	Ministry of Education and Training
MSMEs	micro, small and medium-sized enterprises
NRIC	National Research and Innovation Council
NSDP	National Strategic Development Plan
NUL	National University of Lesotho
OACPS	Organisation of African, Caribbean and Pacific States
OBFC	One-stop Business Facility Centre
OECD	Organisation for Economic Cooperation and Development
PCR	polymerase chain reaction
PRR	Policy Recommendation Report
PSF	Policy Support Facility
R&D	research and development
R&I	research and innovation
RIA	Research and Innovation Agency
RIF	research and innovation fund
RRI	responsible research and innovation
SADC	Southern African Development Community
S&T	science and technology
SDGs	Sustainable Development Goals
SEZ	special economic zone

SMART	specific, measurable, achievable, realistic & time-bound
STEM	science, technology, engineering and mathematics
STI	science, technology and innovation
STIP	science, technology and innovation policy
STISA	Science, Technology and Innovation Strategy for Africa
SWOT	strengths, weaknesses, opportunities and threats
TAU	Technical Assistance Unit
TED	Technologies for Economic Development
TISC	technology and innovation support centre
TVET	technical and vocational education and training
UIS	UNESCO Institute for Statistics
UN	United Nations
UNCTAD	United Nations Centre for Trade and Development
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
WEF	World Economic Forum

R&I Vision

Private sector driven economy ensued from modern technical skills, innovative society and highly collaborative research and innovation ecosystem.

R&I Mission

To remould Lesotho's private sector, academia and other key sectors into globally competitive sectors through enormous support for Research and Innovation activities for amelioration of every Mosotho's live, infrastructure and the economy.

Guiding Principles

The effective implementation of the national R&I Policy will be guided by these key principles and all shall comply entirely with Lesotho laws and all appropriate regulations:

- I. **Relevance:** Under this principle each R&I activity is subjected to critical examination to determine its relevance to the country's development;
- II. **Cost-effectiveness:** This principle requires each R&I activity to be cost-justified in terms of the methods it employs to achieve the desired results;
- III. **Realism:** Despite the lofty nature of Lesotho's desire to reach and break global limits in terms of R&I activities for amelioration of its economy, the need for realistic targets in the short and medium term must always be borne in mind.
- IV. **Synergy:** R&I development must be holistic; and there must be a multi-disciplinary and cross-sectoral approach to problem-solving for synergy;
- V. **collaborations:** There must be conscious efforts for strategic collaboration with all local and foreign stakeholders as partners in development, especially with the private sector.
- VI. **Opportunity creation:** R&I activity or intervention should hold promise for developing capacities to create jobs and wealth.
- VII. **Demand-driven potential:** Investments in R&I capacities are to be market or society-driven.
- VIII. **Risks avoidance:** All supported R&I activities should limit or avoid promotion global challenges such as global warming and Environmental Impact Assessment (EIA) should be performed where necessary.
- IX. **Sustainability:** Lesotho like all countries also commits to the global Sustainable Development Goals and therefore the principle of sustainability must underpin all R&I activities.

Executive Summary

The Research and Innovation (R&I) policy of Lesotho consists of a series of strategies on activities to be undertaken by the Government of Lesotho and its institutions, mainly the Department of Science and Technology (DST) under the Ministry of Communications, Science and Technology (MCST), within the proposed timeframe of 10 years (2022-2032). The realisation of a strong national R&I ecosystem requires efforts from multiple actors in society and other relevant ministries, departments and agencies, including tertiary education institutions, non-governmental organisations, urban, rural and remote communities, professional associations and private citizens. Each of these actors has a unique and invaluable contribution to make in the R&I sphere to achieve the goals and objectives articulated in policy statements under the identified thematic areas.

Coordination, networking, monitoring and communication between multiple actors in the R&I ecosystem are essential for harmonisation and cooperation in fostering R&I in Lesotho. The establishment of a specialised agency to coordinate national R&I efforts will enable linkages between the various agents, help influence and mobilise more participants. It will also enable actors to pool resources, coordinate efforts to avoid duplications or working in silos, exchange expertise, and significantly increase innovation and research output through a synergistic approach.

The R&I policy clearly articulate the role of respective actors in the research and innovation ecosystem, and, most importantly, it provides the framework for engagement and coordinating efforts among the key actors and stakeholders. These R&I policy specifically address Sustainable Development Goal (SDG) 3 (good health and well-being), SDG 4 (quality education), SDG 7 (clean and affordable energy), SDG 9 (industry innovation and infrastructure) and Target 9.5, SDG 10 (reducing inequality), SDG 11 (sustainable cities and communities), SDG 13 (climate action) and SGD 17 (partnerships for the goals), the overall integration of which should contribute to a marked difference in attainment of SDG 1 (no poverty) and SDG 2 (zero hunger), which are the greatest inhibitors for the potential development of human capital of a least developed country (LDC).

Policy formulation approach

The approach adopted for R&I policymaking emphasises that policy addresses the fact that societal actors need to cooperate during the whole R&I process to better align functions and outcomes with the values, needs and expectations of society, ensuring that the policy is cutting across the key R&I ecosystem actors. High-quality information was derived from a variety of sources including expert knowledge; existing local, national and international research; existing statistics; a review of research on the topic; stakeholder consultations; an evaluation of previous policies; as well other relevant national policies, a Country Background Report (CBR) that produced baseline information and data, and other relevant documents.

The approach adopted for policy analysis consisted of:

- a desktop review of previously produced, but not adopted, and current policy documents to develop an overview of the current state-of-play for the Lesotho R&I ecosystem;
- a second layer of analysis that provided the means with which to identify and gather key inputs from all relevant stakeholders through a series of semi-structured interviews and a workshop;
- a third analytical task that was dedicated to the synthesis of stakeholder input from which to develop this policy from the recommendations, and to guide the establishment of a national R&I agency;
- extrapolating respective programmes, projects, outcomes and budgetary requirements for R&I policy implementation and establishing a national R&I agency through the deployment of a rigorous results-based monitoring and evaluation mechanism based on a Logical Framework Analysis.

From the review of the national blueprint on socioeconomic development, which currently is the National Strategic Development Plan (NSDP) II, the existing R&I policies of Lesotho and the outcomes of the stakeholder engagements, together with expert synthesis and analysis, and the grand vision towards which the Lesotho R&I capacity is being directed, take into consideration about 8 expected policy results. This chain of results is summarised into short-, medium- and long-term recommendations as follows:

Short-term objectives (1 to 2 years)

- I. ***Establishment of a national Research and Innovation Agency.*** The national R&I Agency (RIA), reporting to Parliament through the Ministry responsible for Science, Technology and Innovation, is recommended to provide a framework for guidance on R&I, undertake mobilisation of research resources and direct the nation's investments in R&I funding. The RIA shall support the local incubators and accelerator programmes and help innovative start-ups and micro, small and medium-sized enterprises (MSMEs) in Lesotho to build innovation capacity and take ideas to market. This shall be done through financial assistance, advisory services, and connections to the available business and R&D expertise.

Medium-term objectives (2 to 4 years)

- II. ***Strengthening of tertiary education and workforce training programmes.*** The government will improve the efficiency and effectiveness of workforce training systems so as to respond to the socioeconomic, cultural and development needs of Lesotho. Proposed programmes should improve the relevance of higher education and Technical and Vocational Education and Training (TVET), address the skills mismatch, and improve the quality of education and the overall global footprint of Basotho tertiary education institutions.

III. *Prioritisation of investments in collaborative scientific research and development.*

The government will intensify investment in scientific research and development (R&D), and strengthen local innovation and technological capabilities. Proposed programmes should embed the need to develop and strengthen sustainable financing mechanisms, and improve effective collaboration between government, academia, industry and society (quadruple helix model of innovation¹).

IV. *Improvement of inclusion and socioeconomic equality and equity in R&I.*

The government will align and mainstream socioeconomic equality and the inclusion of all marginalised groups to improve the participation of women, girls, herd boys, rural youth, disabled persons and all other disadvantaged persons in science, technology, engineering and mathematics (STEM) education, research and occupations.

V. *Integration of indigenous knowledge systems and management of intellectual property (IP) protection.*

The government will mobilise indigenous knowledge systems (IKS) and grass-root innovations, nurture the talent of ordinary citizens outside the education and training system, and strengthen the effective protection of intellectual property rights and enforcement mechanisms.

VI. *Creation of a conducive business environment for innovation.*

The government will create where necessary and improve the regulatory environment (implement accessible incentives and innovative tax measures) in support of innovative start-ups and improve the performance of MSMEs for employment creation.

VII. *Strengthening access to R&I information.*

The government will strengthen various institutions' ability to manage their own data, create an open data platform to make non-confidential R&I information easily available, share regular updates on R&I-related activities, and strengthen bottom-up job creation and economic growth.

Long-term objectives (4 to 6 years)

VIII. *Adoption of new and relevant emerging technologies.* The government will support the adoption of technologies for emerging applications with a strong focus on technical training to initiate a rapid transition to climate-resilient agriculture, quality healthcare, ICT, manufacturing digitisation and the green economy.

¹ To read more on the quadruple helix model please visit [Co-shaping the Future in Quadruple Helix Innovation Systems: Uncovering Public Preferences toward Participatory Research and Innovation – Science Direct.](#)

Chapter 1

1. Introduction

1.1. Justification for the research and innovation policy

Innovation is the foundational source of long-term global economic growth and improvements in quality of life and standards of living. Recent policy approaches around the globe have recognised the importance of innovation as a driving force for the economy, supported by new knowledge generated by scientific research and development. To drive economic growth and transform people's lives, innovative ideas, research and developments must be successfully translated into valuable products.

In the past, the role of research, innovation and entrepreneurship in Africa's economies has scarcely been addressed in policy discourse. This has been attributed to a low level of innovations, and a lack of official reporting and statistics. Many of Africa's innovations have traditionally been 'below the radar' and existed in the informal sector. To tap into the opportunities presented by R&I in developing countries, a clearly defined and coordinated innovation system (IS) is necessary. An IS encompasses all institutions and economic structures affecting both the rate and the direction of technological change in society. It facilitates cooperation between agencies and supports individuals working in the R&I ecosystem to initiate, import, modify and diffuse new technologies.

