REPUBLIC OF KENYA

MINISTRY OF SCIENCE AND TECHNOLOGY

SCIENCE, TECHNOLOGY AND INNOVATION POLICY AND STRATEGY

March, 2008

Vision

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

Mission

To mainstream 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

FOREWORD BY THE HON. MINISTER

The Kenya Government has been implementing the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC) since 2003, as its medium term plan to address development challenges of economic growth and poverty alleviation. 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 industrial transformation that will lead to sustained economic growth of 10 per cent per annum, and social well-being in the next 25 years.

The economic recovery gains that have been made in the last few years and the envisaged Vision 2030 goals provide an opportunity for Kenya to position herself strategically on the global scene. The Government therefore, formulated this National Science, Technology and Innovation (ST&I) Policy and Strategy to guide and promote focused integration of ST&I in all sectors of the economy. Specific emphasis will be placed on identified National Priority Growth Sectors that have high potential to harness ST&I in attaining the targeted 10% annual economic growth.

In order to realize the above, the Government commits itself to facilitate the identification, acquisition, transfer, diffusion and application of relevant ST&I knowledge in all sectors of the economy. In this regard, the Government seeks the concerted and supportive efforts by all stakeholders in the Kenyan national innovation system to re-engineer structures, institutions and sectoral policies or successful implementation of the ST&I Policy and Strategy.

In conclusion, I call upon all stakeholders to embrace and implement this policy and strategy by making the ST&I to be a component of their institutional and sectoral strategies.

Hon. Dr. Noah Wekesa, MP, EGH.

Minister for Science and Technology

STATEMENT BY THE PERMANENT SECRETARY

The new National Science, Technology and Innovation (ST&I) Policy and Strategy underscores the importance of mainstreaming science, technology and innovation in all sectors of the economy and ensure that Kenyans benefit from acquisition and utilization of available ST&I capacities and capabilities to improve their quality of life. The (ST&I) policy and strategy, therefore, provides a framework for harmonized and coordinated approach to create a robust knowledge-based economy that is centred on self-reliance and equitable development.

Through this policy and strategy, the Government will harness Kenya's collective talents and creativity to promote capacity building in ST&I human, financial and infrastructure development and effective networks and linkages for knowledge generation and sharing. Strengthened science, mathematics and language skills will be critical in supporting Kenya's scientific, engineering and technology base. Equally important will be creating the enabling environment to apply these skills into productive and innovative competencies and opportunities for technological learning particularly within industry and business enterprises. The thrust in the realization of these objectives is outlined in the document in various prioritised programmes and projects within which Kenyans are expected to promote scientific and technological deepening and application in industry, enterprise, community, research and development institutions.

Our success in attaining these objectives however has immense human, financial and capital implications and will entail paradigm shifts in the way our sectoral research, science and technology priorities are identified, programmed and managed. In this regard, the policy and strategy has envisaged a robust and invigorated Kenya National Innovation System.

In conclusion, I wish to take this opportunity to appreciate the institutions and their staff who participated in one way or the other in the preparation of this policy and strategy document.

Prof. Crispus M. Kiamba, CBS, MBS

Permanent Secretary, Ministry of Science and Technology

EXECUTIVE SUMMARY

Background to the ST&I Policy

1. Macroeconomic

Kenya's economic performance has improved steadily since 2003. This is demonstrated by a steady improvement in the performance of the macroeconomic policy targets based on the reforms implemented since 2003 under the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC). The consistency in GDP growth provides an opportunity for wealth creation and increased resources for strategic investment in high growth activities and enhanced global competitiveness. For sustained development to be realized the efficiency gains must be enhanced and more importantly complemented with productivity growth. Science, technology and innovation will play a critical role in ensuring that productivity growth occurs, and that the economy is progressively transformed into knowledge based one.

ST&I will be central to the development of the existing economic sectors as well as the creation of new ones with high growth potential. ST&I has been identified as a foundation for Vision 2030, the long term economic plan that is set to guide the economy into a globally competitive and prosperous nation. It is envisaged that the long term plan will: yield an average GDP growth rate of over 10 % per annum; create a just and cohesive society with equitable social development, in a clean and secure environment; and a democratic political system that nurtures issue-based politics, respects the rule of law, and protects all the rights and freedoms of every individual in society.

2. Social

The economic growth has taken place within an emerging constrained environment in terms of the state of the natural environment, the national demographic profile, the health status as well as significant governance challenges. 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 and developing a sustainable tourism industry.

Kenya's demographic profile indicates a high percentage of a young population. As a result the total population is projected to 60 million by the year 2030 from the current 34.3 million. This necessitates investment to provide for the growing population in terms of health, education, infrastructure among others.

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 national sectors significant to achievement of national growth and development targets are:

a) *Agriculture, Rural Development;* - increasing the value of agricultural products through agro-business related processes, agro processing, agricultural research with special reference to bio-technology and drought management, address biotic and abiotic stresses that lead to losses due to pests and diseases.
b) *Health and Life Sciences* - developing the Kenyan health system to international standards
c) *Trade and Industry* - prioritized link between research findings and industry, diversification and upgrading of production capacity of local industries
d) *Human Resource Development* - the supply of adequate and competent human resource necessary for rapid and sustained ST& I development
e) *Physical Infrastructure* - reforming the legal, Institutional and regulatory frameworks to facilitate advancement
f) Energy - research and development to be carried for efficient and affordable energy use and conservation practices; research and analysis of waste management and utilization of the same for energy production;
g) Environment and Natural Resource Management - forest management, environmental management and biodiversity conservation
h) Information Communication Technology (ICT) – Provision of a robust ICT and infrastructure to stimulate and support local ICT industry growth, improved service delivery in both public and private sectors.

4. Kenya's National Innovation System

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. This awareness has replaced an earlier belief that heavy investment in scientific and technological research and the purchase of technology from abroad were sufficient to achieve these goals. The national system of innovation in its broadest conception is the means through which Kenya seeks to acquire, exploit and diffuse knowledge for the achievement of individual and collective goals. The accuracy and effectiveness of the national system of innovation will depend on how well knowledge, technologies, products and processes are converted into increased economic growth for improved quality of life.

The Government's three key interests will therefore be focused on

- ensuring that Kenya has institutions, organizations and policies with legal basis that give effect to the various functions of the national system of innovation,

- fostering interactions among and within all sectors and actors in the economy and,

- ensuring that there is an agreed set of goals and objectives which are in harmony with vision 2030.

5 Strategic Policy Issues

The policy and strategy will be focused on the following four thrusts;

- *Institutional re-engineering* focusing on filling in the policy formulation and implementation gaps as well as addressing the implementation weaknesses inherent in the current KNIS do we have one

- *Strategic resource mobilization* focusing on harnessing the resources needed to support the mainstreaming of ST&I in the Kenyan economy.

- *Strategic knowledge and technology governance* focusing on the generation and management of Intellectual Property Rights; technology development, transfer and diffusion as well as modernization of indigenous resources, practices and knowledge and.

- *Cross-cutting issues* to address the need for strategic partnerships for enhanced ST&I linkages and collaboration; ST&I for integrated disaster management and the application of effective public communication and advocacy for ST&I.

These are elaborated through the following twelve strategic objectives,

a) *Governance framework for ST&I* to support coordinated and partnership-based application of ST&I, ensure establishment of a national innovation system and facilitate integration of ST&I into all sectors.

b) Facilitate renewal, upgrading and creation of *supportive infrastructure* for science, technology and innovation.

c) Progressively increase the rate of *generation of a high quality skilled human resource* at all levels by providing an environment for building a critical mass of human resource capacity, harnessing and effectively participating in the application of science, technology and innovation for value addition activities, solving problems and enhancing human welfare.

d) Encourage and support *collaborative, multi-disciplinary scientific research* in universities and other academic, scientific and engineering Institutions and promote regional and international cooperation and collaboration in science, technology and innovation specifically targeted towards achieving the goals of national development and security.

e) Support *application of traditional knowledge* in the formal and informal sectors of the economy for enhanced livelihoods and promote the use the full potential

of science, technology and innovation to protect, preserve, evaluate, update, add value to and utilize the extensive indigenous resources and traditional knowledge available in the various Kenyan communities;

f) Ensure that existing *Intellectual Property Rights (IPR) regime are strengthened* to maximize incentives for the generation, protection and utilization of intellectual property by all types of inventors and foster achievement of Kenya's national development objectives.

g) Facilitate *technological development, transfer and diffusion* for the accomplishment of national strategic development goals by strengthening mechanisms that support technology development, evaluation, absorption and upgrading from concept to utilization.

h) Support and take an active role in research and application of *ST&I for forecasting, early warning, prevention and mitigation of emergencies and natural hazards*, particularly, floods, landslides, drought, security threats, acts of terrorism, epidemics and emerging infections.

i) *Public Communication and Advocacy for ST&I* including the ethical and moral, legal, social and economic aspects by facilitating development mechanisms of communicating ST&I results /findings to increase knowledge and understanding for adoption and utilization.

j) Support effective and efficient leveraging of reliable and adequate public and private sector as well as *domestic and international funding* in support of Kenya's national ST&I policy objectives and strategies, including a review of administrative and financial procedures to permit efficient operation of ST&I Institutions in Kenya

k) *Integrate ST&I at all levels of education and training* by promotion of learning by discovery method, experiential learning, participatory approach and through interactive environments, promoting attitudes receptive to ST&I among all education stakeholders and establishing sustainable centres of excellence to enhance the quality of the product of training at all levels.

l) Development of a comprehensive *performance management framework* linking programme outcomes to long term impacts of this ST&I Policy and strengthening science-based monitoring and reviewing mechanisms

6. Strategies (2008/9-2012/13)

The strategies outlined will be implemented in a period of five financial years starting 2008/9 after which a review will be undertaken.

