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**A POLICY FRAMEWORK FOR SCIENCE, TECHNOLOGY
AND INNOVATION**

Revitalizing and harnessing Science, Technology and Innovation in Kenya.

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LIST OF ABBREVIATIONS

BRICS	Brazil, Russia, India, China and South Africa
CEO	Chief Executive Officer
CoEP	Centres of Excellence Programme
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HIV/AIDS	Human Immuno-Deficiency Virus/Acquired Immune Deficiency Syndrome
HR	Human Resources
HRM	Human Resources Management
ICT	Information and Communication Technology
IMF	International Monetary Fund
IP	Intellectual Property
IPR	Intellectual Property Rights
KEMRI	Kenya Medical Research Institute
KEPSA	Kenya Private Sector Alliance
KEPHIS	Kenya Plant Health Inspectorate Services
KENET	Kenya Education Network
KICTB	Kenya ICT Board
KIRDI	Kenya Industrial Research and Development Institute
KIPI	Kenya Industrial Property Institute
KNIS	Kenya National Innovation System
KSH/Ksh.	Kenya Shillings
MOHEST	Ministry of Higher Education, Science and Technology

NCST	National Council for Science and Technology
NEPAD	New Partnership for Africa's Development
NREN	National Research Education Network
NIC	Newly Industrialized Country
NIS	National Innovation System
PMF	Performance Management Framework
PPP	Public Private Partnerships
PS	Permanent Secretary
R&D	Research and Development
RDI	Research, Development and Innovation
RSTI	Research, Science, Technology and Innovation
SET	Science, Engineering and Technology
S&T	Science and Technology
SMMEs	Small, Medium and Micro Enterprises
STP	Strategic Technology Platform
ST&I	Science, Technology and Innovation
TVET	Technical, Vocational and Entrepreneurial Training
UE	University Education

EXECUTIVE SUMMARY

The Kenya Vision 2030 recognises the critical role played by Research and Development (R&D) and Innovation in accelerating economic development in all the newly industrializing countries of the world. Given that ST&I is one of the foundations for socio-economic transformation in the Kenya Vision 2030, this policy has therefore been created to support Vision 2030.

Challenges

The Kenya ST&I sector is fragmented, losing on the benefits of synergy and networking. It also lacks national research agenda and does not have a strong institutional framework. Other challenges include poor linkages between the researchers and industry; inadequate funding, with great over-reliance on external resources; lack of advocacy for ST&I at high political and policy levels; low science culture among the population; relatively low global competitiveness ranking; and weak performance management framework.

Objectives and Guiding Principles

The main objectives of science, technology and innovation (ST&I) policy are to create endogenous ST&I capacities appropriate to national needs, priorities and resources, and to create a science, technology and innovation culture whereby solutions to socio-cultural and economic problems of the individual, the community and the nation are recognized and sought within the domain of ST&I. The policy will be based on the guiding principles of relevance, realism, cost-effectiveness, multi-disciplinarily and synergy, partnerships, environmental protection and conservation, empowerment and participation, equity and non-discrimination, ethical leadership and good governance.

Link to National Vision

ST&I is one of the foundations for socio-economic transformation in the Kenya Vision 2030, enabling creation of new knowledge which plays a central role in wealth creation, social welfare and international competitiveness. At the economic front, science, technology and innovation will play a critical role in ensuring that productivity growth occurs, and that the economy is progressively transformed into a knowledge-based economy. Universities and research institutions will be critical drivers of innovation systems and the resultant

developments in ST&I and application of knowledge, especially in biotechnology, value-addition, manufacturing, Information and Communication Technologies (ICT). This will lead to industrial and entrepreneurial development with new products and services, and areas of economic growth. From a social development perspective, ST&I will be applied to provide solutions that will enhance natural resource management for public safety, food security and poverty alleviation as well as resolving human and animal health conflicts and developing a sustainable tourism industry.

National priority sectors for ST&I Policy Interventions

To address the macroeconomic and social challenges and achieve the transformation to a knowledge based economy, priority sectors in which ST&I will be strategically integrated to create technology platforms for enhanced productivity growth were identified through a consultative process. The national sectors significant to achievement of national growth and development targets are Agriculture and Rural development; Health and Life Sciences; Trade and Industry; Human Resource Development; Physical Infrastructure; Energy; Environment and Natural Resource Management; Information Communication Technology (ICT); and Space Science Technology. Specifically, the following areas of innovation will be given a high priority: biotechnology; space science; telecommunications, electronics and computers; and automobile and nuclear electricity.

Kenya National Innovation System (KNIS)

An innovation system essentially refers to the interactions among diverse group of actors involved in the production, diffusion and use of new, and economically useful knowledge. An effective innovation system is required for a country to harness the potential offered by modern science and technology to its social and economic advantage. Kenya's current innovation system lacks coordination among the actors, is linear and fragmented, has limited linkages between academia, industry and government; the academic curricula and graduate skill sets are not well-aligned to industry needs and, has inadequate funding and support for innovations. Generally, it does not effectively serve critical national needs. The government will therefore adopt a new Kenya national innovation system (KNIS) to ensure that the education and research system (universities, TVET institutions, sector-based research centres, national research and education network and schools), the business system (from start-up informal businesses to large and multi-national companies), the intermediate organisations, ST&I infrastructure (financial, information, IPR regime, regulatory, incubation centres,

science and technology parks, special economic zones, etc.) and framework conditions in which they operate interact, dynamically and effectively respond to national needs of the stakeholders (consumer, private sector and Government) , while continuously learning from these interactions.

Purpose

The National and County Governments will promote ST&I as the means to making Kenyan products and services globally competitive. The Government will therefore seek to entrench innovation in all national and regional production systems. Through ST&I, new knowledge-intensive industries will be created in addition to transforming the industry structure and mix of products as we strive to become an industrialized state. The goal of the ST&I policy is to build critical capacity and capability in ST&I that will create change and transform Kenya into a newly industrialized country (NIC) through the utilization of knowledge as the driving force.

Required Resources

In line with Vision 2030, this policy commits to mobilizing adequate resources to mainstream ST&I into the Kenyan economy. To this end, the equivalent of at least 1% of GDP will be mobilized from the Government and other sources to support the development of the required ST&I capabilities and capacities.

Institutional Framework

This policy proposes to create three institutions as body corporates to manage the whole ST&I sector. These bodies are National Commission for ST&I (NCSTI) to primarily set the national and county ST&I priorities and coordinate the sector across all sector ministries and in the County Governments; the National Research Fund (NRF) to mobilize resources for the National Innovation System; and the Kenya National Innovation Agency (KENIA) to largely develop and manage the National Innovation System.