Countries that undertook the initiative to develop policies and define the scope and operations of their innovation systems are realising socioeconomic benefits. For example, in 2014, countries such as Kenya, Nigeria, South Africa, Tunisia, Senegal and Morocco acquired more than 10 % of their gross domestic product (GDP) from innovation-led sectors, primarily ICT. Innovation spaces, such as Kenya's iHub, have become internationally recognised spaces for innovators and attract significant investment. Exposition events such as demo Africa show a

variety of innovations built by African innovators. The Kenyan, Nigerian and Eswatini governments have invested in creating special economic zones (SEZS) targeted at science and technology innovation parks.

The global innovation landscape is undergoing drastic transformation at the same time as global challenges are becoming more complex, less predictable and require more urgent action. The covid-19 pandemic is one example where the challenges facing global economies have shown the need for robust and resilient R&I systems to handle unexpected challenges. In the absence of well-defined policy that is framed to adapt to changing situations, the potential benefits of R&I are not fully realised. It is therefore necessary to have a policy that can guide R&I efforts to where they are needed most.

Accordingly, at the 23rd ordinary session of the African Union (AU) heads of states and government summit, member states adopted a 10-year Science, Technology and Innovation Strategy for Africa (STISA-2024). The strategy supports the au agenda 2063, which is underpinned by science, technology and innovation as multifunction tools and enablers for achieving continental development goals. The government of Lesotho, therefore, seeks to transition to an innovation-led and knowledge-based economy.

The policy period of the Science and Technology (S&T) policy (2006-2011) of Lesotho expired a while ago, and a new Science, Technology and Innovation (STI) policy is about 10 years overdue. The previous S&T policy had traditionally emphasised the role of advancement of scientific knowledge and skills, as well as the adoption and integration of new technology in Basotho society. However, the important role of innovation and the creation of new knowledge and products available to the market were not emphasised. Innovation on its own changes very fast, and the previous policy was already misaligned with the current national blueprint for socioeconomic development (NDSP II).

1.2. Research and innovation framework

The innovation strategy of any country must coordinate a multitude of disparate policies that aim to foster scientific research, education and skills development, information technology, intellectual property (IP), technology commercialisation, investments, tax, trade, government procurement and regulatory policies in an integrated fashion to drive economic growth. A snapshot of some relevant policies and strategic plans in Lesotho that must be coordinated and harmonised is provided below with the aim of moving the country towards the achievement of the UN'S SDGS.

1.3. Science and Technology Policy and MCST strategic plan

The vision of the Lesotho national science and technology policy (2006-2011) is 'to have a prosperous and progressive economy and society that are sustained through intelligent use of science and technology assets by progressive and innovative citizens'. Its mission is 'to transform Lesotho into a modern state, having enough highly skilled, innovative and technologically trained personnel with a competitive science and technology infrastructure to support a growing economy' (DST, 2006).

Although this policy highlighted major challenges and identified suitable strategies to address them, implementation was very low due to lack of buy in from authorities and there were too many priorities, which took attention away from a focus on the key R&I challenges and solutions that are relevant to improving the performance of the national R&I systems in Lesotho. There is a need, therefore, for an updated policy with clear priorities and implementation mechanisms to address issues specific to R&I development in Lesotho. The newly developed MCST strategic plan 2020-2022 places emphasis on the enhancement of institutional capacity for R&I as one of its strategies to achieve the planned strategic objectives (MCST, 2020).

1.4. Tertiary Education Policy and Education Sector Plan

To prioritise issues of R&I in the education sector, the Ministry of Education and Training (MOET) has developed a Higher Education (HE) policy 2013 (CHE, 2013) and the Education Sector Plan 2016-2026 (MoET, 2016). The policy outlines strengthening R&I in Higher Education Institutions (HEIs) as one of its overarching goals and it gives clear guidance on how to achieve these goals. Some of the policy objectives are to put in place national mechanisms for promoting, supporting and coordinating R&I activities across different sectors, and to promote increased engagement in R&I by students in HEIs.

The Education Sector plan's strategic objectives include the reform of the national curriculum and assessment system to meet the needs of Lesotho, an improvement to the relevance of programmes offered at HEIs, and training more students in the relevant stem subjects, with the provision of funds for R&D for technology adoption and innovation in HEIs. This is in line with SDG 4 (quality education) and SDG 9 (industry innovation and infrastructure). There is an urgent requirement to radically transform HE and TVET (Technical and Vocational Education and Training) institutions to support the emergence of an entrepreneurial culture. In addition, the MoET needs to collaborate and work with industry to develop new curricula, and evaluation and assessment processes to address the current skills mismatch. Finally, the MCST must work closely with the MoET to collectively address the key challenges of R&I development in HEIs and TVETs.

1.5. National Strategic Development Plan with SADC, AU and UN plans

The National Strategic Development Plan 2019-2023 (NSDP II) prioritises technology and innovation as one of the four main productive sectors that have the potential to create jobs and contribute to inclusive growth. NSDP II has the ambitious policy targets of transforming the Lesotho economy from a consumer-driven economy to a producer-based economy led by the private sector. One of its strategic objectives is to improve manufacturing capabilities and move into knowledge-intensive value chains, facilitated through the development of innovation hubs

and incubation frameworks to support early-stage start-ups with seed financing, R&D and trade financing.

The national objectives mentioned above are in accordance with those articulated in the AU's agenda 2063 – *the Africa we want*. The aspiration of agenda 2063 is 'to have a prosperous Africa based on inclusive growth and sustainable development and to have African people educated and highly skilled with Science, Technology and Innovation (STI) being the bedrock of its inclusive education system'. This is also in agreement with the Southern African Development Community (SADC) protocol on science, technology and innovation, stisa-2024 (au, 2020) and the UN'S SDGS (un, 2015).

1.6. Main challenges and gaps in the Lesotho R&I ecosystem

a. Global challenges

Technological innovation has always been at the heart of economic and social development. Today, the global scale and complexity of the challenges facing society make the case to renew attention on STI even more compelling. It is imperative for countries to provide a framework for inter-institutional collaborations in developing STI programmes in all sectors of the economy to meet the basic needs of society. STI play a key role in fostering the further development of productive capacities and provide a path to sustainable socioeconomic development for least developed countries (LDCS). Some of the global challenges and the role of R&I are detailed as follows;

First, the world is in the midst of a serious economic crisis brought about by a global pandemic (covid-19), which has exposed limits in the current economic and social systems. STI systems were put under stress but have responded strongly and flexibly. Funding for new research and development initiatives were set up in record time, and innovative solutions quickly emerged and were disseminated. Technology and innovation have proven to be effective means of resuscitating economic activities worldwide.

Second, environmental challenges require wide-ranging changes in patterns of production and consumption. Technological innovation, anchored on scientific R&D, holds the potential to

address environmental challenges such as climate change, energy efficiency, food security and natural disasters.

Third, the world is undergoing a profound transformation due to the rate of innovation and technological advancement. New technologies, such as information technologies, have drastically changed the way people interact and societies are structured. Advancements in cutting-edge technologies such as cloud computing, high-performance computing, artificial intelligence, machine learning, manufacturing digitisation, biotechnology and nanotechnology are changing our world and our societies, bringing with them unprecedented challenges and opportunities.

Promoting R&I culture

The relationship between innovative thinking and entrepreneurship has proven their potential to transform our societies in positive ways. The combination of the innovative mind and the entrepreneurial spirit has defined the way our societies work. Promoting the R&I culture is necessary to maintain the trajectory toward sustainable development while ensuring the global competitiveness of countries' economies. To achieve this, the workforce and human capital must be strengthened through education and skills development in pursuit of excellence in scientific research with a focus on the national market in order to foster innovation and entrepreneurial skills.

Environmental challenges and natural disasters

Collaborative and multidisciplinary efforts are required to combat the complexity and transboundary nature of environmental problems such as pollution, resource exploitation and depletion, and the impact of climate change. These environmental challenges, which necessitate nations to work together and develop innovative solutions to reduce the vulnerability of people and nations to natural disasters, energy, food and water shortages, also require more innovative technologies and approaches.

Information technology and security

Information technology, including advancements in communication technologies and fields such as artificial intelligence, is becoming more commonplace. As national security infrastructure and personal information are becoming more digital, they are potentially more vulnerable to threats from actors who wish to cause disruption or theft. It is necessary that precautions and regulatory frameworks be put in place to regulate the advancement of such technologies and minimise the vulnerability of national infrastructures and personal privacy to

exploitation. The sophistication of these threats is increasing daily and therefore so should the response by governments and the private sector to such threats through R&I.

b. Challenges and gaps in the national R&I ecosystem

Several challenges and gaps were identified through a systematic approach and analysis of the R&I value chain (linear) and ecosystem (non-linear), beginning with basic and applied research, prototyping and product development, incubation and mass production, all the way to product distribution and market access. The identified weak leverage points in the Lesotho R&I ecosystem include human resources and workforce training, knowledge and idea creation, commercialisation, transition to emerging technologies and the need for a central coordinating R&I agency at national level. These challenges and gaps were also identified in the country Background Report (OACPS R&I PSF, 2021), a baseline study for diagnosing the Lesotho R&I ecosystem through the review of policies and the national strategic development plans.

i. Workforce training programs

Tertiary education

Tertiary education institutions are critical for the process of knowledge creation and the emergence of a highly skilled workforce. In Lesotho, this sector comprises 3 universities and 51 non-university institutes. The main challenge for the creation of knowledge and an appropriately skilled workforce is that unemployment numbers are high among graduates. This can be attributed to an underdeveloped local business sector, no relationship between the higher education sector and industry, and a mismatch of educational programmes with the economic and social needs of the country. In addition, the private sector reports a shortage of both highly skilled and skilled labour, especially from the stem fields of study.

Some of the key challenges highlighted in the country's current development plan (NSDP II) include but are not limited to 'low efficiency and effectiveness of public spending on education, skills mismatch, shortage of critical skills such as entrepreneurial skills, medicine, engineering and managerial skills'. It is therefore imperative for Lesotho to strengthen education and skills development programmes to foster innovation. Quality and affordable HE and TVET are key

ingredients in achieving sustainable economic growth and inclusive development of Lesotho (in line with SDG 4).

Socioeconomic equality and inclusion

Article 23 section 1(d) of the African youth charter states that ‘state parties shall guarantee universal and equal access of a minimum of nine years of formal education’. In section 1(e), the article states that ‘parties shall guarantee equal access to and completion of vocational, secondary and higher education to effectively address the existing imbalance between young men and women in certain professions. This is in line with the African agenda 2063, which says

“Africa shall be an inclusive continent where no child, woman or man will be left behind or excluded, based on gender, political affiliation, religion, ethnic affiliation, locality, age or other factors. All the citizens of Africa are actively involved in decision making in all aspects of development, including social, economic, political, and environmental. Women and youth are fully engaged and empowered to play their rightful role in all spheres of life”.