(a) Governance Framework

A coherent and focused legal, institutional and regulatory framework will be developed to support the growth, development and utilization of science, technology and innovation through policies review, institutional and leadership re-engineering in ST&I. To integrate ST&I into all sectors of the economy, the education system will be restructured to promote the advancement and use of ST&I in all productive sectors and strengthen the role of ST&I players in Policy formulation, planning and budgetary processes among other interventions

(b) Human Resource Development

To build a critical mass of human resource capacity to effectively harness and apply ST&I for solving problems and enhancing human welfare, efforts will be made to nurture Kenyans from the youngest possible age to pursue careers in ST&I and develop capacities and competencies in technology management.

(c) Education And Training

The focus in this case will be to promote experiential learning, innovation and creativity and well coordinated programmes in education, R&D and Training in all aspects of technology management. Teachers, parents, students, and all stakeholders will be sensitised on ST & I and its benefits. Efforts will also be made to cultivate and sustain interest in mathematics, science and technology from Early Childhood to Primary and Secondary Education levels.

(d) Research

To promote the generation of knowledge and its application in ST&I, the strategies will involve introducing innovation and creativity as a major function of ST&I in all post secondary education and training institutions and promote research in strategic areas, national sector priorities and key growth areas.

(e) ST&I Infrastructure

To strengthen supportive physical infrastructure, including strategic facilities and their maintenance through renewal, upgrading and creation, strategies will involve establishing infrastructure and equipment needs for ST&I to support overall national development objectives and support ST&I intervention in strategic priority areas. ICT infrastructure will also be expanded through nation-wide development of initiatives for application of information technologies to strategic priority sectors.

(f) Linkages, Collaborations And Partnerships

Systems and institutions will be developed and strengthened to foster targeted collaborative, multi-disciplinary scientific research within and amongst universities

and other academic, scientific and engineering institutions. Opportunities will also be created to promote close and productive interaction between public and private sector in existing and emerging issues in ST&I. A supportive inter-institutions network will be established to nurture, develop and diffuse required ST&I attitudes, knowledge and skills.

To promote regional and international linkages, collaboration and partnerships in ST&I target programmes will be established that address regional and international linkages, collaboration and partnerships in ST&I as well as mechanisms for networking Policy makers and ST&I experts.

(g) Indigenous Resources And Traditional Knowledge

The objective is to exploit the full potential of science, technology and innovation through generation, protection, preservation, evaluation, updating, adding value to, and utilizing the extensive indigenous resources and traditional knowledge, as applicable to national development. This will be accomplished through evaluating and updating of the extensive indigenous resources and traditional knowledge and promoting partnership between the Government, Private sector, NGO's-and other Stakeholders. This will enhance utilization of IRTK results for national development, that are Kenyan in origin and character.

(h) Generation And Management Of Intellectual Property

To strengthen the existing Intellectual Property Rights (IPR) regime, existing Intellectual Property Rights (IPR) regime will be reviewed to identify, generate, acquire and protect indigenous resources and traditional knowledge. Programmes will also be developed to encourage the generation, protection, use and management of competitive intellectual property from Kenyan ST&I and large scale and rapid commercialization of IPR locally and internationally.

(i) Technology Development, Transfer And Diffusion

The aim will be to support search, acquisition, development and application of modern and traditional knowledge and the utilization of the ensuing technologies in the formal and informal sectors of the economy. Quality standards and accreditation of testing and calibration laboratories according to international requirements will facilitate Kenyan industry to avoid non tariff barriers in global trade and a strong, supportive and comprehensive policy environment for speedy and effective commercialisation of inventions and innovations for maximum public good, while enhancing national capacity and capabilities for generation and development of globally competitive technologies. New technology-based firms will also be created through the establishment of science, technology and innovation parks.

(j) Environment and Natural Resources Management

Alternative technologies will be explored to conserve and manage Kenya's natural resources to harness maximum benefits from environment and natural resources and protect the livelihoods of Kenyans. This will be accomplished through, capacity to acquire cleaner technologies and ST&I programmes identified and implemented to manage natural resources and enhance predictive capabilities and preparedness for responding to emergencies arising from epidemics, volcanic eruptions, floods, climate change, earthquakes drought and famine among others.

(k) Public Communication and Advocacy for ST&I

To elevate the profile of national ST&I and build its competitiveness, the strategy will involve building credibility for national ST&I, its Institutions, processes and activities and encouraging a national integrated advocacy programme for ST&I. Dialogue involving researchers, the different users and beneficiaries on ST&I will be encouraged to promote public acceptance of and support for national science, technology and innovation activities. Communication between the scientific community and their audience, comprising of consumers of ST&I products and services will also be promoted through online and other approaches to ST&I information exchanges.

(l) Funding Measures and Mechanisms

To secure adequate funding streams for the various science, technology and innovation components, a robust institutional framework will be established to source, mobilize and manage ST&I resources targeted at strategic national priorities. Administrative and financial procedures for ST&I funding mechanisms and measures will be reviewed to promote achievement of set performance targets.

(M) Performance Management Framework (PMF) and Impact Assessment

To develop a comprehensive performance management framework linking programme outcomes to long term impacts of this ST&I Policy, an effective and efficient Web-based monitoring and review mechanism will be established while exploiting the on-going initiatives on ministerial re-organization to have the PMF well defined and funded.

(N) Structure for Implementing and Evaluating the ST&I Policy and Strategy

The main structure for implementing and evaluating the ST&I policy and strategy is the proposed Institutional Structure for the Kenya National Innovation System that provides an opportunity to articulate means for the promotion of coherence and integration among national activities.

The new Kenya National Innovation System (KNIS) aims at ensuring that there is greater harmony in ST&I policy prioritization coupled with a coherent implementation of identified priority ST&I programmes and projects. Policy institutions will be focused around the ministry responsible for science, technology and innovation. These will include the Presidential Advisory Commission on Science, Technology and Innovation (PACSTI). PACSTI will be drawn from members of the National Economic and Social Council (NESC). A Parliamentary Office for Science, Technology and Innovation (POSTI) will be set up to ensure that the legislative arm of government is fully appraised of the need to prioritize ST&I Policy together with the accompanying legislation. Other institutions involved will include reorganized Ministry of Science and Technology and by extension the National Council for Science and Technology (NCST), regulatory Institutions, implementing institutions at sectoral level and funding mechanisms.

An effective, expeditious, transparent performance management framework linking programme outcomes to long-term impacts of this ST&I Policy is envisaged. An effective M&E framework *(what is the relation with PMF above)* for the policy will be designed and applied. The Monitoring and Evaluation team will monitor and evaluate the inputs, activities and outputs to ensure that the policy and strategy objectives are delivered in accordance with the implementation plan.

TABLE OF CONTENTS

FOREWORD BY THE HON. MINISTER ____ **III**

STATEMENT BY THE PERMANENT SECRETARY ____ **IV**

EXECUTIVE SUMMARY ____ **V**

BACKGROUND TO THE ST&I POLICY ____ **V**

KENYA'S NATIONAL INNOVATION SYSTEM ____ **VI**

ENSURING THAT THERE IS AN AGREED SET OF GOALS AND OBJECTIVES WHICH ARE IN HARMONY WITH VISION 2030. ____ **VII**

STRATEGIC POLICY ISSUES ____ **VII**

(A) Governance Framework ____ IX
(B) Human Resource Development ____ IX
(C) Education And Training ____ IX
(D) Research ____ IX
(E) ST&I Infrastructure ____ IX
(F) Linkages, Collaborations And Partnerships ____ IX
(G) Indigenous Resources And Traditional Knowledge ____ X
(H) Generation And Management Of Intellectual Property ____ X
(I) Technology Development, Transfer And Diffusion ____ X
(J) Environment and Natural Resources Management ____ XI
(K) Public Communication and Advocacy for ST&I ____ XI
(L) Funding Measures and Mechanisms ____ XI
(M) Performance Management Framework (PMF) and Impact Assessment ____ XI

TABLE OF CONTENTS ____ **XIII**

LIST OF ABBREVIATIONS ____ **XV**

LIST OF TABLES ____ **XVII**

LIST OF FIGURES ____ **XVII**

CHAPTER ONE – BACKGROUND TO THE ST&I POLICY ____ **18**

Macroeconomic ____ 18
Social ____ 18
National Priority Sectors for ST&I Policy Interventions ____ 19
Summary ____ 22

CHAPTER TWO - KENYA'S NATIONAL INNOVATION SYSTEM ____ **23**

Conceptual Framework - the National Innovation System (NIS) ____ 23
Kenya's National Innovation System (KNIS) ____ 24
Benchmarking Kenya's ST&I Status ____ 27
Intervention Areas ____ 29
Summary ____ 30

CHAPTER THREE - STRATEGIC POLICY ISSUES ____ **31**

Governance Framework ____ 31
Generation and Management of Intellectual Property and Rights ____ 32
Technology Development, Transfer and Diffusion ____ 32
Human Resource Development ____ 32
Education Training and Research ____ 32
ST&I Infrastructure ____ 33

COLLABORATIONS AND PARTNERSHIPS 33
INDIGENOUS RESOURCES AND TRADITIONAL KNOWLEDGE (IRTK) 33
ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT 34
PUBLIC COMMUNICATION AND ADVOCACY 34
FUNDING MEASURES AND MECHANISMS 34
PERFORMANCE MANAGEMENT FRAMEWORK 34
SUMMARY 35