CHAPTER ONE – INTRODUCTION

1.1 Background

Knowledge creation and application is key to Kenya's economic growth, global competitiveness and meaningful employment creation in a global context where there are significant shifts in knowledge production, accompanied by shifts in global wealth. It is recognized that effective leveraging of science, technology and innovation is essential for wealth creation in all nations. Science, technology and innovation is also a key component of social integration, sustainable development and poverty eradication based on equity, freedom, justice, governance, peace and prosperity. At the international level, science, technology and innovation acts as a tool of international co-operation and solidarity. It is useful for provision of knowledge and information as well as facilitating globalization with human development while concomitantly strengthening national governance and acting as a vector of common heritage, international cooperation and solidarity.

Global experience shows that countries that have leveraged the production management and application of knowledge have achieved sustained economic growth rates, with significant improvements in quality of life. Examples of this include South Korea, Malaysia, Singapore and Brazil. These countries have industrialised and achieved middle income status, some within a generation, defying traditional economic development models. Appropriate Science, Technology and Innovation policy is key to the production, distribution and use of knowledge and information. This is reflected in trends towards growth in high-technology investments, high-technology industries, and utilization of skilled labour and associated productivity gains.

1.2 Global and National Context

1.2.1 Global Trends and Best Practices

There are some notable events that characterize current situation in ST&I globally that may qualify as best practice and hence influence the formulation of policy and strategy framework for Kenya. These are:

- a) Most countries with pronounced socio-economic success have a well-defined and articulated goal for ST&I sector aligned to national objectives;
- b) A dedicated Ministry of ST&I;

- c) Innovation is the driving force behind S&T and R&D. Most research is multi-disciplinary and generally product oriented;
- d) There is general shift from research institutes to research in universities. Dedicated universities are being created to develop national capacities in key national priority areas;
- e) Strong indigenous industries and strong links between industry and researchers;
- f) An environment that makes ST&I vibrant, including good facilities, well trained human resources, good access to information and knowledge resources and well organized delivery institutions;
- g) A firm and sustainable financing mechanism for ST&I; and
- h) A well-coordinated ST&I sector.

Globally, there are significant efforts to close the three missing links, which are key to leveraging science, technology and innovation for national development. These include; the need to establish a culture that respects knowledge and embed this in the various education curricula; the need to focus on active knowledge creation and acquisition and a deliberate and conscious effort to link knowledge creation to actual opportunities aimed at enhancing productivity and creating employment opportunities in existing and/or new sectors.

1.2.2 National context

The Kenya Government has been implementing the Kenya Vision 2030 since 2008, as its long term plan to address development challenges of economic growth and poverty alleviation. The Constitution of Kenya, 2010 further informs the development and application of ST&I for national development and prosperity. In its long term development strategy, outlined in Vision 2030, the Government of Kenya envisages a nation that is globally competitive and prosperous with a high quality of life by the year 2030. In pursuit of the vision, Science, Technology and Innovation will be harnessed to stimulate technological and economic transformation that will lead to sustained economic growth of 10 per cent per annum, and social well-being in the next 20 years. This policy outlines the structures, frameworks and mechanisms towards bringing a collaborative engagement of all stakeholders into the Kenya National Innovation System.

1.3 National Priority Sectors for ST&I Policy Interventions.

To address the macroeconomic and social challenges and achieve the transformation to a knowledge based economy, priority sectors in which ST&I will be strategically integrated to create technology platforms for enhanced productivity growth were identified through a consultative process. The Strategic Technology Platforms (STP) will be sufficiently broad in scope to support the development of products, processes and services in a wide range of sectors. At the same time, they will be sufficiently narrow so that they define a set of competencies that will be developed to achieve sustained global competitiveness.

The national sectors significant to achievement of national growth and development targets are agriculture and rural development; health and life sciences; trade and industry; human resource development; physical infrastructure; energy; environment and natural resource management; information communication technology (ICT); and space science technology.

1.4 The ST&I Policy and Kenya Vision 2030

The Kenya Vision 2030 and the Millennium Development Goals are the twin strategies adopted by the Government of Kenya to reduce poverty and enhance access to basic needs for majority of Kenyans. Science, Technology and Innovations are recognized nationally and globally as essential for the economic transformation, growth and competitiveness of Kenya and are also key components of social integration, sustainable development and poverty eradication. Implementation of relevant Science, Technology and Innovations strategies in Kenya must be successfully delivered in order to achieve the goals set under the Kenya Vision 2030.

The Science, Technology and Innovation (STI) sector seeks to integrate knowledge into all production systems of the Kenyan economy. The policy and strategy regime pursued by the sector seeks to achieve key objectives of enhanced quality of outcomes in Research, Science, Technology and Innovation (RSTI) as well as strengthened governance and management at sector at institutional levels and further ensure financial sustainability of the sector. The purpose is to ensure an improved and efficient environment in which RST&I business is conducted for the achievement of the Vision 2030.

This ST&I Policy seeks to achieve the following objectives: Strengthening the technical capacities and capabilities of ST&I, UE and TVET institutions and systems; developing a core mass of highly skilled human resources; intensification of innovation in priority Sectors including setting up a functional National Innovation System; enhancing awareness on the role of knowledge in enhancing productivity among policy makers, implementers and beneficiaries.

1.4.1 Macro-economic Context

Kenya's economy expanded by an estimated 4.5 per cent in 2011 compared to 5.6 per cent, 2.6 per cent and 1.6 per cent growth rates recorded in 2010, 2009 and 2008 respectively. While, the improved economic growth recorded in 2010 was attributed to favourable weather conditions which contributed to improved agricultural output, effects of the fiscal stimulus package initiated by the government, improved liquidity in the economy, prudent macroeconomic management and recovery in global economy, in 2011, the conditions changed significantly. Rising domestic interests rates, fuelled by deterioration in the exchange rate, rising oil prices and major political transition expected in 2012 severely dampened economic growth prospects. In 2011, the global economic environment deteriorated significantly, with the IMF scaling down economic growth forecasts. In its World Economic Outlook of September 2011, it is stated that:

Global growth will moderate to about 4 per cent through 2012, from over 5 per cent in 2010. Real GDP in the advanced economies is projected to expand at a pace of about 1½ per cent in 2011 and 2 per cent in 2012, helped by a gradual unwinding of the temporary forces that have held back activity during much of the second quarter of 2011.

In Kenya real GDP per capita increased from Kshs.35,470 in 2009 to Kshs.36,419 in 2010 after a slight slowdown in 2008 and 2009 following the 2008 shocks (post-election violence, global financial crisis and drought).

In the macroeconomic context, although growth prospects for Kenya are improving, there is need to deal with significant risks, locally and globally. These include dampened global growth prospects, potential adverse local weather conditions, rising global energy prices, the Somalia incursion and the impending general elections. As related to the context of the overall national planning horizon, there is a very strong relationship between the social, economic and political pillars as outlined in Kenya Vision 2030 and mandates of the

Constitution of Kenya 2010. Being the foundation upon which the pillars spring, the implementation of relevant ST&I interventions are key in ensuring a stable, low interest macroeconomic context which will in turn support interventions in the social and political pillars.