The SADC protocol on STI aims to promote gender equity and equality in the teaching and learning of basic science and mathematics at all levels of the education system. This is in line with SDG 5, which is about achieving gender equality and empowering women and girls.

Priorities 3, 4 and 10 of the Lesotho gender and development policy 2018-2030 focus on gender, education and training; gender, productive resources and employment and economic empowerment; and gender and peace building. While Lesotho has made progress in promoting these gender equality priorities, and, currently, more females than males attend secondary and tertiary education, female students only represent 40 % of the R&D personnel in full-time equivalents (FTEs). There is also a recognisable shortage of rural youth, herd boys, people with disabilities, and other socially and economically marginalised groups in terms of participation in stem and innovation-oriented programmes and jobs.

ii. Knowledge creation

Scientific research and development

Research and development are a broad category describing the entity of basic research, applied research and development activities. In general, R&D encapsulates a series of systematic activities that increase knowledge and the use of this knowledge when developing new

products, processes or services. Nowadays innovation activities are strongly tied to the concept of R&D as an important driver of socioeconomic growth. Accordingly, and in line with the targets of SDG 9, countries (including Lesotho) have pledged to build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation. Target 9.5 of SDG 9 calls upon countries to encourage innovation and sustainability in order to increase the number of researchers as well as private spending on research and development.

The CBR indicates that the R&D system of Lesotho is minimal, and that gross expenditure on R&D was 0.05 % in 2015, which is lower than the required target of 1 %. Research is mainly concentrated at the National University of Lesotho (NUL) but the country has no clear mechanisms guiding research priorities and funding. Lesotho's R&D personnel amount to only 35 in FTE per 1 million inhabitants. This is 10.5 times smaller than Eswatini's number of R&D personnel, which amounts to 369 FTE per 1 million inhabitants.

HEIs are facing shortcomings in their laboratories and internet infrastructure, and the decreased funding indicates a shift in the MOET'S focus over the years, away from the tertiary sector. In terms of research and publications, Lesotho ranks 42nd among African countries, with the main performer being NUL and the government the main funder. In addition, Lesotho holds a very low place in international rankings² in terms of scientific outputs and innovation capabilities vis-à-vis 'the number of patent applications made with collaborators from other countries', 'the number of patent applications filed relative to population size' and in terms of 'the prominence and standing of local research institutions'.

If the potential outcomes and contribution of this sector are to be realised, there is an urgent need to renew government commitment and investments in national technology and innovation programmes, including strengthening R&D institutions and programmes (innovation capabilities), as well as increased private sector and international engagements in the development, transfer and adoption of relevant technologies.

Academia and industry partnerships

Academia-industry links are one of the crucial aspects to ensure a good match between manpower supply and demand, relevant knowledge creation and that graduates have the skills that industry needs. The first key performance area (kpa1) of the NSDP II makes references to 'promoting inclusive and sustainable economic growth and private sector-led job creation'.

² WEF Competitiveness Rankings of Lesotho on its Strategic Intelligence Platform (weforum.org).

Target 17.16 of SDG 17 (partnerships for the goals) aims to enhance global partnerships for sustainable development, complemented by multi-stakeholder partnerships that mobilise and share knowledge, expertise, technology and financial resources to support the achievement of the SDGS. Additionally, target 17.17 encourages and promotes effective public, public-private and civil society partnerships, building on experience and resourcing partnership strategies.

One of the policy objectives of the 2013 HE policy is to promote and facilitate engagement by students and staff members with entities in both the public and private sectors, and to strengthen linkages between HEIs and local communities. Nevertheless, at the time of writing, interaction between individual HEIs with companies is limited and fragmented. There is a general lack of knowledge creation by industry and the exploitation of research results is random. The expenditures of industry/the private sector on R&D are zero, thus indicating that the business sector is not directly engaged in research and has very limited innovation activity. Business activity is concentrated in labour-intensive sectors with low knowledge intensity, following low-cost strategies with no industrial research support programmes.

Indigenous Knowledge Systems

Indigenous knowledge is regarded as a unique, traditional and local knowledge existing within and developed around specific conditions of people who are indigenous to a particular locality or geographic area. It is a form of knowledge that covers various aspects of life, including food production, management of natural resources, medicine, forming socialisation and human life, developed as a survival mechanism for specific local communities.

One of the aspirations of agenda 2063 is to have a prosperous Africa based on inclusive growth and sustainable development. It aspires that ‘Africa’s agriculture will be modernised and productive, using technology, innovation and indigenous knowledge’. The African youth charter, article 20, section 1(d), encourages state parties to work with educational institutions, youth organisations, media and other partners to raise awareness of and teach and inform young people about African culture, values and indigenous knowledge.

Indigenous Knowledge Systems (IKS) have previously been identified as one of Lesotho’s science and technology assets; IKS technologies are considered as key products that need more recognition focused on them. The Lesotho Indigenous Knowledge Systems policy (2021) focuses on the formalisation of local community indigenous knowledge in the fields of medicine, agriculture, food and environmental management.

Intellectual Property Protection

Intellectual Property (IP) refers to any creation of the mind that is capable of being protected against unauthorised use by any other person, whether in terms of Lesotho law, or foreign intellectual property law, and includes any rights in such creation. The most well-known types of IP protection are copyrights, patents, trademarks and trade secrets.

The absence of industrial research and low innovation activity results in minimal patenting activity. Since 1980, applicants from Lesotho have filed only 12 patent applications. Of these, 9 were filed in the national patent office in 1995 and 1996 and 3 were filed abroad between 2012 and 2015; a total of 10 were finally granted. Most of the IP activities are centred on the registration of trademarks; 191 trademarks have been registered in the country since 1980. However, a challenge remains in the enforcement of protecting IP as the piracy of content such as music, videos and books persists.

Access to information for R&I

The kpa4 of the NDSP II proposes to strengthen governance and accountability with an emphasis on planning and statistics, international cooperation and access to information. The right of access to information empowers citizens to obtain information related to research and innovation held by public bodies (with limited exceptions). It encompasses a right to request and receive scientific and technical information, as well as an obligation for governments to publish such information proactively.

There is a lack of statistics in the country regarding research and innovation, with critical STI indicators being outdated. Fragmented approaches and a lack of networking, sharing of information and interactions among entrepreneurs prevent the shaping of an entrepreneurial ecosystem.

iii. Commercialisation

Business regulatory environment

Complex requirements or ineffective regulations in the country can stifle innovation and discourage investments, weaken competitiveness and compromise economic growth. Concerning the ease of doing business, Lesotho is ranked 122nd out of 190 countries, but starting a business is among the areas with a higher score for Lesotho, which performs better than the average for Sub-Saharan Africa in all sub-criteria. The challenge is slow job creation

in the private sector, hence increasing pressure on the public sector to provide employment and increased public expenditure. The survival rate of companies is low with many firms dying after 5 years of operation; the size of the market for modern technologies and innovative products is too small to create a sustainable demand.

Incentives and access to finance

According to the global competitiveness index 2019 by the World Economic Forum (WEF), Lesotho scores very low on the financing of MSMEs and the availability of venture capital. The government's past efforts to set up a partial credit guarantee scheme from 2011 were not very successful as it provided only a small number of guarantees due to the stringent requirements of commercial banks. Despite the increasing number of initiatives for the support of start-ups, the efforts are fragmented with questionable quality and effectiveness. Political instability affects the ability of the governance system to coordinate actions across policy domains, such as international collaborations for resource mobilisation and foreign direct investment.

iv. Transition to emerging technologies

Climate-resilient agriculture

Climate resilient agriculture is an approach that includes the sustainable use of natural resources through crop and livestock production systems to achieve long-term productivity and farm incomes under climate variabilities. This practice reduces hunger in line with SDG 2 (zero hunger). Agenda 2063 states that Africa's agriculture will be modern and productive, using science, technology and indigenous knowledge, and shall have environmentally sustainable and climate-resilient economies and communities in line with SDG 13 (climate action) and SDG 9 (affordable clean energy). In its efforts to achieve this aspiration, the kpa1 of the NSDP II plans to ensure sustainable commercial agriculture, taking cognisance of the impacts of climate change.

Agriculture, together with forestry and fishing, contributes to 4 % of GDP, employs around 60 % of the workforce and constitutes the main source of income for 70 % of the population living in rural areas. However, increasing temperatures and lower levels of rainfall due to climate change have a significant negative impact on agriculture and food production. Shifting production from the low-value cereals to high-value horticulture could transform the rural economy, creating jobs and raising income in the rural areas. In addition, expanding the

existing small research and innovation capacity on areas that are relevant to horticulture would be necessary to contribute to a greater capacity in food security for the country.

Quality healthcare

Quality healthcare systems consist of a network of well-trained healthcare professionals in reliable healthcare facilities with adequate infrastructure. Ideally, emerging technologies, such as recent laboratory equipment, medicines and knowledge generated by on-going research, support these facilities.

The government of Lesotho, with the assistance of national and international partners, has made significant progress in improving the healthcare system. However, Lesotho faces an aging healthcare system with inadequate service delivery, an insufficient number of facilities, inadequate and aging infrastructure, accessibility challenges and poor technical supervision. Available data from 2010 indicated that there was a total of 372 healthcare facilities serving a population of close to 2 million inhabitants.

Government effort has focused on providing adequate healthcare facilities, a trained healthcare workforce, and ensuring the affordability of healthcare and medicines. However, the current healthcare system is under pressure and not advanced enough to deal with emerging medical and public health challenges. There is a need for emerging healthcare technologies and trained laboratory technicians.

Emerging technologies in healthcare such as ICT technologies, advanced healthcare equipment (such as covid-19 Polymerase Chain Reaction or PCR testing) and medicines offer opportunities to greatly improve the quality of life for patients. By promoting the adoption of emerging technologies, problems caused by inaccessibility, for example patient diagnosis, tracking and monitoring, can be resolved by using innovative approaches such as mobile technology and newly developed medicines to treat illnesses with greater effect. Advancements in Health Information Systems (HIS) and data analytics offer unique opportunities for research by availing a wide range of data and methods for analysis.