CHAPTER FOUR - POLICY OBJECTIVES AND STRATEGIES (2008-2012) 36

4.1 STRATEGIC POLICY ISSUE NO. 1: GOVERNANCE FRAMEWORK 36
4.2 STRATEGIC POLICY ISSUE NO. 2: GENERATION AND MANAGEMENT OF INTELLECTUAL PROPERTY 37
4.3 STRATEGIC POLICY ISSUE NO.3: TECHNOLOGY DEVELOPMENT, TRANSFER AND DIFFUSION 37
4.4 STRATEGIC POLICY ISSUE NO. 4: HUMAN RESOURCE DEVELOPMENT 38
4.5 STRATEGIC POLICY ISSUE NO. 5: EDUCATION TRAINING AND RESEARCH 38
4.6. STRATEGIC POLICY ISSUE NO. 6: ST&I INFRASTRUCTURE 39
4.7 STRATEGIC POLICY ISSUE NO. 7: COLLABORATIONS AND PARTNERSHIPS 40
4.8 STRATEGIC POLICY ISSUE NO. 8: INDIGENOUS RESOURCES AND TRADITIONAL KNOWLEDGE 41
4.9 STRATEGIC POLICY ISSUE NO. 9: ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT 41
4.10 STRATEGIC POLICY ISSUE NO. 10: PUBLIC COMMUNICATION AND ADVOCACY 42
4.11 STRATEGIC POLICY ISSUE NO.11: FUNDING MEASURES AND MECHANISMS 43
4.12 STRATEGIC POLICY ISSUE NO. 12 PERFORMANCE MANAGEMENT FRAMEWORK 43
SUMMARY 43

CHAPTER FIVE - STRUCTURE FOR IMPLEMENTING AND EVALUATING THE ST&I POLICY AND STRATEGY 44

PROPOSED INSTITUTIONAL STRUCTURE FOR THE KENYA NATIONAL INNOVATION SYSTEM 44
PERFORMANCE MANAGEMENT FRAMEWORK 46
SUMMARY 48

ANNEX I: INDICATIVE PROGRAMMES AND PROJECTS 50

1. ST&I GOVERNANCE FRAMEWORK PROGRAMME 50
2. GENERATION AND MANAGEMENT OF INTELLECTUAL PROPERTY RIGHTS PROGRAMME 53
3 TECHNOLOGY DEVELOPMENT, TRANSFER AND DIFFUSION PROGRAMME 54
4. NEW AND EMERGING TECHNOLOGIES PROGRAMME 56
5. SCIENCE, TECHNOLOGY AND INNOVATION FOR EFFICIENTPRODUCTION PROGRAMME 59
6. HUMAN RESOURCE DEVELOPMENT PROGRAMME 64
7. EDUCATION TRAINING AND RESEARCH PROGRAMME 65
8. ST&I AWARDS PROGRAMME 68
9. TIVET DEVELOPMENT PROGRAMME 69
10. SCIENCE, TECHNOLOGY AND INNOVATION INFRASTRUCTURE PROGRAMME 70
11. ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT PROGRAMME 72
12. ST&I PUBLIC COMMUNICATION AND ADVOCACY PROGRAMME 73
15. INDIGENOUS RESOURCE, PRACTICE AND KNOWLEDGE PROGRAMME 79

LIST OF ABBREVIATIONS

AIA	Appropriation in Aid
AG	Attorney General
ASAL	Arid and Semi-Arid Lands
ATI	ArCo Technology Index
BCI	Business Competitiveness Index
BPO	Business Process Off shoring
ECD	Early Childhood Development
EPZs	Export Processing Zones
ERS	Economic Recovery Strategy
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GCI	Global Competitiveness Index
GIS	Geographic Information System
HES	Higher Education Sector
HIV/AIDS	Human Immuno-Deficiency Virus/Acquired Immune Deficiency Syndrome
HR	Human Resources
HRM	Human Resources Management
ICT	Information and Communication Technology
IEC	Information, Education and Communication
IPR	Intellectual Property Rights
IRTK	Indigenous ST&I Resources and Traditional knowledge
ISO	International Standardization Organization
KAM	Kenya Association of Manufacturers
KIE	Kenya Institute of Education
KEMRI	Kenya Medical Research Institute
KEPSA	Kenya Private Sector Alliance
KEPHIS	Kenya Plant Health Inspectorate Services
KIPI	Kenya Industrial Property Institutes
KIPO	Kenya Industrial Property Organization
KIRDI	Kenya Industrial Research and Development Institute
KNIS	Kenya National Innovation System
KSH/Ksh.	Kenya Shillings
KTMM	KIPPRA -Treasury Macro Model
LA	Lead Agency
M&E	Monitoring and Evaluation
MDG	Millennium Development Goals
MIC	Middle- Income-Country
MoTTAT	Ministry of Technical Training and Applied Technology

MoRST	Ministry of Research Science and Technology
MoST	Ministry of Science and Technology
MTEF	Medium Term Expenditure Framework
NCST	National Council for Science and Technology
NEPAD	New Partnership for Africa's Development
NESC	National Economic and Social Council
NGO	Non-Governmental Organization
NIC	Newly Industrialized Country
NIS	National Innovation System
PAC-ST&I	Presidential Advisory Committee on ST&I
PMF	Performance Management Framework
PPP	Public – Private Sector Partnerships
PROs	Public Research Organizations
PS	Permanent Secretary
RSEs	Researchers, Scientists and Engineers
R&D	Research and Development
SET	Science, Engineering and Technology
SMEs	Small and Medium Enterprises
S&T	Science and Technology
SAGA	Semi-Autonomous Governmental Agency
SACMEQ	Southern Africa Consortium for Monitoring Educational Quality
SMART	Specific, Measurable, Achievable, Realistic and Time bound
SMMEs	Small, Medium and Micro Enterprises
STP	Science and Technological Policies
ST&I	Science, Technology and Innovation
SWGs	Sector Working Groups
TAI	Technology Achievement Index
TADP	Technology Acquisition and Diffusion Programme
TIMSS	Trends in International Mathematics and Science Study
TIVET	Technical, Industrial, Vocational and Entrepreneurial Training

LIST OF TABLES

Table 1: Performance of Macroeconomic Variables 2008-2013

Table 2: Gross Domestic Products by Activity (Per cent Contribution to GDP)

LIST OF FIGURES

Figure 1; Generic elements of a National Innovation system Figure 2: Proposed Institutional Structure for the Kenya National Innovation System

CHAPTER ONE – BACKGROUND TO THE ST&I POLICY

Macroeconomic

During the last five years, Kenya has made tremedous strides in laying a foundation for a competitive and prosperous nation. This is demonstrated by a steady improvement in the performance of the macroeconomic policy targets based on the reforms implemented in 2003 under the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC). For instance, poverty rates declined from 56.8 percent in 2000 to 46 percent in 2006. The GDP has also grown consistently from 0.6 percent in 2002 to 6.1 percent in 2006. This is a big and positive departure from the inconsistent growth patterns experienced during the 1990s. The consistency in GDP growth provides an opportunity for wealth creation and increased resources for strategic investment in high growth sectors and enhanced global competitiveness.

The improved economic performance is based on significant growth across a wide range of sectors mainly as a result of efficiency gains. Generally the structure of the economy has remained unchanged and agriculture continues to contribute the largest share in the economy. For sustained development to be realized the efficiency gains must be enhanced and more importantly complemented with productivity growth. 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 one.

ST&I will be central to the development of the existing economic sectors as well as the creation of new ones with high growth potential. ST&I has been identified as a foundation for Vision 2030, long term economic plan that is set to guide the economy into a globally competitive and prosperous one. It is envisaged that the long term plan will; yield an average annual GDP growth rate of over 10 %, create a just and cohesive society with equitable social development in a clean and secure environment and a democratic political system that nurtures issue-based politics, respects the rule of law, and protects all the rights and freedoms of every individual in society.

Social

The economic growth has taken place within an emerging constrained environment in terms of the 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 and developing a sustainable tourism industry.

Kenya's demographic profile indicates a high percentage of a young population. As a result the total population is projected to 60 million in 2030 from the current 34.3 million. Moreover the urban growth rate will transform the country into 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.

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 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, Rural Development and related industries
- Health and Life Sciences
- Trade and Industry
- Human Resource Development
- Physical Infrastructure
- Energy
- Environment and Natural Resource Management
- Information Communication Technology (ICT)

Agriculture, Rural Development and Related Industries

Priority areas in this sector are increasing the value of agricultural products through agro-business related processes, agro processing, agricultural research with special reference to bio-technology and drought management, address biotic and abiotic stresses that lead to losses due to pests and diseases. Application of ST&I will be effected in production of fertilizers, seeds, animal breeds and irrigation technologies to reduce the cost of farming and improve land use to increase productivity. Science and technology will create more value in the domestic market by removing

inefficiencies in the supply chain by enhancing the quality and quantity of storage facilities, market access and pricing mechanisms.

Health and Life Sciences

This sector has priorities in developing the Kenyan health system to international standards through ST&I in Quality service and standards improvement, research in multi—sectoral health issues including infectious diseases, HIV/Aids, TB, Malaria and emerging infections, traditional knowledge and resources, and commercial production of traditional plants for medical use. It will also involve streamlining inter-sectoral and public-private sector partnerships in state of the art medical technologies

Trade and Industry

The sector has prioritized linkage between research findings and industry, diversification and upgrading of productive capacity of local industries, increasing adoption of new and appropriate technologies, promoting utilization of IPRs and standards, promoting the growth of SMEs, increasing utilization of reverse engineering and increasing utilization of cleaner production techniques. In addition, the sector will strive to do the following:

- Provide requisite infrastructure and services for technological innovation and R&D to enable knowledge-based enterprises to grow and compete in the global marketplace
- Utilize Science and Technology expertise for economic development especially for the rural community
- Involve a business system that is critical to the process of acquiring and utilizing ST&I for national development needs.

Kenya's industrial structure has insufficient linkages between various categories of firms especially the medium and small-scale enterprises where most innovations take place. There has been limited participation of these firms in the industrial sector leading to inadequate stimulation and improvement in technology imports.

Human Resource Development

Human resource development in respect of ST&I aims at skills development and management. Education and training ensures the supply of adequate and competent human resource necessary for rapid ST& I development. Changes needed include high quality, relevant, equitable and accessible education and training. One of the main areas is education Infrastructure such as physical, energy, communication and ICT. The other priority is the creation of a critical mass of a human resource to support ST&I development and sustainability.

In the Kenyan context, education, research and training institutions are weak for a variety of reasons ranging from inadequate staffing, funding and lack of linkages among others. There is also a gap between generation of knowledge in such Institutions and its application across the country.