1.4.2 Social

Despite the concerted efforts, Kenya has sustained a steady growth in its population since independence. According to the 2009 Population and Housing Census, Kenya's population was 38.6 million in 2009 with a sex ratio of about 1:1, and an inter-censal growth rate of 2.6 per cent. The population is further projected to increase at 2 per cent per annum to 60 million in the year 2030 (US Census Bureau, 2010).

Rapid population growth—and the even more rapid urbanization that accompanies it are likely to affect Kenya's development prospects. First, high urbanization is good for development. No country has ever reached high income levels with low urbanization. Secondly, population growth increases density and, together with rural-urban migration, creates higher urbanization which is critical for achieving sustained growth. Large urban centres have two distinct economic advantages. These are; as more people interact, there is more scope for innovation. Young people need jobs, but they also create jobs. Kenya has an educated workforce and a dynamic service industry, which typically has lower barriers of entry than agriculture or manufacturing, and provides opportunities for young entrepreneurs. In addition, larger groups of population living in close proximity allow for economies of scale. Companies can produce goods in larger numbers and more cheaply, serving a larger number of low-income customers. Over the past decade, Kenya has seen the emergence of a number of companies such as telecommunication that have successfully targeted the large numbers of lower and lower-middle income groups using the “bottom of the pyramid” model. This business model is viable because they can serve a multi-million customer base.

Total Government allocation to the social sector was expected to increase by 24.5 per cent from KSh.208.8 billion in 2009/10 to KSh.259.9 billion in 2010/11 financial year to cater for the increasing population.. the rapid urban growth rate resulting from the increase population will transform the country into a predominantly urban nation by 2030 with the urban population growing from the current 26% to more than 60%. This necessitates investment and expansion of the wealth creation base through enhanced productivity growth to provide for the growing population in terms of health, education, infrastructure among others. The

population expansion will also provide an opportunity to develop a human resource base that is able to harness ST&I and create a knowledge based economy. In this regard, ST&I will be critical to the socio-economic transformation of the country.

In respect to the social pillar, ST&I interventions will be critical in ensuring that we manage the demographic transition in a manner that ensures improvement in the health and education profiles of the Kenyan population to enable it to take advantage of changes in the global environment. It will also deal with the poor state of the natural environment, the national demographic profile, the health status as well as significant governance challenges. Safeguarding our natural environment against natural disasters, climate change and man-made disasters will require effective and efficient environmental conservation methods. ST&I will be applied to provide solutions that will enhance natural resource management for public safety, food security, as well as resolving human and animal health conflicts.

1.4.3 Political

The goal for ST&I is to operationalize legal and institutional framework needed to strengthen innovative electoral and governance processes. Towards this pursuit, ST&I will facilitate and support constitutional values such as democracy and public participation; transparency and accountability; public administration and service delivery; security, peace building and conflict management.

In addition, the proposed National Innovation System will be structured to be responsive to national and county interests in order to facilitate the application of ST&I at National and County levels.

1.5 Leveraging ST&I for National Development: The Key Challenges

Although the constitution has emphasized the importance of science, technology and innovation in Kenya's development, the sector continues to operate in a fragmented manner losing on the benefits of synergy and networking. The investments that Kenya has made in science and technology infrastructure have not yielded the expected improvements in economic growth. This can be attributed to a number of challenges including the following:

- a) The NCST has operated as a department in a Ministry. This rendered the Council ineffective as it failed to coordinate R&D in the more autonomous and generally better endowed Research Institutes.

- b) There has been no national research agenda to guide the researchers. Each research institute and university has developed their own research programmes without regard to what the others were doing.
- c) The linkages between the researchers, innovators and industry who are expected to use the research outcomes, are weak. The result has been the lack of commercialization of research findings.
- d) Funding for research has been very low. Researchers have had to rely on foreign funding with the attendant danger of pursuing a foreign agenda.
- e) The structure and mix of products from the local industry has not stimulated innovation. Most industries are engaged in retailing of other companies products hence the demand for Research, Development and Innovation (RDI) has been minimal.
- f) The non-alignment of the research agenda with national development goals and market needs so as to attract more funding for ST&I.
- g) The inadequate scientific expertise in the country due to over reliance on foreign experts leading to the neglect of the development and use of local expertise.
- h) Lack of advocacy for ST&I at high political and policy levels.
- i) Low science culture among the population.
- j) Weak mechanisms for implementation, evaluation and review of ST&I initiatives.
- k) Weak linkages between various agencies and organizations in ST&I.
- l) Poor performance in Mathematics and Sciences in Secondary schools which lays the foundation of science expertise.

1.6 Aspirations

The overall goal of ST&I is to generate knowledge and innovation to drive Kenya's Vision 2030. The time available to do this is simply too short, less than 10 years. There is therefore need to review the existing ST&I policy and legal framework to make the sector more dynamic and responsive to global developments and national needs. The ST&I sector will require a major transformation to achieve the following:

- a) Re-align ST&I programmes to national goals and market needs;

- b) Re-structure and rationalize the existing ST&I and R&D institutions to make them more effective in addressing national priority needs;
- c) Establish institutions dedicated to developing key industries that will see the country attain NIC status;
- d) Entrench product oriented multi-disciplinary approach to R&D;
- e) Strengthen governance and management of the ST&I sector and institutions to make them more efficient and effective; and
- f) Develop and implement a mechanism for sustainable financing of ST&I.

1.7 Justification for ST&I Innovation Policy

Lack of an integrative policy framework to facilitate effective delivery and utilization of knowledge and the integration of ST&I into the economy is an issue that needs urgent action. The productive sector does not have commensurate expertise that constitutes graduates from relevant institutions. This makes the private sector to incur higher costs in re-training staff for effective service delivery. Inadequate entrepreneurship skills mean that this cadre of expertise faces a barrier in the creation of ST&I technology-based enterprises within the economy.

The existing policy and legal framework present an elaborate institutional arrangement for public R&D. This was well conceived in line with most international practices in the 1970s when the Act was enacted. However, it is evident that the existing policy framework neither provides guidance on priorities for S&T nor addresses issues on innovation. A further challenge is the lack of a robust financing mechanism. It is therefore important that Kenya reformulates ST&I policy to address these challenges

The ST&I policy should take advantage of global opportunities as well as meet the needs of the Kenyan populace. In this regard, areas of significant potential have been identified under Vision 2030 and ST&I will play a fundamental role in achieving the targeted benefits of the long term plan. The national ST&I policy proposes to integrate ST&I into the eight identified sectors by ensuring that the sector players have access to the necessary technologies that will be relevant to the improvement of a diverse range of products, processes and services. Therefore, the ST&I policy will facilitate the achievement of Kenya Vision 2030 with regard to the following: creating a knowledge economy; promoting competitiveness in productive sectors of the economy; creating enterprises and employment; expanding industrialization; and enhancing the quality of life through innovation. Others are developing scientific human

resources; expanding national infrastructure; promoting an information society; optimizing on the sustainable use of the natural and environmental resources; and commercializing research findings.