Emerging ICT applications and digitisation

ICT has led to important changes over recent decades, transforming value chains and the products of trade goods and services. While SDG 9 encourages innovation and infrastructure improvements including ICT, it also recognises the risk that many people and businesses can

be left behind. To address this, target 9(c) calls for increased access to ICT, striving to achieve universality and affordability.

In Lesotho, there are significant obstacles hindering the uptake of ICT technologies that go beyond the boundaries of R&I policy, such as low competition in the ICT market, slow progress on e-government efforts, weak digital skills in the user base, and the slow uptake of digital technologies and relevant business models by companies. Another obstacle hindering uptake of ICT technologies in the country is the intensified international competition by other low-cost countries pressing for an increase in productivity and product differentiation.

Emerging green economy

The United Nations Environment Programme (UNEP) defines a green economy as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one that is low-carbon, resource-efficient and socially inclusive. Lesotho is well placed to begin the transition to a green economy because of its small carbon footprint. However, there is a slow uptake of green technologies and energy efficiency programmes. More effort is needed to direct the country to the uptake of green technologies through technology transfer, research and innovation.

The first and most practical step towards transition is to build capacity in clean energies and waste management (SDG 7 AND SDG 11), which is to be supported by designing TVET and university study programmes to align with these goals. However, the ministries responsible should engage and develop a roadmap to identify areas where green and clean technologies can be developed to enable this transition.

v. Absence of national innovation agency

Lesotho's innovation capability ranks 138th due to its low diversity in the workforce, the feeble cluster development, the absence of international collaboration on innovation development, the weak stakeholder collaboration, insufficient R&D expenditure and the inadequate conditions for commercialisation. This fragmentation of approaches and lack of networking, sharing of information and interactions among entrepreneurs prevent the shaping of entrepreneurial ecosystems. Many economies that are successful in R&I around the globe have now articulated

national innovation strategies and most have even created special agencies or foundations to maximise the innovation output of their countries' enterprises and organisations.

Past efforts to create the Lesotho advisory commission on science and technology, and the science and technology trust fund (DST, 2006) are still pending. Current plans to establish the National Research and Innovation Council (NRIC) and the research and innovation fund (CHE, 2013) are yet to materialise. The lack of an entity that is specifically responsible for R&I has been identified as a weakness that has to be addressed in this new R&I policy formulation.

Chapter 2

2. Thematic areas of policy intervention

The NSDP II identifies ‘technology and innovation’ as one of the four productive sectors that can contribute to the economic development of Lesotho, holding the potential to create thousands of jobs. It also clearly indicates that progress in the other productive sectors of the economy will need to largely rely on technology and innovation for inclusive growth and job creation. The prioritisation of ‘technology and innovation’ in the NSDP II, however, does not correlate with current commitments in this sector, given the limited investments of 0.05 % of GDP and the lack of mechanisms and guidance for prioritising and funding R&I.

To address this apparent gap together with the key challenges highlighted in the CBR, and to achieve sustainable economic growth and development in line with the NSDP II, Lesotho undertakes to prioritise R&I through relevant policy interventions in the following thematic areas for the next 10 years (2022-2032):

- Tertiary education and workforce training programmes;
- Collaborative scientific R&D;
- Inclusion and socioeconomic equality and equity;
- Indigenous knowledge systems, IP protection and access to R&I information;
- Business regulatory environment and access to incentives;
- Emerging applications in agriculture, health, ICT, manufacturing and green economy.

2.1. Tertiary education and workforce training programmes

2.1.1. Background

Quality and affordable tertiary education (HE and TVET) are key ingredients in achieving sustainable economic growth and development in Lesotho. Some of the key challenges highlighted in the country’s current development plan (NSDP II (2019-2023)) includes but are not limited to ‘low efficiency and effectiveness of public spending on education, skills mismatch, shortage of critical skills such as entrepreneurship skills, medicine, engineering and management skills’. To ensure that tertiary education fits societal and job market needs, the government is seeking to strengthen workforce training programmes and to improve partnerships with industry in order to deliver a more appropriate and relevant level of quality education for all.

2.1.2. Policy statement

The government will support an improvement to the efficiency and effectiveness of workforce training programmes so as to respond to the socioeconomic, cultural and development needs of Lesotho.

2.1.3. Priority issues

1. To address the mismatch between tertiary training programmes and job market requirements.
2. To improve the relevance and quality of TVET and higher education curricula.
3. To improve educational outcomes of TVET and higher education institutions.
4. To ensure qualification frameworks and quality assurance compliance of TVET and higher education institutions.
5. To improve the scientific, technological and entrepreneurial culture of Basotho.
6. To enhance the global competitiveness of Lesotho's TVET and higher education institutions.
7. To contribute towards the achievement of SDG 4.

2.1.4. Strategic activities

1. Conduct regular or periodic market research and skills audits to tailor institutional training programmes to market and societal needs.
2. Carry out annual tracer studies to establish employability and market absorption of graduates.
3. Establish institutional or faculty-industry advisory boards for a periodic review of curricula and appropriate titles of qualifications to keep up to date with industry requirements.
4. Integrate new or modern training programmes in technology and engineering up to postgraduate level for alignment with the fourth industrial revolution.
5. Development of industrial attachments, internship programmes or workplace integrated learning for imparting relevant skills to graduates by including 'employability' as a key indicator for institutional quality assurance systems.
6. Develop and implement mandatory entrepreneurship curriculum across the educational spectrum.
7. Promote TVET for increased numbers in the workforce with hands-on skills.
8. Support science and mathematics training and students' projects from first and second cycles of education.
9. Establish science centres or Technology and Innovation Support Centres (TISCS) in the main institutions.

2.1.5. Key performance indicators

1. Number of periodic market research and skills audits undertaken.
2. Number of institutional or faculty-industry committees established.
3. Number of programmes reviewed and updated in line with industry requirements.
4. Increase in training programmes in technology and engineering.
5. Number of TISCS established and operational.

Measure progress towards the achievement of SDG 4 indicators (the UN has identified 10 targets and 11 indicators for SDG 4). These indicators will be detailed in the results-based monitoring and evaluation section, including nationally relevant indicators.

2.2. Collaborative scientific research and development

2.2.1. Background

Lesotho holds a very low place in the international rankings of its scientific outputs and innovation capabilities vis-à-vis ‘the number of patent applications made with collaborators from other countries’, ‘the number of patent applications filed relative to population size’ and in terms of ‘the prominence and standing of local research institutions’.

If the potential outcomes and contribution of this sector are to be realised, there is an urgent need to renew government commitment and investments in national technology and innovation programmes, including strengthening R&D institutions and programmes (innovation capabilities), as well as increased private sector and international engagements in the development, transfer and adoption of relevant technologies.

2.2.2. Policy statement

The government will intensify investments in scientific research and development, and strengthen local innovation and technological capabilities.

2.2.3. Priority issues

1. To establish a national Research and Innovation Agency (RIA).
2. To establish a national Research and Innovation Fund (RIF).
3. To implement and sustain public and private sector investments into the RIF.
4. To encourage voluntary contributions, donations and grants into the RIF.
5. To increase the number of local institutions undertaking basic and applied research under the freedom of scientific research.
6. To improve the prominence and standing of local research institutions.
7. To promote R&D linkages and collaborative activities locally and internationally.

8. To facilitate partnerships with government, academia, industry and society (quadruple helix model) for knowledge creation, technology transfer and commercialisation.
9. To facilitate linkages with the Basotho diaspora in various academic and research institutions around the world.

2.2.4. Strategic activities

1. Promulgate an act of parliament to set up the RIA and RIF.
2. Set aside annual seed funding for the RIF at a minimum of 0.05 % of GDP.
3. Implement a contributory and tax-deductible research and innovation levy for large businesses towards the fund.
4. Offer tax rebates (reductions) for individuals and other businesses that support research and development.
5. Establish national laboratories and Centres of Excellence (CoE) for research and development in priority areas.
6. Create R&D linkages and clusters of innovation through effective government-academia-industry-society partnerships (quadruple helix model).
7. Make support available for research and development in priority areas through transparent calls for proposals.
8. Develop principles and guidelines on how collaborations should work.
9. Submit an annual plan of individual and collaborative activities or programmes to be supported under the R&I funding.
10. Support existing incubation and accelerator parks and establish new ones.
11. Enhance R&D collaboration with the Basotho diaspora through the signing of memoranda of understanding or cooperation agreements.

2.2.5. Key performance indicators

1. Establishment of RIA and RIF within the first 2 years.
2. Percentage increase in government budget allocation for R&D (GBARD)
3. Percentage increase in business enterprise expenditure on R&D (BERD)
4. Number of R&D programmes supported.
5. Increase in number of R&D local collaborative projects.
6. Increase in number of R&D international collaborative projects.
7. Number of R&I clusters.
8. Percentage increase in scientific publications (index of scientific reservation and promise).
9. Percentage increase in incubated prototypes and/or commercialised products.
10. Number of MoUs or agreements signed with institutions involving the Basotho diaspora.

2.3. Indigenous Knowledge Systems, IP protection and access to R&I information

2.3.1. Background

Lesotho has a rich cultural heritage. There are ways of life that have been passed from generation to generation, whether it be treating animal and human diseases, agricultural practices, tool making or behavioural practices. For this traditional knowledge to be successfully regulated and commercialised, efforts to effectively protect it through Intellectual Property Rights (IPR), create safe repositories for preservation and conservation, and establish support programmes for its promotion are overdue.

Lesotho, like other African countries, has realised the importance of indigenous resources and knowledge. It is therefore crucial to exploit this knowledge through commercialisation in order to improve the livelihoods of Basotho indigenous knowledge holders and society at large and so achieve inclusive socioeconomic development.

2.3.2. Policy statement

The government will mobilise indigenous knowledge systems and grassroots innovations, strengthen effective protection and enforcement mechanisms, and create an open data platform for research and innovation (open science) to strengthen bottom-up job creation and economic growth.

2.3.3. Priority issues

1. To coordinate and support IKS activities and grassroots innovations identified as being viable.
2. To nurture the talent of ordinary citizens and those who are outside formal school or higher education catchments.
3. To regulate, control and monitor IKS products and services, and maintain relevant standards.
4. To improve national IPR capacities and capabilities.
5. To improve the capacity of the Bureau of Statistics (BoS) for the collection and dissemination of R&D and STI indicators in liaison with the DST.
6. To enhance the use of real-time data and big data analytics for evidence-informed policy and decision-making.