Physical Infrastructure

Infrastructure is a prerequisite for effective utilization of science, technology and innovation. Lessons from global experience suggest that infrastructure development provides an important lever through which a nation can enhance its level of technological development. This is through its contribution to effective utilization of ST&I. It will also enhance potential positive impact on enhancing the technological learning process. Clearly, therefore, the inadequate state on infrastructure and the services thereof in Kenya presents an important opportunity through which Kenya can leap-frog in its application of science technology and innovation.

Priorities in this sector will involve infrastructure development process to enhance the country's technological foundation, improve technological innovation as well as the technological learning processes. Measures in this sector will include reforming the legal, Institutional and regulatory frameworks with a view to enhancing proper infrastructure design, integrity in contract procurement, enhancing safety, proper and timely maintenance, allowing for private sector and community participation. It also involves integration of information technology network to improve performance and create seamless, efficient and cost effective telecommunication services for business and social interaction.

Energy

Vision 2030 growth targets are expected to make significant demands for relatively cheap, affordable, reliable and clean energy. In this regard the sector priorities will be research and development for efficient energy use and conservation practices; research and analysis of waste management and utilization of the same for energy production; exploration to establish the availability and use of alternative energy sources; as well as capacity building and human resource development in all areas of engineering and technical fields in the sector.

Environment and Natural Resource Management

The sector comprises forest, water, mining and minerals and wildlife. The priority areas of interventions in this sector include biodiversity conservation, forest and environmental management. Knowledge-based technologies provided by ST&I are necessary to reinforce the current efforts designed for the management of environment and natural resources.

Information Communication Technology (ICT)

The ICT sector will intensify training efforts to build capacity in ICT, facilitate development and growth of a robust ICT and infrastructure to stimulate and support local ICT industry growth, improve delivery of service to private organizations and businesses, streamline registration and licensing through e-government, leverage ICT and provide a stable umbrella for public-private sector growth, integrate and popularize the use of ICT in learning institutions, workplaces and rural communities. It

will also involve development of a network of ST&I resource centres which will be linked to other centres locally, regionally and internationally.

Summary

The significant economic gains that have been made in the recent years have mainly been driven by the efficiency gains. There is a need to alter the structure of the Kenyan economy to 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 science, technology and innovation policy and strategy 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 product, process and services.

CHAPTER TWO - KENYA'S NATIONAL INNOVATION SYSTEM

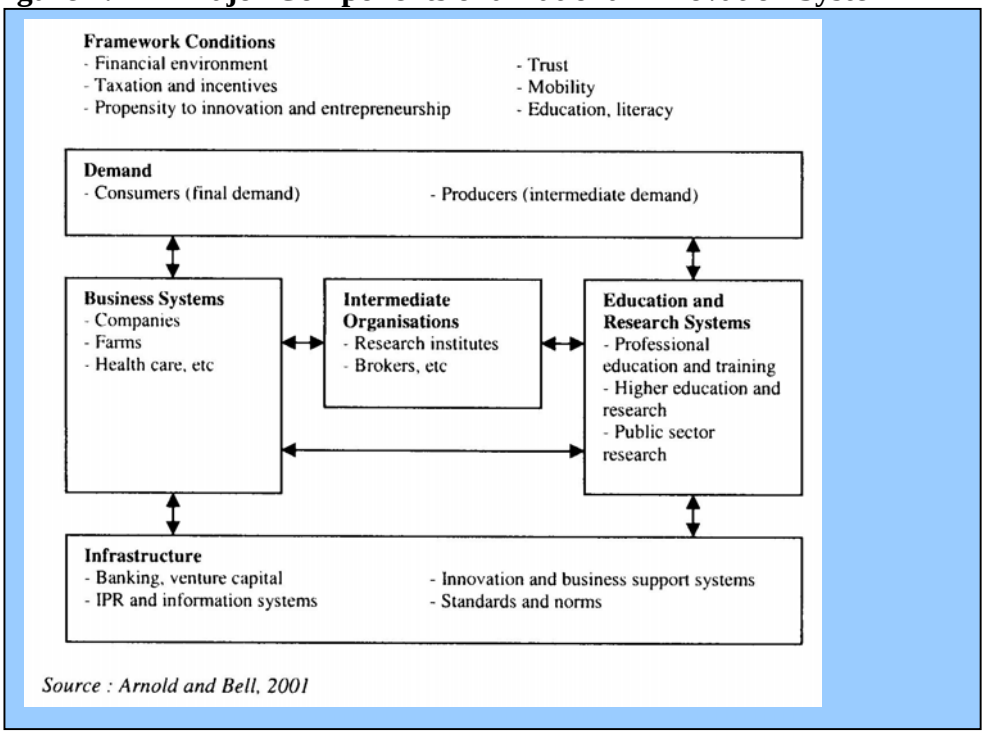
Conceptual Framework - the National Innovation System (NIS)

Innovation is the practical application of creative ideas, which in many cases involves introduction of inventions into the marketplace. Two fundamental types of innovation are product and process innovation. Process innovations are changes that affect the methods of producing outputs. Product innovations are changes in actual outputs of the organization. Competitive companies have to continually innovate to improve products and production processes.

An effective NIS is required if a country is to harness the potential offered by modern science and technology to its social and economic needs. This awareness has replaced an earlier belief that heavy investment in scientific and technological research and the purchase of technology from abroad were sufficient to achieve these goals. The national system of innovation is the means through which Kenya seeks to acquire, exploit and diffuse knowledge for the achievement of individual and collective goals. The accuracy and effectiveness of the national system of innovation will depend on how well knowledge, technologies, products and processes are transformed into increased economic growth for improved quality of life.

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. In summary, the national system of innovation can be thought of as a set of functioning institutions, organizations and policies, which interact constructively in the pursuit of a common set of social, and economic goals and objectives as illustrated in Figure 1 below.

Figure 1: Major Components of a National Innovation System



The Government's effort will therefore be directed at:

- ensuring that Kenya has a set of institutions, organizations and policies which give effect to the various functions of a national system of innovation,
- ensuring that there are interactions among and within all sectors and actors in the economy and,
- Harmonizing an agreed set of goals and objectives with vision 2030.

Kenya's National Innovation System (KNIS)

Kenya's innovation system is linear and does not effectively serve critical national needs. The government will therefore adopt a new 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 needs.

Kenya has made successes in various fields of research, particularly in medical and agricultural research. However, the achievements have been based on isolated efforts leading to limited socio-economic impact. The focused implementation of this policy & strategy is aimed at transforming these individual achievements into a dynamic system to enhance national benefits. It will also be aimed at establishing and sustaining Kenya's distinction in the generation and management of science, technology and innovation. In order for Kenya to realise maximum benefits arising from research, there is need to adopt a system approach to address innovation dynamism in all sectors of the economy by examining their interdependency, interconnections, and interrelations. This will require reforms to encourage access, use, generation and diffusion of knowledge within business systems.

The main components of the National Innovation System as indicated in figure 1 in regard to the Kenyan context are discussed below.

Demand for ST&I

Demand for ST&I is highly correlated to the structure of the economy. This Policy and Strategy aims to put in place a well functioning innovation system that will ensure enhanced competitiveness. The pressure of competition will drive firms to demand better skills and knowledge. This will result in "technology deepening" and expansion across sectors as a result increased interaction of all actors within the NIS in search of better and more cost-effective technological means of producing goods and services.

As the Kenyan economy moves into an era of high growth, there will be need for new and better human resource skills and technologies focused on making business and other processes more efficient and effective. Lessons from South Korea, Malaysia, Taiwan, Brazil and Chile indicate that in the absence of local demand for ST&I, 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 resource. 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.

Kenya's investment in high-level technical human resource is low. This arises from two factors; First, 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 NIS and second, even though some firms offer on-the-job training; this is aimed mainly at providing basic operational skills for specific jobs, rather than developing technological capabilities. Focus on technological learning within industry is required for the exploitation of technologies to enhance competitiveness.

The 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.

Localised innovation will be also be crucial in targeting our specific challenges and in addition, it 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. This will ensure creation. 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 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 medium and small-scale enterprises, 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.

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 would be inbuilt in contracts with engineering suppliers. These would not only specify training in capabilities to operate facilities once built, but they would 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 the 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.

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.

Framework conditions

Framework conditions are the regulatory and facilitative environmentments 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 among others. Fiscal and taxation policies for instance are important in providing incentives and stearing NIS in desired directions., Levels of education and literacy and the national propensity to entrepreneurship are equally important. Several of these factors are closely linked to culture. All can be influenced by appropriate policies within the governance framework.

In Kenya, the Government has instituted fiscal and taxation measures to support innovation, but these are incomprehensive 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 appropriate environment for NIS implementation

Benchmarking Kenya's ST&I Status

Benchmarking is an important tool for assisting an economy to target specific areas that enhance the ability to draw benefits from ST&I. In this regard, the use of indicators shows the status of inputs, process, outputs and outcomes and provides a basis to assess ST&I efforts within and between countries. The indicators broadly measure the dynamism of the innovation process of the economy. This will facilitate the formulation and implementation of strategic ST&I interventions in order to achieve national development goals. Some of the indicators used to benchmark international performance are discussed below.

Mathematics, English and Science Performance

Mathematics and science are the foundation upon which rests a country's leadership in innovation and its economic prominence. This expertise is required to build and sustain economic and scientific leadership in a world whose focus has evolved from agricultural to industrial and finally informational.

There are two broad indicators, the Comparative Southern Africa Consortium for Monitoring Educational Quality (SACMEQ) II Performance and the IEA's Trends in International Mathematics and Science Study/TIMSS International Mathematics Achievement Report, 2003, which measure students' achievement/trends in math and

science. Kenya is not part of the two studies (SACMEQ and TIMMS). It is thus not possible to compare Kenya's Mathematics, English and Science performance. However based on secondary school performance as well University intake, emphasis has been more on social sciences. Kenya should be included in future studies to facilitate comparison.