CHAPTER TWO - VISION, MISSION, PHILOSOPHY, PURPOSE AND GOALS

2.1 Vision

The Vision for Kenya's Science, Technology and Innovation is:

To be a nation that harnesses science, technology and innovation to foster global competitiveness for wealth creation, national prosperity and a high quality of life for its people.

2.2 Mission

The Mission of the Science, Technology and Innovation is:

To mainstream the application of science, technology and innovation in all sectors and processes of the economy to ensure that Kenyans benefit from acquisition and utilisation of available capacities and capabilities to achieve the objectives of Vision 2030.

2.3 Philosophy and Guiding Principles

2.3.1 Philosophy

The ST&I policy reforms articulated in this paper have been anchored on a firm philosophy and principles for the sector. ST&I is premised on the philosophy “*research for social and economic transformation and development*”. ST&I therefore cannot be provided just for the sake of it but for the purpose of driving social and economic development. The outcome of ST&I is knowledge embodied in people or in products, processes and systems. Innovation is considered successful if it causes a change in the product offered, service, business model or operations which meaningfully improves the experience of a large number of stakeholders. ST&I is therefore the perfect means to transforming production in a country through production of globally competitive goods and services. Hence, ST&I cannot be left to chance. There must be put in place well planned programmes and projects that lead to entrenching innovation in all national production systems. The education and training systems (primary, secondary and tertiary) must entrench creative and critical thinking as a standard way of learning. There is need to dedicate specific institutions to support innovation in critical manufacturing sub-sectors if a country has to attain and sustain industrialized status.

2.3.2 Guiding Principles

The effective implementation of the Science Technology and Innovation Policy will be guided by the following principles:

1. **Relevance:** ST&I policy shall be aimed at helping to achieve the country's Vision 2030.
2. **Cost-effectiveness:** There shall be use of the most cost-effective means to achieve the desired results.
3. **Realism:** Whereas Kenya desires to reach the international frontiers of ST&I application and development, this policy will be implemented within the Country's capacities and aspirations.
4. **Multi-disciplinary and synergy:** ST&I development and application must be holistic. There thus shall be a multi-disciplinary and cross-sectoral approach to problem-solving for synergy.
5. **Partnerships:** There shall be conscious efforts for collaboration and interaction with all local and foreign stakeholders in the national innovation system.
6. **Environmental protection and conservation:** All ST&I institutions shall make efforts to protect and conserve the environment.
7. **Empowerment and participation:** Promote the empowerment as well as full participation of women, youth, marginalized communities and disadvantaged persons in all ST&I activities.
8. **Equity and non-discrimination:** Ensure there is equity and non-discrimination in appointing the leadership team and in recruitment, promotions and human resource management of public ST&I institutions; and ensure the principle that not more than two-thirds of the members of elective or appointive bodies shall be of the same gender is observed.
9. **Ethical leadership:** Ensure that the leadership team of public ST&I institutions complies with the ethical leadership principles as specified in Article. 73(2) of the Constitution.

10. **Reward and recognition:** Develop and implement a robust system for identifying, evaluating, recognising, protecting intellectual property rights and rewarding excellence in ST&I activities
11. **Good governance:** Ensure that the leadership team of public ST&I institutions complies with the values and principles in the management and administration of public institutions as provided in Article 232(1) of the Constitution as well as the principles governing the management of public finances as specified in Article 201 of the Constitution.

2.4 Purpose

The Government will promote ST&I as the means to making Kenyan products and services globally competitive. The Government will therefore seek to entrench innovation in all national production systems. Through ST&I, new knowledge-intensive industries will be created in addition to transforming the industry structure and mix of products as we strive to become an industrialized state. The goal of the ST&I policy is to build critical capacity and capability in ST&I that will create change and transform Kenya into a newly industrialized country (NIC) through the utilization of knowledge as the driving force.

2.5 Goals

The ST&I sector, in facilitating achievement of the mandates of the Constitution of Kenya 2010 and Vision 2030 will pursue the following goals:

- a) Re-align ST&I programmes to national goals and market needs in order to identify sector priorities and determine the strategic technology platforms required to address those priorities.
- b) Identify and develop key industries, which include ICT, energy, manufacturing, agriculture, transport and space science that will help the country attain middle income country status.
- c) Rationalize, re-structure and establish ST&I institutions to make them more effective in addressing national priority needs in order to build a robust national innovation system that uses product oriented multi-disciplinary approaches to become globally competitive.
- d) Strengthen governance and management of the ST&I sector and institutions to make them more efficient and effective and accountable for performance.
- e) Develop and implement a mechanism for sustainable funding of ST&I.

CHAPTER THREE - KENYA'S NATIONAL INNOVATION SYSTEM

3.1 Existing National Innovation System

In summary, the national system of innovation can be thought of as a set of functioning institutions, organizations and policies, which interact constructively in pursuit of a common set of social and economic goals and objectives. Kenya's current innovation system comprises of the following key stakeholders: National Council for Science and Technology; Research Institutes; Universities; Kenya Industrial Property Institute (KIPI); micro, small and medium enterprises; passionate innovation stakeholders; and innovation hubs, among others. This innovation system has a number of key challenges.

- (i) Ineffective service provision to the critical national needs;
- (ii) Lack of an integrative policy framework to facilitate effective integration of ST&I into the economy;
- (iii) Lack of a coordinated national research agenda;
- (iv) The existence of a linear and fragmented innovation system;
- (v) "Silo Mentality" of researchers;
- (vi) Weak linkages and ineffective coordination between government, private sector and researchers;
- (vii) Non-alignment of academic curricula and graduate SET skills to industry needs;
- (viii) Low commercialization rate of innovations;
- (ix) IP process is perceived as complex and innovators have low awareness;
- (x) Data does not exist to measure innovations;
- (xi) Inadequate funding and support for innovations.

Government will therefore adopt a national innovation system to ensure that the education and research system, the business system, the intermediate organisations, ST&I infrastructure and framework conditions in which they operate interact dynamically and respond to national development needs.

3.2 Proposed Kenya National Innovation System (KNIS)

In order to achieve a revamped and re-invigorated Kenya National Innovation System (KNIS), this policy document will be implemented along four strategic thrusts.