2.3.4. Strategic activities

1. Establish an open science catchment framework and support centres for those citizens outside the education system who have talents, products and ideas for self-employment.
2. Undertake and fund citizen science projects inside and outside the classroom and laboratory to maximise talent from the wider society.
3. Design and implement a legal framework and regulations with the potential to strengthen IKS systems.
4. Promulgate the medicines and medical devices control authority bill or develop a similar legal instrument.
5. Review and update the current laws to cover IKS, trade secrets, geographical indications and the digital space.
6. Undertake IPR public awareness campaigns and training programmes for the police and the judiciary.
7. Establish new centres, or make existing ones eligible, for the testing and certification of standards for local products, so enabling their export to international markets.
8. Support conservation and propagation efforts, technologies and areas of innovation with comparative advantage for Lesotho, such as medicinal products and cosmetics produced from indigenous plants.
9. Strengthen the various institutions' ability to manage their own data, and make non-confidential information available from respective websites and link it directly with the open data platform (national digital depository under BoS).
10. Develop a legal framework to effect and enforce the data mining and sharing of regular updates on R&I-related information.
11. Establish an open-access local journal for peer review and the publication of new R&I findings.

2.3.5. Key performance indicators

1. Number of IKS and grassroots innovations support centres created nationwide.
2. Number of IKS-related curricular materials developed and implemented.
3. Number of legal and regulatory frameworks developed and enacted.
4. Numbers of personnel authorised/trained on product/service development.
5. Numbers of personnel trained on IP-related management.
6. Number of new IKS products and services launched.
7. Number of institutions with interactive data platforms and relevant information dashboards for open science.

2.4. Business regulatory environment and access to incentives

2.4.1. Background

The business environment can be defined as a complex of policy, legal, institutional and regulatory conditions that govern business activities. Along with other private sector development initiatives, the business environment affects the performance of private enterprises in both the formal and informal economies. According to the global competitiveness report 2019, the position of Lesotho in the ‘ease of doing business’ is ranked 122nd out of 190 countries, and scores very low on the financing of start-ups and MSMEs and the availability of venture capital. However, an environment conducive to business is one of the pre-requisites for economic growth and poverty reduction.

The country needs improvements to foster the development of an innovative private sector and promote the efficient use of its limited resources by building the requisite entrepreneurial culture. Improving the performance of local investment support institutions to provide more relevant and effective services (ease of access to finance, favourable tax incentives, etc.) For improved MSME competitiveness must be pursued.

2.4.2. Policy statement

The government will improve the regulatory environment in support of innovative start-ups and MSMEs for entrepreneurial culture and employment creation, and implement accessible incentives and innovative tax measures.

2.4.3. Priority issues

1. To reduce the time needed for business registration, registration certificates and licences.
2. To advocate for relief in business-related registration costs.
3. To propose the implementation of tax rebates and tax holidays during incubation.
4. To support start-ups and MSMEs with the appropriate incentives to promote an entrepreneurial culture.
5. To simplify the tax regime and improve user-friendliness.
6. To improve tax compliance and implementation by MSMEs.
7. To encourage investments and business partnerships with the Basotho diaspora.

2.4.4. Strategic activities

1. Widen the One-stop Business Facility centre (OBFC) services to districts outside Maseru and make them available online.

2. Minimise the existing stringent requirements of the partial credit guarantee scheme (up to 75 % of collateral) for small businesses to de-risk their financing by banks.
3. Investigate the usefulness of non-traditional funding mechanisms such as community financial cooperatives.
4. Create new, and support the existing, innovation hubs for providing incubation facilities and entrepreneurship programmes (workspace, subsidized rental space, youth start-ups and business plan competition, coaching, mentoring, etc.)
5. Run dedicated tax clinics (client education programme) to assist taxpayers in SME accounting systems to reduce the strain on small businesses.
6. Advise businesses on the existing allowance to capitalise start-up costs (depreciated over 4 years).
7. Revise existing revenue legislation to provide tax rebates and tax holidays for businesses during incubation.
8. Revise the carry-over provision for businesses to adjust taxable profit with losses from previous years and cap it to avoid abuse.
9. Encourage businesses to support R&D and undertake training and skills development programmes as such expenses are tax deductible.
10. Engage with the Basotho diaspora for business partnerships, via the diaspora outreach forums in South Africa and other countries.

2.4.5. Key performance indicators

1. Number of districts in which OBFC services are available.
2. Reduction in the turn-around times for business registration and licensing.
3. Number and amount of partial credit guarantee facilities extended to MSMEs and start-ups.
4. Reduction in the approval times for support from the credit guarantee scheme.
5. Percentage increase in cover from the current 75 % of a loan.
6. Number of start-ups incubated per annum.
7. Number of dedicated tax education and advisory clinics per annum.
8. Number of businesses collaborating with the Basotho diaspora.

2.5. Emerging applications in agriculture, health, ICT, manufacturing and the green economy

2.5.1. Background

Emerging applications in agriculture are centred on adopting new ways of food production by conserving natural resources and managing the impacts of climate change. There is potential for the adoption of emerging technologies to enhance agricultural productivity, such as genetically modified seeds that are drought tolerant, cropping practices that are sustainable, including climate smart agriculture, and advanced management practices like precision agriculture.

Similarly, in the healthcare sector, emerging applications of technology potentially range from advanced techniques for early detection, diagnosis and treatment of ailments to the usage of ICT to facilitate patient monitoring and recovery tracking. Despite efforts from government and development agencies there is a low level of new technologies being adopted in the healthcare sector and low government expenditure, which was recorded at 9.8 % as of 2018 (CIA Factbook, 2021).

Furthermore, ICT has numerous emerging applications capable of driving socioeconomic growth. The main inhibitor for adoption of emerging ICT and its applications is a low user skills base, slow adoption and the cost of the equipment. The manufacturing sector, while supporting most of the labour force, is focused on low-skill and low-technology production processes. This limits the potential for the sector's growth by increasing the mechanisation of production and the value of products along the value chain.

Lastly, global climate action mandates that countries need to transition to sustainable methods of production to reduce pollution emissions and optimise resource recovery. The adoption of renewable technologies and the shift to circular economies can be a vehicle for an effective response to climate risk while supporting socioeconomic development.

2.5.2. Policy statement

The government will support the adoption of technologies for emerging applications with a strong focus on technical training to initiate a rapid transition to climate-resilient agriculture, quality healthcare, ICTs, digitising manufacturing and transitioning to the green economy

2.5.3. Priority issues

1. To implement conservation agriculture and climate-smart methods.
2. To improve the quality of healthcare services and facilities in accordance with global healthcare trends.
3. To promote the use of ICT nationwide and exploit its emerging applications.
4. To promote the use of digitisation and computerised manufacturing technologies for production efficiency and effectiveness.
5. To mount awareness campaigns and community outreach programmes, and advocate for information sharing on the green economy.
6. To support the adoption of low carbon, resource-efficient and socially inclusive technologies that capture and conserve natural capital.

2.5.4. Strategic activities

1. Promote the use of high-yield seeds that are climate and pest tolerant.
2. Support the mapping of soils and soil testing services to the wider farming communities.
3. Maximise the identified advantage in horticulture (especially cash crops).
4. Strengthen research to improve the agricultural value chain, irrigated agriculture, post-harvest mechanisms, fodder production and indigenous chicken (breeds and feeding regimes), among others.
5. Allocate at least 15 % of the government budget to the health sector in line with the national health strategic plan.
6. Strengthen the health system to improve equity and access to essential services and technology.
7. Assist schools and HEIs with ICT systems and internet access costs for open and distance learning, high-performance computing, blended teaching and learning platforms (learning management systems, virtual video-conferencing tools, etc.).
8. Strengthen ICT units of various government departments to facilitate digitisation and the online availability of public services.
9. Establish and support ICT centres in communities for the adoption and use of related applications.
10. Enhance the market-share of manufacturing in international markets by promoting adherence to ecological labelling standards.
11. Encourage the adoption of digital technologies for efficient production processes.
12. Provide resources for training and research by HEIs for the adaptation of sustainable energy technologies to local conditions and policy guidance.
13. Encourage and support TVETs to train more hands-on technicians to implement clean technologies (solar, wind and hydro plants, waste disposal, recycling, etc.).
14. Support incubation centres that facilitate technology transfer and nurture start-ups and small businesses in green technologies.

15. Provide incentives and eliminate or reduce tariffs on certain green energy technologies, waste disposal and recycling for fast growth and job creation.
16. Promote and support a circular economy for efficient waste management and resource recovery.

2.5.5. Key performance indicators

1. Percentage availability of climate-resilient seeds for farmers.
2. Number of soil testing services provided per annum.
3. Number and size of horticulture projects and other climate-resilient agricultural practices established or supported.
4. Percentage increase in equity and access to quality healthcare services.
5. Number of manufacturing firms with ecological labelling accreditation.
6. Number of manufacturing firms with digitised production processes.
7. Market-share of low carbon manufacturing of garment and apparel exports per annum.
8. Number of schools, TVETs and HEIs equipped with ICT systems for virtual teaching and learning, and access to high-performance computing.
9. Percentage of government departments with digitised public services that are also available online.
10. Number of new natural capital technologies identified, developed and implemented.
11. Number of TVET-trained technicians with practical skills for clean technologies.

Chapter 3

3. Establishment of a national R&I agency

3.1. Introduction

Lesotho's research system is quite small (R&D expenditure ~0.05 % of GDP in 2015), and has no national mechanisms for guidance on research priorities and funding. The country further faces a shortage of local incubators and accelerator programmes essential for a mature start-up ecosystem. In addition, it has been established by the CBR that fragmentation of the duplicative approaches and lack of networking, sharing of information and interactions among knowledge centres and entrepreneurs prevent the shaping of a robust entrepreneurial ecosystem (OACPS R&I PSF, 2021). However, in mature economies, start-ups are backed by applied research, and the innovative thinking of universities and research laboratories acting as knowledge centres. The establishment of a semi-autonomous or independent organisation, council or agency that is specifically responsible for coordinating a framework of research and innovation has been found to be the mainstay of many economies around the world (GTIPA, 2019) and is also recommended for Lesotho, with unanimous support from the main stakeholders.