Technology Achievement Index

The Technology Achievement Index (TAI) captures data on the performance of countries in creating and diffusing technology and in building a human skills base. The TAI reflects a country's level of technological progress and its capacity to participate in the networked economy. It indicates how well a country is creating and using technology. The results show that Kenya had a TAI rank of 68 and TAI Index of 0.129 in 2002. This position ranked Kenya as a marginalised country. Kenya was well behind India, China, Thailand, Malaysia and South Africa as inspirational countries

The ArCo Technology Index

The ArCo Technology Index is built on three main dimensions of technological capabilities - the creation of technology; the diffusion of technology; and the development of human skills. The ArCo Technology Index measures a nation's technological capability. In 2004, Kenya had an ArCo Ranking of 116, again placing Kenya as a marginalized nation in respect of its technological capabilities.

The RAND Corporation Composite Scientific Index

The RAND Corporation Composite Scientific Index measures a country's capacity to carry out scientific research and foster technological progress, as well as offering pointers to policy measures that might strengthen specific national systems of innovation. According to this index in 2001, Kenya was in the category of 'scientifically lagging countries'. This implies that firstly, Kenya lacks both appreciable indigenous S&T capacities and 'enabling conditions' within their political, economic and scientific systems and infrastructure and secondly Kenya is unable to generate new knowledge and has limited capacity to absorb technologies that are available in the international market.

ISO Certification Patterns

According to the Kenya Bureau of Standards, some of the benefits of ISO 9000 Quality Management Systems include increased efficiency; improved consistency; improved quality of product/service; better-motivated employees; cost savings; fewer mistakes; less re-work; less waste; wider market opportunities; increased customer satisfaction; increased competitiveness; increased profits; better use of time and resources; and improved communication. Such attributes are crucial in an increasingly competitive globalizing world. The enhanced performance translates into wealth creation and welfare improving opportunities.

These systems have been successfully applied to enhance competitiveness and growth of enterprises, including small and medium scale enterprises. Although Kenya has placed a high premium on strengthening the role of SMEs in the economy there has been very little effort by such enterprises to seek such certification. In the medium term this will act as a barrier to the process of integrating these firms into the global supply chain. The ISO 9001:2000 Certification indicates that Kenya registered 8 certifications in 2001 and 158 in 2004 compared to South Africa and Thailand which had 87 and 2,486 and 89 and 5,955 respectively.

The Global Competitiveness Index

The Global Competitiveness Index (GCI) is a competitiveness indicator of a country's level of productivity. The Index measures the set of institutions, policies, and factors that determine the sustainable current and medium-term levels of economic prosperity. The GCI separates countries into three specific stages: factor-driven, efficiency-driven, and innovation-driven, each implying a growing degree of complexity in the operation of the economy. According to this index, Kenya was ranked number 94 out of 125 countries in 2005 indicating that it's a factor driven economy.

The Business Competitiveness Index

The Business Competitiveness Index (BCI) examines the underlying conditions defining the sustainable level of productivity and wealth creation. This is influenced by the operating practices of companies as well as the macroeconomic business environment within which firms compete in a country. This index has two major composite sub-factors, namely the degree of corporate sophistication, and the measure of the quality of the national business environment, including such traits as venture capital availability, intellectual property rights protection, anti-trust policy, domestic buyer sophistication, level of business education and managerial practices. Kenya's BCI ranking for 2006 was 68 out of 121 countries.

Intervention Areas

To achieve a revamped and re-invigorated KNIS this policy document will be implemented along four strategic thrusts.

- 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.
- The strategic resource mobilization will focus on harnessing the resources needed to support the mainstreaming of ST&I in the Kenyan economy.
- The strategic knowledge and technology governance focuses on the generation and management of Intellectual Property Rights; technology development, transfer and diffusion as well as modernization of indigenous resources, practices and knowledge.

- 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.

Summary

The Kenya National Innovation System reviewed in this chapter is inadequate in many aspects. Most of the elements within this system are not well structured to boost the dynamism of the innovation system. To address this situation, the Government through this strategy and policy,will intervene on a number of identified strategic issues discussed in the next chapter.

CHAPTER THREE - STRATEGIC POLICY ISSUES

This chapter addresses Strategic Policy issues that were developed from the analysis of the National Sectoral Priorities. The Policy Issues highlight areas meant to create an enabling environment for the growth of ST&I. The policy issues fall within the four strategic thrusts mentioned in the previous chapter. Government policy statements are derived from the policy issues. Twelve Policy Issues have been identified and are discussed below;

1. Governance framework
2. Generation and Management of Intellectual Property and Rights
3. Technology Development, Transfer and Diffusion
4. Human Resource Development
5. Education, Training and Research
6. ST&I Infrastructure
7. Collaborations and Partnerships
8. Indigenous Resources and Traditional Knowledge (IRTK)
9. ST&I integration for Environment and Natural Resources Management
10. Public Communication and Advocacy
11. Funding Measures and Mechanisms
12. Performance Management Framework

These policy issues are briefly elaborated below

Governance Framework

Scientific and technological developments present 'problems' of governance that must be addressed if the benefits of ST&I are to be optimised and the undesirable outcomes mitigated. Such innovations as nuclear power, genetic engineering, food safety and pharmaceutical development all pose issues of governance in relation to public health, safety and security just to mention a few. These issues result in major challenges in ensuring a dynamic innovation system. In view of these challenges, the Government will;

- Create a coherent and focused legal, Institutional and regulatory framework to support the development of effective and sustainable science, technology and innovation
- Promote the empowerment as well as full participation of women, youth and disadvantaged persons in all ST&I activities
- Integrate ST&I into all sectors of the economy and encourage targeted research and innovation in key growth sectors of the economy

- Facilitate acceleration of the accomplishment of national strategic and security related objectives, by using the latest advances in science, technology and innovation.

Generation and Management of Intellectual Property and Rights

The process of globalization is leading to situations where the collective knowledge of societies normally used for common good is converted to proprietary knowledge for commercial profit by a few. In order to address this issue, the Government will;

- Ensure that existing Intellectual Property Rights (IPR) regimes are judiciously enforced to provide impetus for the generation, protection and utilization of intellectual property by all categories of inventors, in particular community, Micro, Small and Medium Enterprises (MSMEs) to foster achievement of Kenya's national development objectives.

Technology Development, Transfer and Diffusion

The Government recognizes that realization of full potential of ST&I in Kenya will depend on appropriate identification, acquisition, transfer, diffusion and application of emerging and relevant technology from collaborating partners and development of locally initiated technology. In this regard the Government will;-

- Support search, acquisition, development and application of modern and traditional knowledge and the utilization of the ensuing technologies in the formal and informal sectors of the economy.

Human Resource Development

Quality human resource is an important determinant of sustainable growth and development. There is therefore need to progressively increase the rate of generation of a high quality skilled human resource with a special focus on developing and upgrading innovation competencies within employment. In this regard, the Government will;

- Provide an enabling environment for building a critical mass of human resource, to harness and effectively participate in the application of science, technology and innovation for value addition activities, creation of new products and services based on enhanced productivity.

Education Training and Research

The pool of skills emanating from education and training institutions influences the ability to develop quality human resources within employment. To ensure that adequate and relevant skills are available, ST&I-related disciplines will be integrated at all levels of education and training. In addition, research is essential for purposes of generating new knowledge and for putting into perspective the already developed knowledge to suit the Kenyan needs. In this regard, the Government will:

- Promote creativity and learning by discovery through a participatory approach
- Promote attitudes receptive to ST&I among all education stakeholders
- Promote appropriate science, engineering and technology (SET) skills at various levels of education and training
- Re-enforce its commitment to targeted transformational research aimed at generating new ideas and putting into perspective those already developed to address the Kenya's strategic priorities.

ST&I Infrastructure

Whereas ST&I is infrastructure intensive, the network of existing infrastructure is inadequate to facilitate the achievement of the national objectives in the field. In order to address this concern, the Government will:

- Create an environment for the strengthening of supportive physical infrastructure for science, technology and innovation;
- Support establishment of efficient ICT infrastructure to ensure speedy, secure and cost effective access to information;

Collaborations and Partnerships

Close and productive interaction between scientists, private sector and public Institutions in the field of ST&I is vital in harnessing the existing potential in a coordinated manner. To this end the Government will:

- Encourage and support collaborative, multi-disciplinary scientific research in academic, scientific and engineering Institutions.
- Promote close and productive interaction between private and public Institutions in existing and emerging issues in ST&I.
- Promote regional and international cooperation and collaboration in science, technology and innovation specifically targeted towards achieving the goals of international relations, national development and security.

Indigenous Resources and Traditional knowledge (IRTK)

Development of technologies that add value to Kenya's indigenous resources and which provide holistic and optimal solutions that are suited to Kenyan social-cultural-economic values are necessary for sustainable development. To this end, the Government will:-

- Exploit the full potential of science, technology and innovation to protect, preserve, evaluate, update, add value to, and utilize the extensive indigenous resources and traditional knowledge available in the formal and informal sectors of the economy for enhanced livelihoods from various Kenyan communities;

Environment and Natural Resources Management

Science, technology and innovation has an important role in conserving the environment, exploring and exploiting natural resources within the context of effective management for human development. Further, our environment needs proper planning and timely application of mitigation measures whenever disaster and security threats occur. To this end, the Government will;

- Explore alternative technologies to conserve and manage Kenya's natural resources to harness maximum benefits from environment and natural resources and protect the livelihoods of Kenyans
- Support and take an active role in research and application for forecasting, early warning, prevention, mitigation of manmade and natural emergencies and hazards, particularly, floods, landslides, drought, security threats, epidemics and emerging infections.