- i. The institutional re-engineering will focus on filling in the policy formulation and implementation gaps as well as addressing the implementation weaknesses inherent in the current KNIS.
- ii. The strategic resource mobilization will focus on harnessing the resources (1% of GDP) needed to support the mainstreaming of ST&I in the Kenyan economy.
- iii. The strategic knowledge and technology governance will focus on the generation and management of Intellectual Property Rights; technology development, transfer and diffusion as well as modernization and utilization of indigenous resources, practices and knowledge.
- iv. The cross-cutting issues will address the need for strategic partnerships for enhanced ST&I linkages and collaboration; ST&I for integrated Environment and Natural Resources Management and the application of effective public communication and advocacy for ST&I.

It is globally recognized that technological transformation is central to economic growth. In this regard, both macro-economic and ST&I policies must be adequately designed to promote innovation. The proposed Kenya National Innovation System is illustrated in Figure 1.

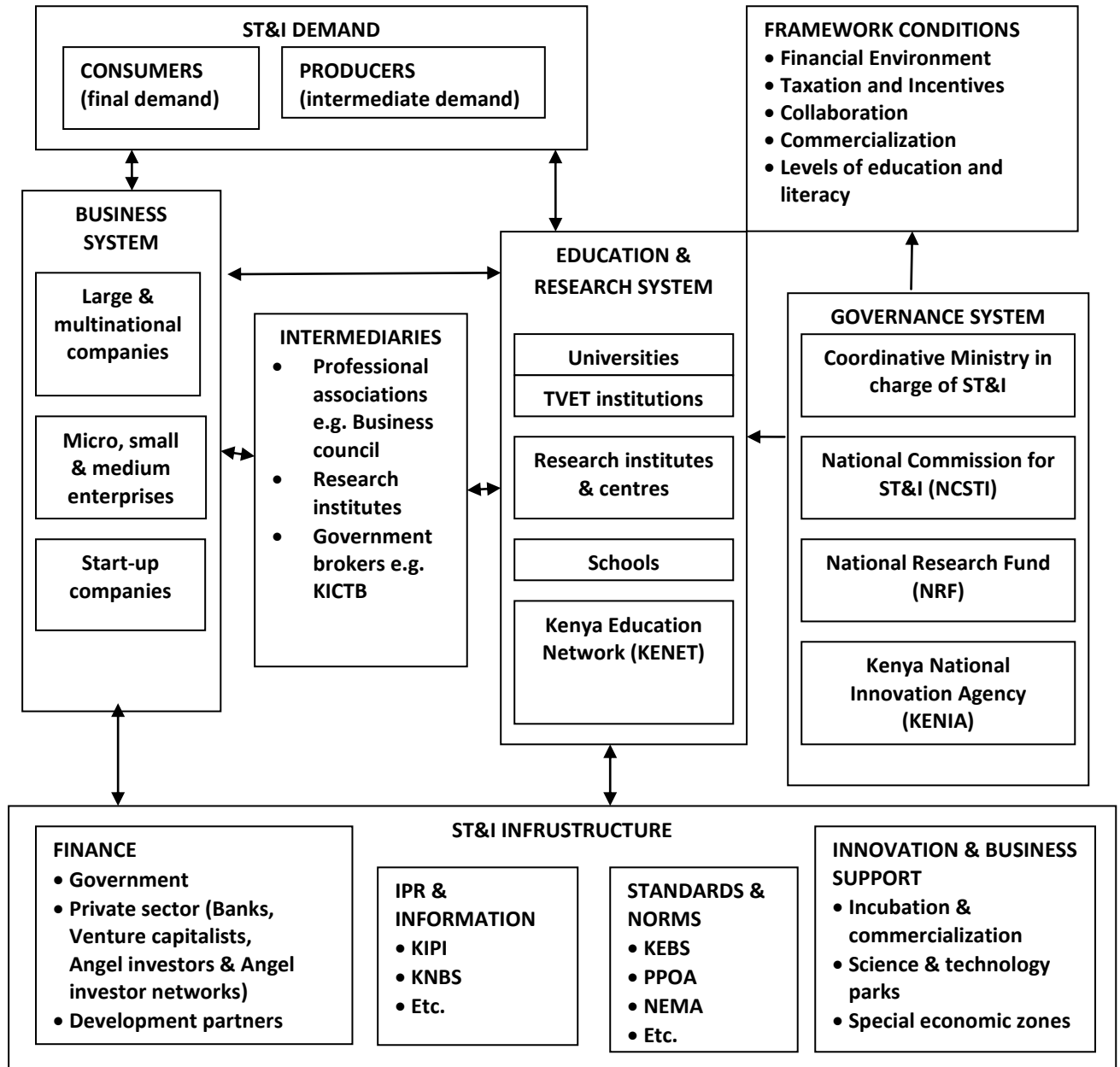


Figure 1: Major Components of the Kenya National Innovation System

3.2.1 The Major Components of the National Innovation System

The major components of the national innovation system include: demand for ST&I, education and research system, business system, intermediate organizations, ST&I infrastructure, framework conditions as well as governance systems.

Demand for ST&I

Demand for ST&I is highly correlated to the structure of the economy. This policy aims to put in place a well-functioning innovation system that will ensure enhanced competitiveness. The pressure of competition will drive private firms to demand better skills and knowledge from the education and research system. This will result in “technology deepening” and expansion across sectors as a result of increased interaction of all the actors within the NIS in search of better and more cost-effective technological means of producing goods and services. Lessons from South Korea, Malaysia, Taiwan, Brazil and Chile indicate that in the absence of local demand for ST&I and technological deepening had to be supported by aggressive government interventions that included targeted public procurement, creation of specialised public ST&I Institutes, and preferential arrangements to steer firms to targeted technology sectors.

Education and Research System

Education and research are important determinants of the ability to create a knowledge-based economy. A pool of relevant and adequate skills must be available for absorption into the economy. Technologically successful countries such as Taiwan and Chile have been supported by an adequate pool of high technical skills. However, for technological deepening to occur within society, it is critical to translate these skills into technologically productive competencies within industry. Education and research system must be proactive in addressing the needs of industry to ensure effective synergy. The knowledge-intensive nature of science and technology requires highly qualified and skilled human resources. Over the years, the supply of such human resource has become acute, while employment of technically qualified personnel remains low by international standards. The rapidly growing economy has already started showing the skills constraints with shortages in critical cadres. An added dimension to this is the emerging age-gap between the senior and junior scientists, engineers, technologists and researchers.

The actors in the education and research system are composed of universities, research institutes and centres, TVET institutions and schools. In addition, the National Research and Education Network (NREN), also called the Kenya Education Network (KENET) facilitates the sharing of educational and research resources through broadband infrastructure and services. KENET will be strengthened to facilitate the sharing of research resources across the education and research system.

Kenya's investment in high-level technical human resource and research is low. This arises from two factors. Firstly, education and training does not adequately meet the needs of industry. The government will make deliberate efforts to support education and research to sufficiently contribute to the KNIS. Secondly, there is limited development of technological capabilities in industry, despite the fact that some firms are offering on-the-job training which largely aims at providing basic operational skills for specific jobs. Focus on technological learning within industry is required for the exploitation of technologies to enhance competitiveness.