The national R&I agency (RIA), reporting to parliament through the ministry responsible for science, technology, and innovation (STI), will provide a framework for guidance on RRI, undertake mobilisation of research resources and direct the nation's investments in R&I funding. The RIA shall support the local incubators and accelerator programmes at academic institutions, public labs and national centres of excellence, and help innovative start-ups and MSMEs in Lesotho to build innovation capacity and take ideas to market. This shall be done through financial assistance, advisory services, and connections to the available business and R&D expertise. The goal is to increase the capacity of the Lesotho economy to grow, invest and create jobs, along with creating new businesses and promoting new entrepreneurs.

3.2. Proposed RIA mandate

The core mandate or role of the RIA should include the provision of financial and non-financial support for research and innovation activities that are coherent with the national development agenda. As articulated by the National Strategic Development Plan (NSDP II) the RIA shall carry out the following:

1. Set up a Research and Innovation Fund (RIF) as an investment and financial assistance programme to provide funding for:
 - (a) Directed multidisciplinary research in priority areas, a technical workforce or human resource development and capacity building activities occurring at higher education institutions and national laboratories;

- (b) The provision of necessary research and technical infrastructure to facilitate knowledge creation, technological development, and innovation in all fields / disciplines, with an emphasis on scientific and industrial research, including indigenous knowledge systems;
 - (c) Catalytic partnerships between academia, industry, government and civil society (quadruple helix model) for development and innovations in a wide range of fields addressing societal needs, such as agriculture, health, energy and all aspects of the natural environment, ICT applications, developing new industry, etc.
 - (d) Citizen science projects that prioritise engagement with grassroots communities for exploiting and enhancing their IKS expertise;
 - (e) The incubation and acceleration of identified inventions and innovative products, processes and services from academia, national laboratories, innovation hubs and grassroots communities for contributing to job creation and improving the quality of life;
2. Strengthen and coordinate the science, technology, and innovation capacity of Lesotho by having direct links with and promoting the active participation of the main stakeholders in the development and implementation of national STI strategies to avoid silo mentality, duplications and fragmentation of efforts;
 3. Urge businesses of all sizes to collaborate with innovation actors, including tertiary and research institutions, to propose bold and ambitious strategies that will transform national innovation ecosystems and develop job-creating clusters;
 4. Act as an articulator and promoter of the connection, networking and coordination between the academic and scientific worlds, government, civil society, and the private productive sector (quadruple helix model) so that academic and scientific innovation may have productive uses;
 5. Reinforce, connect and network incubators, accelerator programmes, technologies and knowledge emerging from universities, national research laboratories and IKSs with MSMEs;
 6. Ensure an emphasis on monitoring, reporting and evaluation of all the supported research and innovation initiatives by different applicants;
 7. Support the creation, hosting and maintenance of the R&I open data platform (open-access information portal), in collaboration with the bureau of statistics, for ease of access to R&I information through institutional repositories.
 8. Host a periodic research and innovation conference and expo for advocacy in the field of R&I to disseminate new information relevant to innovation and R&I products, services and activities, and support networking opportunities.

3.3. Proposed RIA structure

The R&I agency is recommended to be established as an administratively autonomous (semi-autonomous) institution, promulgated by an act of parliament, with strong governance structure and sustainable fundraising function, so that it can be independent and be able to self-finance as much as possible, and drive a knowledge economy that is in the best interests of society. For accountability, the RIA shall procedurally report to the parliament of Lesotho through the ministry responsible for science, technology and innovation. The RIA shall have the following:

1. A board of directors, responsible for governance, oversight and overall strategy, appointed by the minister responsible for science, technology and innovation, with terms of up to 4 years each, renewable once based on good performance and each member can only serve a maximum of 8 years, with a membership composed of:
 - (a) One representative from the ministry/department responsible for science, technology and innovation, with a minimum qualification at master's level;
 - (b) One representative from the ministry/department responsible for tertiary education, with a minimum qualification at master's level;
 - (c) One representative from the ministry/department responsible for national strategic development planning, with a minimum qualification at master's level;
 - (d) Two representatives from the tertiary education sector with the relevant professional skills, proven experience and a record of research and innovation, appointed through a transparent and competitive application process, with a minimum qualification at master's level;
 - (e) Two representatives from the private sector with the relevant professional skills, proven experience and record of leadership and business management, appointed through a transparent and competitive application process, with a minimum qualification of a bachelor's degree;
 - (f) One representative from the indigenous knowledge systems council or the Lesotho association of inventors, with a minimum qualification of a diploma.

2. The board shall be headed by an appropriately qualified executive director with the relevant professional training and skills, proven experience, and record of leadership and management related to research and innovation, appointed by the board of directors through a transparent and competitive recruitment process, who shall become an ex officio member of the board. The executive director shall be the CEO and be eligible for a term of 5 years, renewable once, based on good performance and can serve maximum of 10 years.

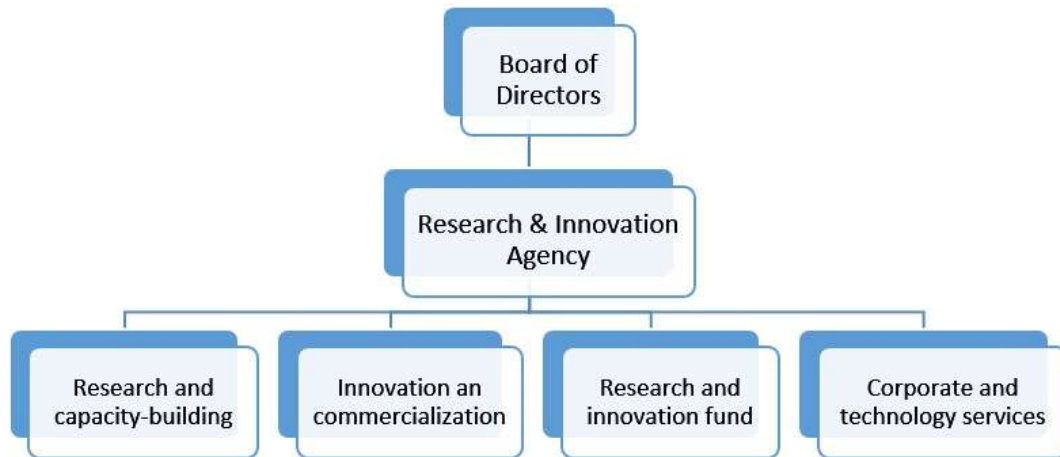


Figure 1 - proposed initial organogram of the R&I agency

3. Set up a lean, effective and efficient executive management and operational structure (see 1) for cost containment, with at least four main functions / departments, consisting of:
 - (a) R&D:
 - For the coordination and support of relevant R&D activities by various academic and research institutions, including IKS-based initiatives;
 - (b) Innovation and commercialisation (I&C):
 - For the coordination and support of relevant I&C activities by incubators, accelerators, start-ups, MSMEs and larger businesses;
 - (c) Research and innovation fund:
 - For the financial support of approved R&D and I&C activities from points 1 and 2 above and internal finance, human resources and administration;
 - (d) Corporate and technology services:
 - For providing the RIA's corporate secretariat, strategic planning, legal / contract services and ICT systems.
4. Be subsidised by a government subvention through the creation of R&I agency cost centre, to be catered for in the annual national budget for appropriation by parliament (with a minimum commitment of 0.05 % of GDP).
5. Institute a R&I levy on large businesses (annual turnover > LSL 5 million) and parastatals at an appropriate and revisable rate of the total revenue (for instance, say at 0.05 % to match the government's contribution), which will be tax deductible, for the sustainability of both the RIA and the RIF.

6. Receive contributions, donations, grants, etc. Into the RIF from individuals, public and private institutions, regional and international development agencies, etc., which shall be tax-exempt.
7. Expend its revenues to meet the cost of its operations and use any surplus accrued for the promotion and development of the R&I ecosystem.
8. Prepare proper accounts annually in compliance with international accounting standards for independent external auditing, together with an annual report to parliament, through the ministry responsible for STI.

3.4. Programmes to be implemented

The RIA shall provide funding to several programmes that are geared towards making a change in the socioeconomic circumstances of Lesotho through workforce training, new knowledge creation, technology development and adoption, prototyping, production and technology commercialisation as envisaged in Figure 2. These include, but are not limited to:

- (a) Research grants:
 - Annual calls for research proposals in priority areas (in line with the existing national blueprint on socioeconomic development – NDSP);
- (b) Bursaries and fellowships:
 - Support for graduate and postgraduate (masters and PhD) research students (including a specific quota for marginalised groups researching in stem);
- (c) Centres of excellence (CoEs):
 - Agro-processing, ICT applications, health informatics, renewable energy, climate change, water and sanitation, cloud computing, cyber security, robotics, artificial intelligence, manufacturing digitisation, 4th industrial revolution, etc.);
- (d) Infrastructure development:
 - Facilities and equipment for scientific research and development, product testing and certification, etc.;
- (e) Technical human capacity development:
 - TVET for a critical mass of hands-on skills development;
- (f) Citizen science projects:
 - Connecting the research community to society, youth (in urban and rural areas), and secondary schools' science competitions (Lesotho Science and Mathematics Teachers Association) through open science;

- (g) Incubators and accelerators:
 - Support for innovation hubs, science / industrial parks, etc.;
- (h) Grassroots innovators:
 - Seed funding for investment in IKS, grassroots innovations, out-of-school ideas, etc.;
- (i) Dissemination activities:
 - Meetings, workshops, conferences and expo for the wider scientific community, policymakers, media and society at large, etc.