Public Communication and Advocacy

There is a growing need to enhance public awareness on the importance of science, technology and innovation and its implication to everyday life, covering the ethical, moral, legal, social and economic aspects. To this end, the Government will:-

- Elevate the profile of national ST&I and build its competitiveness
- Promote public acceptance of and support for national science, technology and innovation activities
- Create and improve awareness on, support for and stakeholders ownership of the development and application of science, technology and innovation for national development
- Promote communication between the scientific community and consumers of ST&I knowledge, products and services.

Funding Measures and Mechanisms

Funding for ST&I and related activities in Kenya has been inadequate and without effective coordination mechanisms in the face of competing demands for the national budget. Innovative resource mobilization mechanisms are critical to successful implementation of the policy objectives. In this regard, the Government will:-

- Secure adequate funding streams for the various science, technology and innovation components to facilitate implementation of the policy objectives and achievement of the intended outcomes

Performance Management Framework

Regular effective, transparent and science-based monitoring and reviewing mechanisms are necessary for the success of ST&I initiatives. To this end, the Government will:

- Develop a comprehensive performance management framework linking programme outcomes to long term impacts of this ST&I Policy.

Summary

In order to implement this policy and strategy twelve policy issues have been developed. Each policy issue is enforced by policy statements that give a broad framework within which strategies are formulated.

CHAPTER FOUR - POLICY OBJECTIVES AND STRATEGIES (2008-2012)

The objectives and implementation strategies for each of the policy strategic issues are outlined in this chapter. Specific interventions and activities as well as the indicative programmes and projects are given in annexes one and two respectively.

4.1 Strategic Policy Issue No. 1: Governance Framework

4.1.1 Strategic Policy Objective 1

To develop a coherent and focused legal, institutional and regulatory framework to support the growth, development and utilization of science, technology and innovation. Strategies to implement the policy include the following

- Provide for continuous review of policies impacting on mainstreaming of ST&I in all sectors of the economy.
- Establish an enabling legal and regulatory framework to support the growth, application and utilization of ST&I.
- Promote institutional re-engineering geared to provide a governance framework to support autonomy, coordination, partnership-based application of ST&I to address Kenya's development challenges.
- Facilitate involvement of scientists and technologists in national governance and public policy making
- Review staffing and leadership of ST&I institutions with a view to promoting progressive gender parity in national ST&I initiatives
- Provide for guidelines for compliance with ethical issues regarding research activities.

4.1.2 Strategic Policy Objective 2

To integrate ST&I into all sectors of the economy, the following strategies will be used.

- Establish structures in the education system to promote the advancement and use of ST&I in all productive sectors of the economy.
- Strengthen the role of ST&I players in Policy formulation, planning and budgetary processes
- Establish ST&I units in relevant ministries and departments to act as champions for advancement of ST&I initiatives.
- Promote innovation in commercial and manufacturing enterprises

4.1.3 Strategic Policy Objective 3

To promote the empowerment and full participation of women, youth and disadvantaged persons in all ST&I activities, the following strategies will be used.

- Develop and mainstream a policy framework to entrench and address gender parity in the ST&I sector

4.1.4 Strategic Policy Objective 4

Facilitate acceleration of the accomplishment of national strategic and security related objectives, by using the latest advances in science, technology and innovation.

4.2 Strategic Policy Issue No. 2: Generation and Management of Intellectual Property

4.2.1 Strategic Policy Objective

To judiciously enforce the existing Intellectual Property Rights (IPR) regime to maximise incentives for the generation, protection and utilization of intellectual property by all types of inventors to foster achievement of Kenya's national development objectives. Strategies to implement the policy include the following

- To ensure Intellectual Property Rights (IPR) regime facilitates the identification generation, acquisition and protection of indigenous (including genetic) resources and traditional knowledge.
- Develop programmes for the rapid commercialization of intellectually protected products and services locally and internationally
- Develop IPR programmes that effectively harness ST&I utilization
- 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 cultural expressions and scientific investigations.

4.3 Strategic Policy Issue No.3: Technology Development, Transfer and Diffusion

4.3.1 Strategic Policy Objective 1

To support search, acquisition, development and application of modern and traditional knowledge and the utilization of the ensuing technologies in the formal and informal sectors of the economy, the following strategies will be used;

- Enhance quality standards and accreditation of testing and calibration laboratories according to international requirements to enable Kenyan industry to avoid non tariff barriers in global trade
- Enhance the transfer of innovations and inventions emanating from Research and Development

- Establish a strong, supportive and comprehensive policy environment for speedy and effective commercialisation of inventions and innovations to maximise public good and interest.
- Enhance national capacity and capabilities for generation and development of globally competitive technologies
- Fast track the accomplishment of national strategic development goals by using Science, Technology and Innovation
- Promote the formation of new technology-based firms through the establishment of science, technology and innovation parks.

4.4 Strategic Policy Issue No. 4: Human Resource Development

4.1 Strategic Policy Objective 1

To build a critical mass of human resource capacity, to harness and effectively participate in the application of science, technology and innovation, the following strategies will be used.

- Establish the status of the national ST&I human resource capacity and skills in science, engineering and technology
- Develop capacities and competencies in technology management
- Promote technological learning within employment to ensure the creation of innovative competencies
- Develop flexible mechanisms to provide opportunities for researchers and other scientists to continue with ST&I initiatives after retirement from formal employment.
- Provide employment flexibility to enhance skills upgrading through job mobility.

4.5 Strategic Policy Issue No. 5: Education Training and Research

4.5.1 Strategic Policy Objective 1

Promote creativity and learning by discovery through a participatory approach. This will be implemented through the following strategies.

- Develop a framework for enhancing creativity and learning by discovery,
- Establish centres of excellence that promote innovation and creativity
- Develop well coordinated programmes in education, Training and Research and Development and Training in all aspects of technology management
- Nurture Kenyans from the youngest possible age to pursue careers in ST&I

4.5.2 Strategic Policy Objective 2

To promote attitudes receptive to ST&I among all education stakeholders, the following strategies will be employed;

- Sensitize teachers, parents, students, and all stakeholders on ST & I and its benefits
- Expose Kenyans to ST&I experiences at the earliest possible age
- Develop mechanisms for recognizing, tapping and nurturing ST&I talent

4.5.3 Strategic Policy Objective 3

To ensure that appropriate content of SET skills are integrated at the various levels of education and training, the following three strategies will be employed

Strategies to Implement Policy

- To cultivate and sustain interest in Mathematics, science and technology at Early Childhood, Primary and Secondary Education level.
- Develop entrepreneurship skills for technology-based enterprises.
- Provide for reforms in vocational training in national priority areas to produce craftsmen, artisans and technicians who are relevant to the needs of modern industry.

4.5.4 Strategic Policy Objective 4

To target transformational research aimed at generating new ideas and putting into perspective, those already developed to address the nation's strategic priorities, a number of strategies will be employed as outlined below;

- Increase public investment for universities, government laboratories and research institutes to enable access to facilities, and equipment needed for research for focusing on identified national strategic priority areas
- Provide enhanced research grants to Kenya's most outstanding researchers in national strategic priority areas through the proposed Kenya National Research Foundation
- Encourage through incentives, in-house R&D by commercial enterprises

4.6. Strategic Policy Issue No. 6: ST&I Infrastructure

4.6.1 Strategic Policy Objective 1

To strengthen supportive physical infrastructure, including strategic facilities and their maintenance through renewal, upgrading and creation, two strategies will be employed;

- Establish infrastructure and equipment needs for ST&I to support overall national development objectives.

- Focus on development of infrastructure and equipment to support ST&I intervention in strategic priority areas.

4.6.2 Strategic Policy Objective 2

Establish efficient ICT infrastructure and promote its use to ensure speedy, cost effective and secure access to information.

Strategies to Implement Policy include,

- Promote nation-wide development of initiatives for application of information technologies to strategic priority sectors.
- Promote widespread access to and use of existing and emerging information technologies.
- Promote generation and widespread access to ST&I information.
- Facilitate timely, secure, affordable and competitive access to information in ST&I
- Promote the design, construction and standardization of national and regional information infrastructure, and encourage its interconnection over global networks.

4.7 Strategic Policy Issue No. 7: Collaborations and Partnerships

4.7.1 Strategic Policy Objective 1

To foster targeted collaborative, multi-disciplinary scientific research within academic, scientific and engineering institutions.

Strategies to Implement Policy include the following;

- Develop and strengthen systems and institutions to facilitate collaboration and multi-disciplinary scientific research
- Establish, implement, monitor and review agreements within research institutions, universities and engineering institutions.

4.7.2 Strategic Policy Objective 2

To promote close and productive interaction between public and private sector in existing and emerging issues in ST&I

Strategies to Implement Policy include the following

- Create opportunities for linkages between private and public Institutions.
- Establish a supportive network of interconnected public and private institutions focused on nurturing, developing and diffusing required ST&I skills, knowledge and attitudes.
- Promote productive interaction between communities, research institutions and knowledge intermediaries in ST&I.

4.7.3 Strategic Policy Objective 3

To promote regional and international linkages, collaboration and partnerships in ST&I specifically targeted towards achieving the goals of national development and security.

Strategies to Implement Policy are;

- Target programmes that address regional and international linkages, collaboration and partnerships in ST&I
- Establish mechanisms for networking between policy makers and ST&I experts

4.8 Strategic Policy Issue No. 8: Indigenous Resources and Traditional Knowledge

4.8.1 Strategic Policy Objective

To exploit the full potential of science, technology and innovation to generate, protect, preserve, evaluate, update, add value to, and utilize the extensive indigenous resources and traditional knowledge, for national development.

Strategies to Implement Policy include the following;

- Evaluate and update the extensive indigenous resources and traditional knowledge.
- Integrate IRTK into national development- promote, develop, create strategic partnership between the Government, Private sector, NGO's-and other Stakeholders in order to enhance utilization of IRTK results for national development.
- Promote utilization of indigenous resources and traditional knowledge.
- Promote value addition on indigenous resources and traditional knowledge.
- Promote ST&I innovations and inventions that are Kenyan in origin and character

4.9 Strategic Policy Issue No. 9: Environment and Natural Resources Management

4.9.1 Strategic Policy Objective 1

To explore alternative technologies to conserve and manage Kenya's natural resources to harness maximum benefits from environment and natural resources sustainably.