Business System

The business system is critical to the process of acquiring and utilising ST&I for national development. Most innovative activities take place within the business system. Actors within the business system must therefore be predisposed to acquire and exploit technology. These actors include start-up companies; micro, small and medium enterprises; and large and multinational companies.

Localised innovation will be crucial in targeting our specific challenges. In addition, localised innovation will offer opportunities for technological learning that will enable the economy to build technological capabilities. Consolidation of Kenyan innovation capabilities will provide an interface for global linkages to provide a continuous flow of knowledge. Although the international companies are an important source of foreign direct investment (FDI), the long-term benefits will emanate from the ability to draw technological knowledge from them.

The Kenyan business system has not fully integrated innovation to enhance competitiveness. As a result, key sectors such as manufacturing have not been able to grow and become competitive. The contribution of manufacturing to GDP has stagnated at 11% over the past 15 years. Kenya's industrial structure displays insufficient linkages between the various categories of firms, especially the micro, small and medium enterprises (MSMEs), where

most innovations take place. In addition, most local firms have not been able to develop technological competencies to acquire and apply knowledge from foreign firms while most start-up companies die before maturity.

Technological learning within the business system will be formally structured and appropriately managed to ensure technological capability building. This will involve purposeful investment. This can be done in various ways. For example; in the case of Korean companies, training activities will be inbuilt in contracts with engineering suppliers. These will not only specify training in capabilities to operate facilities once built, but they will also specify the provision of training in design and engineering through the project cycle, leading to deeper technological competencies and related managerial capabilities.

Intermediate Organisations

Ideally, intermediate organizations are developers and transmitters of knowledge between the business system on one hand and the education and research system on the other. They transmit feedback to the education and research system on the priorities of the business system. They also have strong familiarity with the processes of new knowledge generation and offer expertise in governing interactive learning. In the Kenyan context, they are essentially research organizations that are heavily inclined towards public service particularly in agriculture and health. However, the Kenyan intermediate organizations have not succeeded in creating an overall system of learning and problem solving. In addition, knowledge brokers especially professional organizations have not been effective in new knowledge creation.

The linkages of the intermediate organisation with the business system are generally weak. However, demand for locally generated knowledge is higher in the tea, coffee, and horticultural sectors where research is heavily supported by public-private partnerships. Knowledge generation in the Kenyan intermediate organisations is heavily supported by development partners who influence priorities of these organisations. As a result, the ST&I activities of intermediate organisations are not aligned to national priorities. Intermediate organizations will be strengthened to support the domestic capacity for identifying, acquiring and applying technology.

ST&I Infrastructure

Infrastructure is a key foundation upon which ST&I activities are operationalized. As illustrated in Figure 1, infrastructure encompasses a wide array of critical issues including intellectual property rights, information systems, banking, venture capital, standards and norms, innovation and business support system issues. Science, technology and innovation will be critical in addressing infrastructure challenges. One of the critical infrastructures is that of financing of ST&I. The policy will facilitate multi-faceted financing of ST&I which will include venture capitalists, angel investors and angel investor networks in addition to the traditional methods of financing through access to credit in banks and development partners.

Framework Conditions

Framework conditions are the regulatory and facilitative environments necessary in shaping the performance of national innovation systems. They provide rules that govern research collaboration and commercialisation, research financing, intellectual property rights for commercialisation and researcher mobility, policy direction, among others. Fiscal and taxation policies for instance, are important in providing incentives and steering the KNIS in desired directions. Levels of education and literacy and the national propensity to entrepreneurship are equally important. Whereas several of these factors are closely linked to culture, all of them can be influenced by appropriate policies within the governance system.

In Kenya, the Government has instituted fiscal and taxation measures to support innovation, but these are incomprehensive and not targeted due to lack of a comprehensive KNIS. Levels of trust in business dealings are low and hinder innovation activities. In addition, low levels of awareness negatively impacts on innovativeness by enforcing cultural aspects that do not foster innovation. As a consequence of the unfavourable framework conditions, the propensity to entrepreneurship is low and does not promote innovation activities. This policy and strategy is intended to provide sound framework conditions that will provide an appropriate environment for KNIS implementation.

Governance System

In order to optimize on the development, acquisition, utilization and dissemination of ST&I, the policy statements stated in chapter 4 seek to create the following key institutions to make up the governance system: The Ministry in charge of Science, Technology and Innovation, the National Commission for Science, Technology and Innovation (NCSTI), the Kenya National Innovation Agency (KENIA) and the National Research Fund (NRF). The functions of these institutions are explained in Chapter 5.

CHAPTER FOUR – POLICIES AND STRATEGIES

This chapter addresses policies and strategies that were developed from the analysis of the National Sectoral Priorities. The Policies highlight areas meant to create an enabling environment for the growth of ST&I.

The policies fall within the four strategic thrusts mentioned in chapter three and will be used to address challenges in the ST&I sector which include; lack of an integrative policy framework to facilitate effective integration of ST&I into the economy; lack of a coordinated national research agenda; the existence of a linear and fragmented innovation system; “Silo Mentality” of researchers; weak linkages and ineffective coordination between government, private sector and researchers; non-alignment of academic curricula and graduate SET skills to industry needs; low commercialization rate of innovations; IP process is perceived as complex and low awareness among innovators; data does not exist to measure innovations; inadequate funding and support for innovations.

Policy 1: The government will establish an institutional and regulatory framework to promote, coordinate, mobilise resources and manage ST&I.

Strategies to implement this policy include the following:

- a) Mainstream ST&I in all sectors of the economy both at national and county government levels;
- b) Re-engineer institutions to provide a governance framework to support autonomy, coordination, gender parity and partnership-based application of ST&I;
- c) Provide guidelines for monitoring compliance with ethical issues regarding research activities;
- d) Build capacity for quality standards and accreditation of testing and calibration laboratories according to international requirements;
- e) Establish a strong, supportive and comprehensive policy environment for speedy and effective commercialisation of inventions and innovations to maximise public good and interest;
- f) Promote local ST&I inventions and innovations and ensure that the innovators receive appropriate compensation or royalties; and

- g) Develop, implement, continuously review and globally benchmark a comprehensive performance management framework.

Policy 2: The government through relevant institutions will leverage ST&I to transform the economy through identified national priority areas including:

- a) Telecommunication, Electronics and Computers (TEC) manufacturing technologies;
- b) Software development technologies;
- c) Automobile manufacturing technologies;
- d) Satellite and space infrastructure manufacturing technologies;
- e) Renewable and green energy infrastructure manufacturing technologies;
- f) Nuclear energy technologies;
- g) Food and nutritional security technologies;
- h) Natural resource management technologies;
- i) Health technologies;
- j) New and emerging technologies;

In order to implement the policy, the government will adopt the following strategies;

- a) Establish and sustain network of innovation Centres of Excellence in the national priority areas with specific deliverables.
- b) Identification, evaluation and acquisition of appropriate technologies supportive of the realization of the identified national priority areas to ensure that they are evidence-based and demand-driven.
- c) Review all on-going ST&I interventions and align them to the national priority areas.
- d) Establish and continuously review a Framework for conducting fore sighting linked to the national priority areas.
- e) Promote the formation of new technology-based firms through the establishment of ST&I Parks.