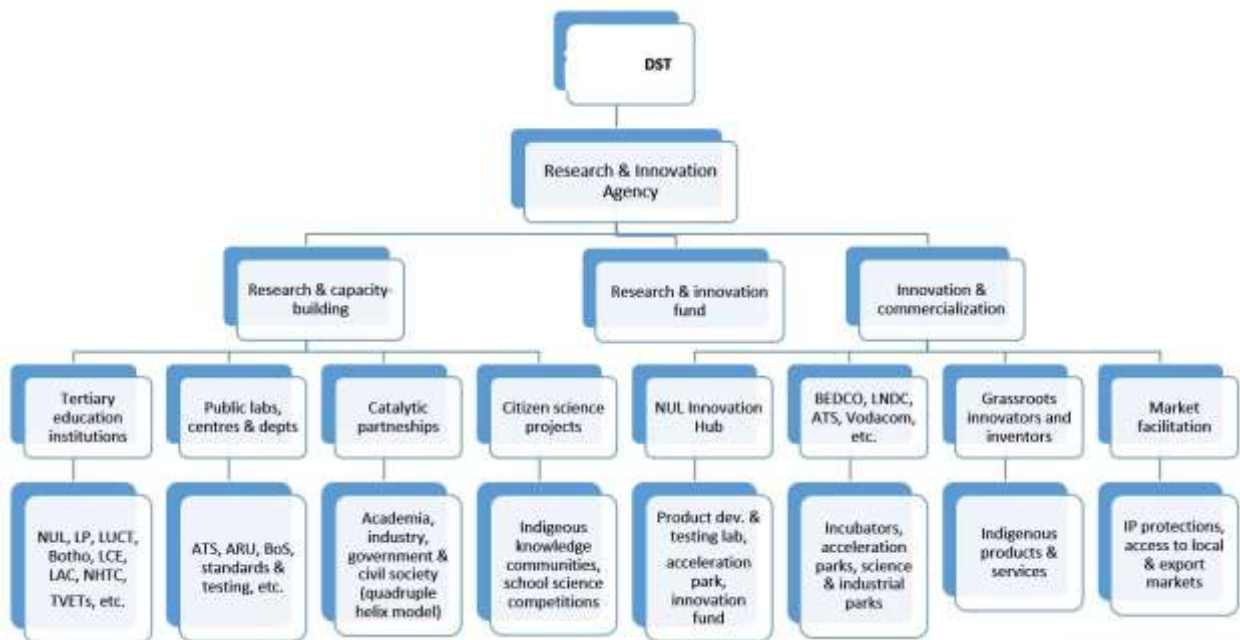


Figure 2 - envisaged interrelation of RIA with the R&I ecosystem

3.5. Possible sources of RIA funding

Three scenarios are proposed for possible sources of funding to the RIA, based on annual government subvention providing seed funding for the RIA, matched by the mandatory R&I levy to be charged on state-owned entities and large businesses (turnover > LSL 5 million) as a percentage of their total annual revenues. Grants, voluntary contributions and donations from international and regional development partners and other goodwill shall also be solicited into the RIF.

For the first scenario, which has the lowest funding at the rate of 0.05% of GDP or total revenues, the activity-based expenditure for the RIA is initially proposed to be efficiently and equitably allocated at about 25 % for employee-related costs, 10 % for administration and operational expenses, and 65 % for the programmes to be implemented. Under this scenario, LSL 22.5 million or more would be made available for R&I programmes based on the available figures for 2019, 2020 or 2021. The second scenario envisages an increase in the percentage of contributions to 0.075 %, making LSL 38 million or more available for R&I programmes per annum. The third scenario, which is the most preferred and recommended, pegs the annual contributions at 0.1 %, with a possible net effect of about LSL 53.5 million as disposable funding for R&I programmes annually.

Chapter 4

4. R&I policy implementation framework

4.1. Results-based monitoring & evaluation framework

The aim of a results-based Monitoring and Evaluation (M&E) framework is to generate evidence for informed decision-making at policy level and to provide information for accountability and performance management. The idea of M&E framework is to encourage a shift from a system of input accounting to a results-based accountability. In this regard, the focus of planning, budgeting, reporting and oversight should shift from how things are done to what is accomplished. It also provides the scope to change course, extend activities or discard irrelevant ones during the periodic performance monitoring and evaluation process, if deemed necessary.

The principles of ‘managing for results’ was especially highlighted in the 2005 Paris declaration on aid effectiveness and reaffirmed in the Accra agenda for action in 2008 as part of the efforts to work together in a participatory approach to strengthen national capacities and to reach agreed development objectives and promote the accountability of all major stakeholders in the pursuit of results. From an institutional point of view, the basic purposes of results-based management systems are to generate and use performance information for:

1. Accountability reporting to stakeholders,
2. Learning and improving performance, and
3. Decision-making

Having decided to adopt the principles of the result-based management to design the monitoring and reporting framework, the priority is to clearly define the results’ chain³, to be able to identify the objectives of future actions and plan activities to reach them. Thus, a proposal for consideration of the MCST is to develop a two-part monitoring and evaluation framework: one that will focus on monitoring Lesotho’s performance in key global R&I indicators, the global innovation index and the relevant SDGS highlighted under the KPIS of the thematic interventions; and another dedicated to tracking and monitoring the MCST’s achievements, and the DST’s in particular. These are realised in the implementation of the national R&I policy following the logic of a results plan or chain of results from inputs to outputs, which will produce intermediate changes and final outcomes to the impact of the R&I policy to national development objectives and the SDGs, as shown in Figure .

³ The purpose of the results chain is to build a logical relationship between the expected results at different programmatic levels. It is built on the principle of aggregation of results, which implies that the aggregation of results at one level should make it possible to achieve the expected result of another level.

This M&E framework is based on output and outcome indicators, and tries to identify the longer-term changes (or impact) that Lesotho's R&I interventions will produce, linking them to impact indicators that will be defined over time. The output and outcome indicators are derived from the thematic areas of policy intervention, which was generated through stakeholder engagements and a review of R&I policies and development blueprints of Lesotho, including a review of international best practices by the expert panel. This should be subject to a further review of the national team to elaborate key and relevant progress indicators through a comprehensive implementation plan. The M&E framework has three main components:

1. The results' chain,
2. The planning, monitoring and evaluation cycle (management cycle), and
3. The M&E plan.

4.1.1. The results chain of the R&I policy

The results chain takes into consideration 7 expected results (or short-term outcomes) defined in this document and derived from policymakers in Lesotho during the stakeholder consultations and review of existing policies, other relevant documents and the country background report.

- I. Improve the efficiency and effectiveness of workforce training programmes to respond to the socioeconomic, cultural and development needs of Lesotho (*R&I workforce developments strengthened*) to improve the relevance of tertiary and higher education, address the skills mismatch, improve the quality of education and the overall global footprint of Basotho higher education institutions.
- II. Intensify investments in scientific research and development and strengthen local innovation and technological capabilities (*R&I needs and investments prioritised*). This also embeds the need to develop and strengthen sustainable financing mechanisms, and improves the effective collaboration between government, research, industry and society.
- III. Align and mainstream stem education with the Basotho culture to improve socioeconomic equality and inclusion in stem education, research and occupations (*socioeconomic equality & inclusion in R&I improved*).
- IV. Mobilise IKS and grassroots innovations, strengthen effective protection and enforcement mechanisms for intellectual property rights, and create an open data platform for research and innovation to strengthen bottom-up job creation and economic growth (*IKS systems integrated & IPR managed*).
- V. Improve the regulatory environment in support of innovative start-ups and MSMEs for employment creation, and implement accessible incentives and innovative tax measures (*conducive environment for innovation created*).

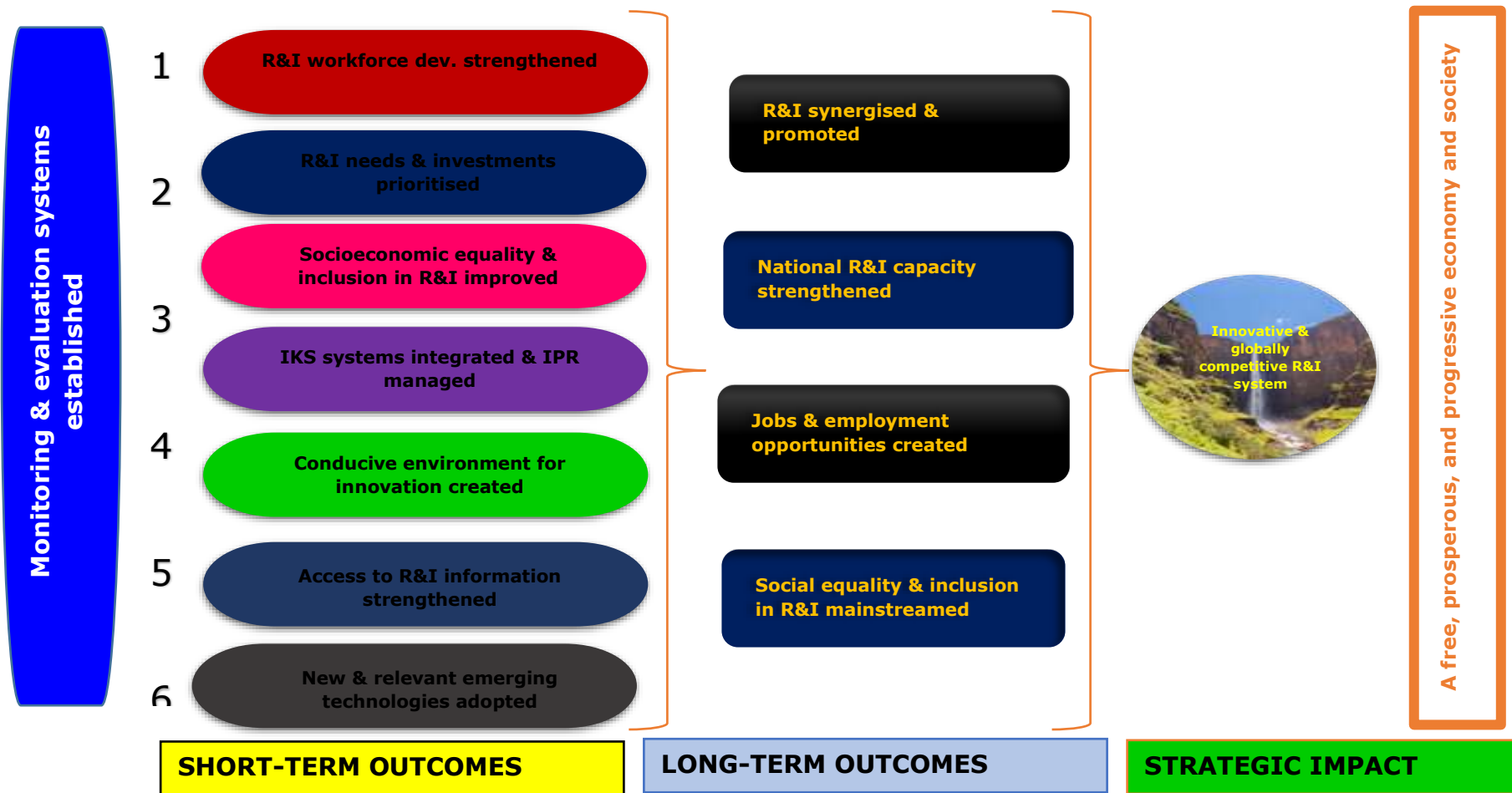


Figure 3 – the results chain for the proposed Lesotho R&I policy

- VI. Support the adoption of technologies for emerging applications with a strong focus on technical training to initiate a rapid transition to climate-resilient technologies in agriculture, quality healthcare, ICTs and manufacturing digitisation, and for the transition to the green economy (*new & relevant emerging technologies adopted*).
- VII. Strengthen various institutions' ability to manage their own data, make non-confidential information available on an open data platform (national digital depository under the BoS), and establish an open-access local journal publication of new R&I findings (*access to R&I information strengthened*).