Strategies to Implement Policy include the following;

- Undertake cleaner technology needs assessment
- Develop capacity to acquire and absorb cleaner technologies

4.9.2 Strategic Policy Objective 2

To ensure the country develops and effectively uses its ST&I capacity for forecasting, early warning, prevention and mitigation of technological and natural hazards,

particularly floods, earthquakes, climate change, landslides, droughts, security threats, epidemics and emerging infections.

Strategy to Implement Policy include the following;

- Design and implement ST&I programmes to enhance predictive capabilities and preparedness for responding to emergencies arising from epidemics, volcanic eruptions, floods, climate change, earthquakes, drought and famine.

4.10 Strategic Policy Issue No. 10: Public Communication and Advocacy

4.10.1 Strategic Policy Objective 1

To elevate the profile of national ST&I and build its competitiveness

Strategies to Implement Policy are as follows;

- Build credibility for national ST&I; its Institutions, processes and activities
- Support and encourage the development of indicators for ST&I.
- Promote and encourage a national integrated advocacy programme for ST&I

4.10.2 Strategic Policy Objective 2

To promote public awareness, acceptance and support for national science, technology and innovation activities

Strategy to Implement Policy are;-

- Fast track one ST&I driven development programme to serve as an example and motivator
- Encourage public dialogue involving researchers, the different users and beneficiaries on ST&I matters of interest.

4.10.3 Strategic Policy Objective 3

To create and improve awareness on, support for and ownership of the development and application of science, technology and innovation for national development

Strategies to Implement Policy are;-

- Benchmark the impact of activities aimed at raising public awareness of science, technology and innovation through effective comparative studies.
- Support and encourage effective communications print and electronic media.

4.10.4 Strategic Policy Objective 4

To promote communication between the scientific community and consumers of ST&I products and services and those supportive of the development and application of ST&I.

Strategies to Implement Policy are;-

- Develop mechanisms for communicating ST&I results to increase knowledge and understanding for adoption and utilization

- Promote online approach to ST&I information exchanges

4.11 Strategic Policy Issue No.11: Funding Measures and Mechanisms

4.11.1 Strategic Policy Objective 1

To secure adequate funding streams for the various science, technology and innovation components to facilitate cost effective implementation of the policy objectives and achievement of the intended outcomes

Strategies to Implement Policy will include;

- Develop mechanisms to mobilize financial resources from both public and private sector for ST&I funding
- Develop and promote a robust institutional framework for mobilization and management of ST&I resources targeted at strategic national priorities
- Support the establishment of a mechanism for regular review of the funding mechanisms in science, technology and innovation
- Review administrative and financial procedures for ST&I funding mechanisms to enhance realization of set targets

4.12 Strategic Policy Issue No. 12 Performance Management Framework

4.12.1 Strategic Policy Objective 1

To develop a comprehensive performance management framework linking programme outcomes to long term impacts of this ST&I Policy.

Strategy to Implement Policy includes

- Develop and implement an effective and efficient Web-based monitoring and review mechanism
- Exploit the on-going initiatives on ministerial re-organization to have the PMF well defined and funded
- Periodic review of the implementation of the ST&I policy with key stakeholders

Summary

This chapter has brought out the strategic objectives that the policy will strive to achieve to actualize the policy statements made in Chapter three. Strategies to implement the objectives have also been outlined. The strategies have been used to identify indicative programmes and projects presented in Annex 1. This chapter marks the strategy section of the policy and strategy document. The strategies will be implemented within the framework in the next chapter.

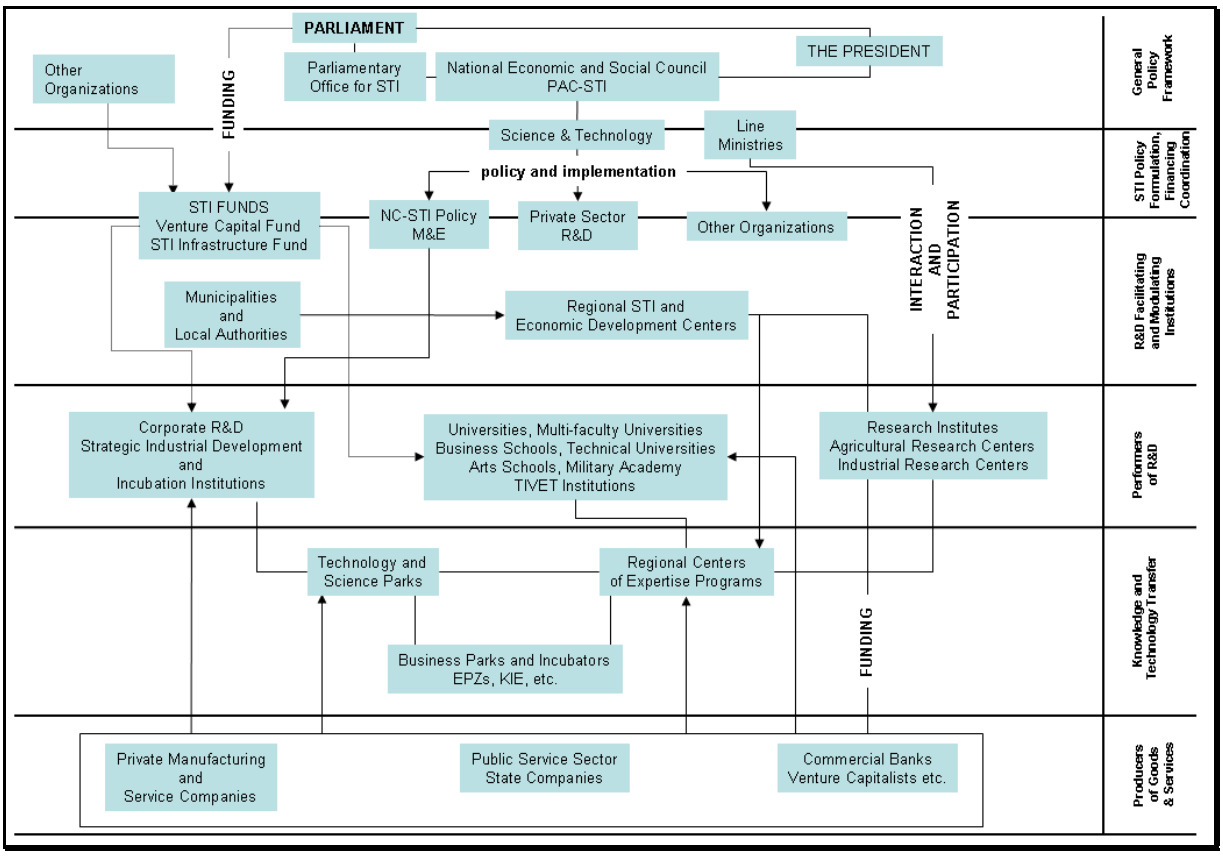
CHAPTER FIVE - STRUCTURE FOR IMPLEMENTING AND EVALUATING THE ST&I POLICY AND STRATEGY

Proposed Institutional Structure for the Kenya National Innovation System

Adoption of the national system of innovation as the basic institutional framework for articulating Kenya's Science, Technology and Innovation Policy Framework, as illustrated in figure 2 below is important because;

- It affords an opportunity to articulate means for the promotion of coherence and integration among national activities, two factors that have been sorely neglected in the Kenyan ST&I system of the past.
- It offers a means of identifying what needs to be done without automatically tying necessary functions to any particular institution or organization, as is currently the case.
- It focuses attention on innovation and doing things in new ways rather than simply on the production of knowledge alone.

Figure 2: Proposed Institutional Structure for KNIS



This new Kenya National Innovation System (KNIS) aims at ensuring that there is greater harmony in ST&I policy prioritization coupled with a coherent implementation of identified priority ST&I programmes and projects.

Policy Institutions

The new KNIS Policy institutions will be focused around the ministry responsible for science, technology and innovation. The institutions will include public commissions and committees such as a Presidential Advisory Commission on Science, Technology and Innovation (PACSTI), drawn from members of the National Economic and Social Council (NESC) which is already operational.

Stronger liaison office to work with the Parliamentary Committee responsible for Science, Technology and Innovation (POSTI) and ensure that the legislative arm of government is fully appraised on the need to prioritize ST&I Policy together with the accompanying legislation. This will also ensure that there is better liaison between the legislative and executive arms of government to ensure that law making rapidly responds to ST&I policy needs in a rapidly changing environment. Further, it is expected that this office will spearhead the effort to lobby for laws that support Kenya's ST&I led national strategic interests.

The Ministry responsible for Science and Technology will further be restructured to ensure that it acquires the necessary capacity and capability to review, formulate and spearhead ST&I policy and strategy. In this regard, the National Council for Science and Technology (NCST) will be reorganized into a revamped and reinvigorated into a Commission with legal mandate to be fully involved in policy development, identification of priorities and mobilization of resources for ST&I. They will be the main agent through which the The Ministry responsible for Science and Technology will implement the strengthened ST&I performance management framework. A key component of this effort will be to ensure that there is alignment between the country's ST&I goals and the operational plans of the various ministries and agencies. This will be pursued through active Inter-agency Councils, whose main mandate will be the development of Sectoral Technology Plans and monitor their evaluation. The Commission will have a board comprising the public and private sector to oversee its operations.

Regulatory Institutions

A number of regulatory agencies and mechanisms will be set-up or strengthened to ensure that ST&I activities in the country are carried out within acceptable ethical and social values. In this regard, a Research Approval & Surveillance Council (RASC) will be set up under the Ministry responsible for Science and Technology to ensure that research approvals are rapidly undertaken and that surveillance is strengthened.