Policy 3: The government will allocate 1% of GDP annually for the R&D sub-sector and motivate other stakeholders to participate in funding ST&I.

In order to implement the policy, the government will adopt the following strategies;

- a) Increase public investment for universities, government laboratories and research institutes to enable access to facilities and equipment;
- b) Create a National Research Fund to support both basic and applied research;
- c) Establish infrastructure and equipment needs for ST&I to support overall national development objectives;
- d) Finance the established ST&I infrastructure and equipment needs;
- e) Develop globally benchmarked ST&I infrastructure to support intervention in strategic priority areas;
- f) Create incentives for industry and other stakeholders to co-fund the innovation and commercialization;
- g) Create a framework for venture capitalists and angel investors to finance innovative ideas in national priority areas;
- h) The short to medium term, utilization of funds will lay emphasis on identification of existing domestic and foreign technologies and adapting these to address our identified national priorities;
- i) Over the medium to long-term, there will be a shift of public resources to growth-engine technologies.

Policy 4: The government in collaboration with relevant stakeholders will identify, nurture, recognise and protect intellectual property rights of scientists, researchers and innovators.

In order to implement the policy, the government will adopt the following strategies;

- a) Establish the status of the national ST&I human resource capacity and skills in science, engineering and technology, identify the gaps and address the deficient areas;
- b) Facilitate involvement of women, youth and disadvantaged groups and other stakeholders in national governance and public policy making to ensure policies are all inclusive;

- c) Document, evaluate and continuously update the extensive indigenous resources and traditional knowledge and integrate them into national development to enhance utilization;
- d) Develop a mechanism to retain the highly talented Kenyans from our education system and attract the best from the Diaspora;
- e) Develop a framework for enhancing creativity and learning by discovery through promotion of appropriate content of SET and entrepreneurship skills at various levels of education and training;
- f) Recognize, tap, nurture and reward ST&I talent through compensations and royalties from the early stages of learning in all sectors by utilizing competitions, exhibitions, sciences congresses among others;
- g) Ensure Intellectual Property Rights (IPR) regime facilitates the identification generation, acquisition and protection of indigenous (including genetic) resources and traditional knowledge;
- h) Develop IPR programmes that effectively harness ST&I utilization for the rapid commercialization of intellectually protected products and services locally and internationally to maximize on public good and interest;
- i) Review and implement a National Intellectual Property Policy and enlist supportive international actions to exploit and protect technological innovations arising out of genetic resources, traditional and cultural expressions and scientific investigations;
- j) Promote innovative in-house R&D in both public and private enterprises through incentive schemes and Public Private Partnerships (PPPs).

Policy 5: The government will establish and promote ST&I knowledge sharing and awareness creation systems.

In order to implement the policy, the government will adopt the following strategies;

- a) Develop and implement dynamic ST&I communication policy
- b) Establish and sustain national integrated advocacy programmes such as encouraging Science, Mathematics and Technology in Schools.

- c) Promote public awareness, acceptance and support for national science, technology and innovation activities.
- d) Develop a framework in a participatory manner to promote technological learning within the public sector to close the competency and knowledge gaps between policy makers and industry practitioners.
- e) Establish national and county ST&I museums.
- f) Promote the generation, documentation and dissemination of ST&I information.
- g) Promote public dialogue involving researchers, the different users and beneficiaries on ST&I matters of interest through print, electronic and other media.
- h) Develop mechanisms for communicating ST&I results to increase knowledge and understanding for adoption and utilization.
- i) Establish a knowledge management information system for disseminating and sharing research findings.
- j) Develop and implement an effective and efficient web -based mechanism for monitoring, reviewing and reporting of ST&I policy implementation process.
- k) Support and encourage the development of indicators for ST&I.

CHAPTER FIVE - INSTITUTIONAL FRAMEWORK

5.1 Organisational Structure

Kenya's drive to be a middle income country by 2030 will be based on development of a robust knowledge based economy. Lessons learnt from most newly industrialized countries show that this transformation has been built around a dedicated Department responsible for science, technology and innovation across all sectors. In line with the benchmark countries, the National Government will establish a dedicated Department responsible for Science, Technology and Innovation. This Department will be responsible for policy, planning and funding of the ST&I sector. It will also coordinate the implementation of flagship programmes across all sector ministries, universities and research institutes and centres with respect to science, technology and innovation. Due to its coordinative nature and to have the required power, this Department will need to be in the Office of the President. The Department shall be devolved into the counties.

The Department will house three state agencies established as body corporates: the National Commission for Science, Technology and Innovation (NCSTI); the Kenya National Innovation Agency (KENIA); and the National Research Fund (NRF). The key functions of these agencies are explained below.

5.1.1 Department in charge of Science, Technology and Innovation

Science, technology and innovation is critical to the realization of Vision 2030 and is cross-sectoral. This function will therefore fall under a dedicated Department in charge of ST&I which will be responsible for policy for science, technology and innovation.

The objective behind the creation of the Department is to improve competitiveness in the fields of Research, Science, Technology and Innovation (RST&I) through the generation, acquisition, transfer and utilization of knowledge for sustainable development as well as management and implementation of Government's RST&I policies

In addition, it will promote and coordinate the interaction between the industry and trade, centres of research and education, and strengthen industry and research policies.

The main functions will be:

- a) Formulate, review and coordinate national research, science, technology and innovation policies and legislative to promote RST&I;
- b) Coordinate the implementation of national RST&I Policy;

- c) Promote strategic regional and international linkages, collaboration, and cooperation in RST&I;
- d) Coordinate various private and public agencies involved in RST&I;
- e) Manage the Government's RST&I investment;
- f) Ensure that RST&I investments yield products beneficial to the economy;
- g) Collaborate with other Government organizations where RST&I intersects with their work;
- h) Coordinate the interaction between knowledge institutions and business and industry.

The Department will house the National Commission for Science, Technology and Innovation (NCSTI); the Kenya National Innovation Agency (KENIA); and the National Research Fund (NRF) as body corporates.