The idea at the basis of the R&I policy is that to create ‘an innovative and competitive R&I system’ for Lesotho there are ‘intermediate results’ to be achieved, such as R&I synergised and promoted, national R&I capacity strengthened, jobs and employment opportunities created, and socioeconomic equality and inclusion in R&I mainstreamed. However, these results can be achieved only if

- The R&I workforce development is strengthened,
- R&I needs & investments are prioritised,
- Socioeconomic equality and inclusion in R&I are improved,
- IKS systems are integrated and IPR are managed,
- A conducive environment for innovation is created,
- New and relevant emerging technologies are adopted, and
- Access to R&I information is strengthened.



Figure 4 – the logic model

4.1.2. The planning, monitoring and evaluation cycle

As previously discussed in the four stages of implementation, four stages are also involved in a results-based management system and illustrate the steps that must be taken to develop and

implement the proposed strategic activities in thematic policy intervention section, as illustrated in Figure . This cycle begins with planning, which should be considered during the initial exploratory phase of implementation, where the DST in consultation with relevant partners develop a comprehensive implementation plan based on available evidence and defined expected results. At this stage, there is a need to clearly identify the deliverables and the intended changes on the baselines. During this stage, the stakeholders implementing the R&I policy must also put in place a strong M&E system, and it is strongly recommended to establish or strengthen planning units under the DST, develop a detailed M&E work plan, identify the relevant indicators and frequency of measurement, establish review mechanisms, and identify and build the required capacities.



Figure 5 – proposed R&I policy management cycle

The plan should also integrate mechanisms for both internal evaluation and external independent evaluation in order to improve confidence in the achieved results, and the continuous improvement and adjustment to the initial implementation plans. As alluded to earlier on, the need for creating a conducive environment for sharing experiences, disseminating information, sharing progress and successes, and incorporating feedback in the relevant phases of implementation is strategic to the overall learning and improvement. It is therefore recommended that a strong web-based information portal be created for the DST, the stakeholders and the public to serve as a conduit for the exchange of relevant information.

4.1.3. The proposed M&E plan

Considering the links in the hierarchy of objectives, the proposed M&E plan is represented in Figure . M&E is an asset strategic to assessing the performance of R&I policies and measures undertaken by Lesotho. Without an effective M&E mechanism in place, it is difficult to conduct research and innovation policy evaluations that could inform future policies and decisions regarding national R&I efforts. It is therefore highly recommended that the DST prioritises the integration of an effective system for the implementation, monitoring and evaluation of national R&I policies. In addition, and beyond the PSF service, the DST, working with the relevant stakeholders, should lead the process of developing a comprehensive implementation plan to provide an elaborate action plan that includes timelines and procedures to produce the desired outputs identified in this document and so induce the changes envisaged in the short and long term (see Figure and Figure).

The DST in close consultation with relevant stakeholders should develop, elaborate and build consensus on a set of ‘progress indicators’ to use as ‘frames of reference’ for monitoring the progress on the implementation of actions to achieve the expected results (outputs, outcomes, and longer-term changes or impact). Each of the outputs and outcome indicators should provide details, including baselines, targets, indicator tracking (by who and when) and sources of verification. These indicators should also be aligned with international STI indicator initiatives such as the African science, technology and innovation indicators (ASTII), UNESCO institute for statistics (UIS) STI data and the global innovation index (GII), among others.

4.1.4. The project design for R&I policy implementation

The programme and project design for the implementation of Lesotho’s R&I policy should be led by the DST with support from all the key stakeholders in the R&I ecosystem. This exercise requires a number of managerial and technical skills and must not be conducted by an individual in isolation. It is best if policy proprietors lead the process of developing a complete logical framework.

Programme-level managers should be identified who could further develop their own logical framework to design detailed programmes. The reason for each programme level would be recorded as the purpose of that programme. The purposes are referred to as ‘outcomes’ and each of the projects required to achieve the programme’s purpose are recorded as ‘outputs’ of that programme. Each output of a programme (project) should be assigned to a project manager, and the output is regarded as the purpose of that project. The project goals are, therefore, the purpose of the programme it falls under.

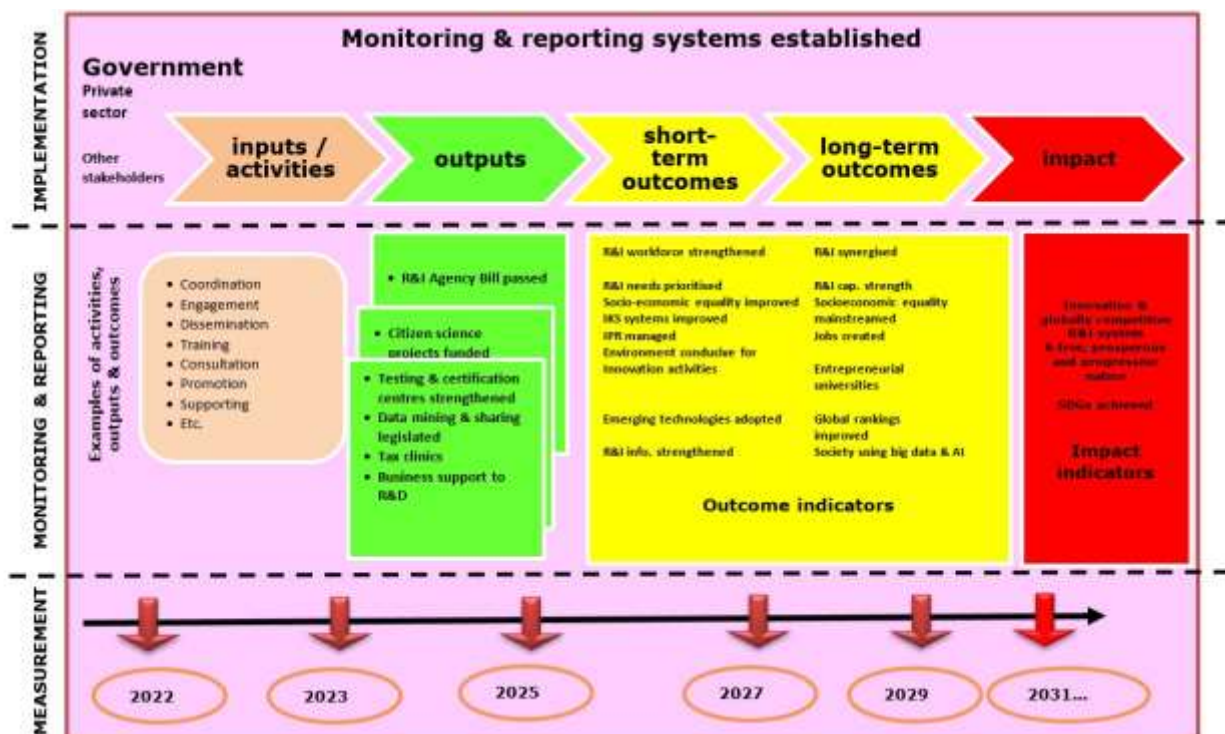


Figure 6 – proposed M&E plan for implementation of the R&I policy of Lesotho

4.2. Mechanisms for financing R&I policy implementation

4.2.1. Estimated costs by R&I programmes

The estimated budget for R&I programmes in Lesotho for the next 10 years, starting in 2022, is approximately EUR 36.7 million (which is about LSL 655 million) as presented in **Error! Reference source not found.** This estimate translates to EUR 3.67 million per year (about LSL 65.5 million per year) and is roughly 0.18 % of the 2021 national budget. It is to be intended as a preliminary indication, while a more precise quantification will be possible when the programmes are transformed into concrete projects by the DST and the related implementing agencies.

There is a strong need for commitment from the government to successfully implement the R&I policy's 7 recommended programme areas as strategic priorities. With this minimum level of investment, the R&I policy will be able to offer enhanced opportunities to even more researchers

and innovators, making a tangible contribution to bridging the research and innovation divide and participation gaps in the country and beyond.

4.2.2. Potential sources of funding

A viable financial landscape is at the core of enhancing the national R&I ecosystem. This is imperative for this R&I policy to function in tandem with other policies (such as the fiscal and industrial policies) of the Lesotho government in order to attract public as well as private sector contributions to the strengthening and growth of the national R&I ecosystem.

Government's efforts

The government's financial support to establishing the RIA and the RIF is essential to strengthen the R&I ecosystem in the country, by building local institutional capacity and skills development to reduce the heavy reliance on external donations. A firm commitment by the government to promote R&I in the country has to be expressed in terms of annual allocation (GBARD and government expenditure on R&D – GERD) from the national budget (e.g., 0.05 % of GDP). This will be the first step towards affirming its ratification of the SADC protocol on science, technology & innovation (1 % of GDP by 2010), STISA, etc.

Private sector

To build a robust national R&I ecosystem, local private enterprises should be encouraged to contribute to the RIF. Large businesses and state-owned entities could be incentivised to contribute a compulsory R&I levy (e.g., 0.05 % of annual turnover) that is tax deductible. The private sector should also be encouraged to collaborate with academic institutions and pursue market-relevant research through mutually decided agreements. Furthermore, various collaborative academia-industry-civil society clusters based on the quadruple helix model could be encouraged (manufacturing, ICTs, etc.)

International cooperation and development partners

Other potential funding sources, apart from the government's leading role supported by the state-owned entities and local private sector, can include SADC, the African union, the European Union via R&I programmes such as ERASMUS+ and HORIZON Europe, the world bank, UK research and innovation, USAID – national science foundation, Canadian International Development Agency, Japan International Cooperation Agency, Korea international cooperation agency, Swedish international development cooperation agency, next Einstein forum and many others. The recommended national R&I agency should undertake the coordination of funding and the harmonisation of activities.

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