5.1.2 National Commission on ST&I (NCSTI)

The existing National Council for Science and Technology shall be replaced by the (NCSTI) which shall be a body corporate. The mandate of the Commission is to regulate and assure quality in the ST&I sector and advise Government on matters of science, technology and innovation. The specific functions of the Commission will be:

- a) Determine, in consultation with stakeholders, priorities for scientific, technological and Innovation activities in Kenya in relation to the economic and social policies of the Government and its international commitments;
- b) Advise the National and County governments on science, technology and innovation policy, including general planning and the assessment of the requisite financial resources;
- c) Accreditation of research institutes;
- d) Assuring relevance and quality of ST&I programmes of research institutes;
- e) Register research institutes;
- f) Approve all research programmes in Kenya;
- g) Liaise with the Kenya National Innovation Agency and the National Research Fund to ensure funding and implementation of prioritized research programmes;
- h) Ensure co-ordination between the various agencies involved in Science, Technology and Innovation;

- i) Advise on science education, not only at the advanced level in respect of the quality and quantity of potential manpower training but also at lower levels in respect of general science education for the public;
- j) Review and advise on the programmes and budgets for the promotion of the research and related scientific activities proposed by cabinet secretary concerned and ensure that they are in harmony with the national ST&I policy;
- k) Maintain relationships with corresponding scientific organizations in other countries;
- l) Spearhead the internationalisation of ST&I diplomacy.

The NCSTI will have ST&I offices in Counties to carry out the key mandates, including communicating R&D issues to National Government, promoting ST&I in the Counties, forming partnerships with local industries and institutions of learning, among others.

5.1.3 Kenya National Innovation Agency (KENIA)

The Kenya National Innovation Agency will be a body corporate. The mandate of the Agency will be to develop and manage the Kenya National Innovation System. The key functions will include:

- a) Institutionalize linkages between universities, research institutes, private industry, government and other actors in the national innovation system;
- b) Facilitate the creation of specialized innovation centres of excellence in priority sectors;
- c) Develop and continuously track and benchmark the National Innovation Metrics based on International Best Practice;
- d) Scout and nurture innovative ideas from individuals, training institutions, private sector and other ST&I institutions;
- e) Recommend provision of financial and any other assistance to any person, for the purpose of enabling that person to develop any technological innovation;
- f) Acquire rights or interests in or to any technological innovation supported by the Agency from any person or assign any person any rights in or to such technological innovation;

- g) Create synergies among different technological innovations, incubations and diffusion initiatives in Kenya;
- h) Develop the national capacity and infrastructure to protect and exploit intellectual property derived from research financed by the Agency;
- i) Facilitate the application for the grant or the revocation of patents and institution of legal action in respect of any infringement of intellectual property rights;
- j) Establish and regularly update the database on innovations;
- k) Regularly undertake technology monitoring and forecasting in all areas relevant to national development;
- l) Increase IP awareness among innovators;
- m) Disseminate scientific knowledge or technology through any medium;
- n) Promote increased awareness, knowledge and information of the innovation system;
- o) Provide ST&I advocacy, so that the voice of the country's ST&I community will be represented in the country's programs and policies at all levels;
- p) Establish and maintain a presidential award system for commercialization of novel innovations;
- q) Establish and implement mechanisms of rewarding novel innovations to share and drive innovation; and
- r) Implement the research and commercialization policy.

KENIA will have an independent Board and will be responsible to the Cabinet Secretary responsible for ST&I. In order to ensure linkages with the National Commission, the CEO of NCST&I will be a member of the KENIA board.

The National Innovation Agency will have branches in Counties to carry out its core functions, including promoting innovation, scouting for innovations, protecting IP, and facilitate incubation and commercialization.

5.1.4 National Research Fund

A National Research Fund (NRF) will be established and will be managed by a Board of Trustees. The mandate of the Trustees will be to mobilize and manage financial resources for the Kenya National Innovation System in order to create knowledge, innovation and

development in all fields of science and technology, including indigenous knowledge. The functions of the Trustees will be to:

- a) Mobilize resources for the Kenya National Innovation System from Government, private sector, development partners and other sources;
- b) Prudently manage and invest the funds mobilized;
- c) Support the development of human resources through grants, scholarships or bursaries to persons or research institutions or universities pursuing postgraduate programs in national priority ST&I areas;
- d) Provide financial support for the development of ST&I infrastructure in universities, research institutions, centres of excellence, and others as may have been identified by the National Commission for ST&I;
- e) Support the development of research capacities in the national priority areas of science, technology and innovation;
- f) Allocate funds for research and promote multi-disciplinary collaboration among Universities and Research Institutions, including identified centres of excellence;
- g) Monitor and evaluate the results and impacts of research funded by the Fund;
- h) Provide financial support for participation in international scientific activities through maintaining membership of appropriate international science organizations;
- i) Provide financial support for collaboration, co-operation and sharing of research information and knowledge, including supporting conferences, workshops, seminars, meetings and other symposia;
- j) Provide financial support to the Kenya Education Network (KENET) as the National Research and Education Network for the development of broadband infrastructure to facilitate co-operation and sharing of research information and knowledge;
- k) Initiate liaison with structures involved in the protection of intellectual property rights; and
- l) Compile and maintain a national database of research and innovations funded by the Fund.

The Fund will consist of an initial amount provided by the Government of not less than 1% of Gross Domestic Product; such sums of money as may be designated by Parliament; such other sums as may be received in the form of donations, endowments, grants or gifts from whatever source and designated for the Fund.

The National Research Fund will have an independent Board of Trustees and will be responsible to the Cabinet Secretary responsible for ST&I. In order to ensure linkages with the National Commission, the CEO of NCST&I will be a member of the NRF board.

5.2 Research Institutes

Research institutes will be hosted by the respective sector ministries. The National Commission for ST&I will work with the sector ministries to restructure and rationalize the research institutes to promote product-oriented multi-disciplinary research. The policy, planning and budgeting of the sector-based research institutes will be harmonized under the Commission. These institutes will however, only access funds from the National Research Fund to carry out projects that have been prioritized by the Commission.

A County Government may establish specialized research institutes or innovation centres of excellence to carry out mandates that have been prioritized by this level of Government. However, the County Government will need to negotiate this establishment with the National Government as provided for by the Constitution.

5.3 Centres of Excellence

Kenya's drive to achieve the Vision 2030 goals and realise the constitutional mandates is predicated on effective institutions, driven by appropriate leveraging of ST&I. Lessons from the BRICS and other rapidly developing countries tells us that achieving national and regional economic competitiveness as well as sustainable development is key to this effort. This requires growth of institutions dedicated to scientific research and technological innovation, which are the bedrock of a modern knowledge economy. In this regard, the Department responsible for Science, Technology and Innovation in collaboration with the National Commission on Science, Technology and Innovation and the National Research Fund will establish Centres of Excellence (COEs). The Centres will be established at the county, national, regional or international institution or in units or departments, which could either be public or private and, by virtue of its profile has achieved a high level of repute or profile within its area of performance in respect of science, technology and innovation. The Centres would be carrying out work guided by a Centre of Excellence Programme (CoEP), which will be dedicated to initiatives focusing on identified national priority areas.