Implementing Institutions

Sectoral policies and implementing institutions will be reviewed to focus on key growth areas as identified and also to facilitate them to operate within a national system while providing them with necessary autonomy to accomplish their sectoral mandates. An office will be set up within the Commission to spearhead the country's technology search and acquisition effort in support of all sectors of the economy.

The nations R&D functions will continue to be performed by public and private universities. In addition effort will be made to encourage firms to invest in R&D through a variety of measures and mechanisms. Kenya will strive in to actively build international centres of excellence in national strategic priority areas. It will actively pursue the establishment of more international research facilities to strengthen its ST&I capacity and capability.

Funding of the ST&I Effort

In recognition of the funding challenge for ST&I activities, a variety of measures have been incorporated in the proposed KNIS. First, the Kenya National Research Foundation (KENREF) will be set up. KENREF will operate a National Innovation Fund as well as a Venture Capital Fund. In addition to this, this policy and strategy document has signalled the Governments commitment to increasing ST&I funding by adopting fiscal and other measures to mitigate the risks involved in strategic ST&I activity. These mechanisms and measures will be reviewed from time to time to ensure that they actually contribute to the achievement of national strategic targets.

Performance Management Framework

Effective, expeditious and transparent performance management mechanisms are necessary in securing the success of ST&I initiatives. To this end, the Government will:

- Ensure the development of a comprehensive performance management framework linking programme outcomes to long-term impacts of this ST&I Policy.
- Develop, implement and strengthen science-based monitoring and reviewing mechanisms

Target Setting

Under the KNIS, all agencies and organs will have specific performance targets to ensure coordination of efforts. It is also expected that results of such effort will result in positive outcomes for the Kenyan people.

Monitoring

Monitoring is an important management tool that will help management teams to, among others; make decisions aimed at improving performance, achievement of intended objectives, ensuring accountability to all parties involved in the implementation, to assess the use and delivery of the resources in accordance with the implementation plan and to monitor the timely achievement of the intended deliverables. The main purpose is facilitate evidence-based decisions by managers about any corrections needed in implementation. In this regard, the Monitoring and Evaluation team will monitor and evaluate the inputs, activities and outputs to ensure that the policy and strategy objectives are delivered in accordance with the implementation plan. An effective M&E framework for the policy will be designed and applied.

The evaluation of the policy and strategy will be useful in several ways; first, to avoid the possibility of wasting money by aiding the selection of the most effective options. Second, it will help the implementation teams to operate through an informed network of information and performance system across the sectors and other implementing agencies.

In developing the monitoring methodologies, it is recognized that numerous interrelationships exist between the policy and strategy with other sectoral policies and programmes at national and institutional levels. Each of them having been developed independently and as a result, the monitoring methodology will cross-reference between them, with the ST&I policy and strategy providing the harmonizing framework.

Monitoring will involve routine data collection and analysis on the success of the implementation of this policy and strategy by the key sectors as identified. The results from the analysis will then be used to inform decision making at all levels through the national coordination mechanism.

The methodologies used will have as their foundation a baseline survey of all existing, upcoming and future policies in all the sectors and cross referencing to identify the degree to which they address and are in harmony with the ST&I policy and strategy, propose areas of enhancement and review the implementation frameworks continuously.

To realize the objectives, the following activities will be undertaken.

- Development of monitoring and evaluation indicators at all levels of implementation
- Carrying out continuous data collection, analysis and periodic reporting to the Ministerial Management Steering Committee
- Carrying out random inspections and making objective observations
- Conducting specially designed surveys and rapid assessments to assess progress
- Carrying out participatory M&E
- Establishing Work Improvement Teams in the respective implementing agencies
- Facilitating independent assessment and reviews of the programmes under implementation in the implementing agencies.

The implementing agencies (shown in Figure 2) will submit periodic review reports to the Inter-Agency M&E steering committee. These reports will be reviewed regularly against the indicators to ensure that there is positive progress.

Evaluation

The policy and strategy will be evaluated during and after implementation to ensure that it produces the intended results. The plan will be subjected to independent evaluation to remove any element of bias. The evaluation will be carried out using relevance, efficiency, effectiveness, sustainability and impact measures.

A logical framework will be designed for each strategic objective showing the expected outputs, activities, M&E tasks, means of verification, the action centres, timeframe and resource requirements to help track and monitor progress in the implementation of the plan.

Performance of this policy & strategy document will be reviewed along the following dimensions,

- Speed and extent of implementation of programmes and projects identified;
- Increased proportion of technology based growth in Kenya's wealth creation efforts;
- Performance of businesses in terms of their utilization of science, technology and innovation;
- Extent of creation of new technology based growth sectors;
- Increase in the number and value of local patents as well as their contribution to world patents;
- Increased innovative efforts of the Kenyan ST&I sector;
- Enhancement of Kenya's ST&I potential;
- Increased ST&I human capital; and
- Increased contribution of ST&I to improvements in the quality of life of Kenyans.

Deliberate efforts will be made to objectively assess Kenya's performance along these dimensions using internationally acceptable, but locally relevant indicators. This is expected to provide insights into the performance of this policy & strategy. It will also provide an objective basis for measures to improve future interventions aimed at applying ST&I to enhancing the welfare of the Kenyan people.

Summary

The proposed institutional structure for the Kenya National Innovation System (KNIS) aims at ensuring that there is greater harmony in ST&I policy prioritization coupled with a coherent implementation of identified priority ST&I programmes and projects. Key institutional reforms will revolve around policy, regulatory and implementing institutions.

Policy institutions will be focused around a reorganized ministry responsible for science, technology and innovation. Similarly regulatory agencies and mechanisms

will be set up under the MoST while Sectoral policies and implementing institutions will be reviewed to focus on key growth areas as identified while operating within a national system. A National Technology Acquisition Office (KENTAO) will be set up to spearhead the country's technology search and acquisition effort in support of all sectors of the economy. A variety of funding measures proposed within KNIS will operate a National Innovation Fund as well as a Venture Capital Fund.

Effective, expeditious, transparent and performance management mechanisms will be established to facilitate linking programme outcomes to long-term impacts of this ST&I Policy and strengthen science-based monitoring and reviewing mechanisms. Deliberate efforts will be made to objectively assess Kenya's performance along these dimensions using internationally acceptable, but locally relevant indicators.

ANNEX I: INDICATIVE PROGRAMMES AND PROJECTS

In order for ST&I to facilitate realization of Kenya Vision 2030, substantial resources are required to implement this policy and strategy. Twelve (12) indicative programmes to be implemented through various projects have been proposed for the realization of Kenya's ST&I agenda. Details of each project will be drawn during the planning and implementation stages. These programmes and projects are articulated below

1. ST&I GOVERNANCE FRAMEWORK PROGRAMME

(a) ST&I Governance Programme

The programme goal is to create a coherent and focused legal, Institutional and regulatory framework to support the development and sustenance of effective Science, Technology and Innovation. Under this programme, the following projects will be undertaken:

Review of the Institutional, Legal and Regulatory Framework for Science, Technology and Innovation in Kenya

The project will focus on developing and implementing policies and enabling legislation to support the generation and utilization of ST&I. In addition, the National IP Policy will be reviewed to ensure judicious enforcement of IPR to maximize incentives for exploitation and generation of ST&I. This project also aims at reviewing and harmonizing existing policies and laws governing TIVET, and drafting a TIVET Bill and enacting the TIVET Act, sensitization of all the stakeholders on the Act. It will also establish the TIVET Authority. The project will also involve revision of legal frameworks governing registration, qualification, training and development of TIVET trainers. It will harmonize the system of examinations, credits, certification, and qualification within the TIVET system. Finally, it will develop and implement a national TIVET qualifications framework. This project will also focus on reviewing the legal, Institutional and regulatory framework to facilitate institution of a regulatory regime that will allow positive and defensive protection and beneficial exploitation of indigenous knowledge, technologies and practices for the benefit of Kenyan people.

The project will ensure a coordinated and efficient system for development, acquisition, use, transfer and management of technology.

Other outputs of this project include:

The identification of new science and technology policy choices for sustainable development as well as benchmarking good practice activities in support of the creation of framework conditions for ST&I

A Presidential Advisory Commission on Science, Technology and Innovation will be

established to oversee the implementation of the ST&I policy. It will involve putting in place mechanisms to establish the PAC – ST&I as well as appointment of the Presidential Advisory Commission. The project will ensure a coordinated and efficient system for development, acquisition, use and transfer of technology. The project will also ensure political good will to support ST&I.

A National Commission on Science, Technology and Innovation (NACSTI) will also be established to enhance co-ordination of national ST&I. The NCST will be elevated to a National Commission on Science, Technology and Innovation to strengthen its national ST&I coordination role. NACSTI will ensure timely and relevant advice to government on matters of ST&I in addressing National priorities. A National Technology Acquisition office and National ST&I Approval and Surveillance Council will also be established alongside this institution. A TIVET Authority will also be established to guide and determine technical training in the country including a National Qualifications Framework

Establishment of Access Regimes for National and International Digital Research Data from Public Funding will be done to develop a data base based on commonly agreed principles to facilitate optimal cost-effective access to digital research data for decision making. This will ensure International exchange of data, information and knowledge which will contribute to the advancement of scientific research and innovation. Access to data will be facilitated to maximize the value derived from public investments in data collection efforts. The project will target participation in the global science system, for improved social and economic development

Establishment of Research Councils for identified national priority sectors to facilitate the set objectives.

National Innovation System Development Project

The objective of this project is to create an effective national innovation system and coordinating Agency

Under this project the Government will establish a National Innovation Agency and system as the basis of effective national innovation system that responds to distinctive characteristics for Kenya and its implementing agency and to create economic stimuli for the collaboration of science-industry activities and joint research work. The Agency will implement the policy supporting all types innovation funding, develop the innovation infrastructure and establish a system that prepares specialists and consulting services that are useful for participants in innovation activities and act as a depository for information and data on inventions and innovations.

The expected outcomes of the project will be the establishment of an effective national infrastructure, legal environment, and management for innovation activities;

the development of market relations (1) in use of intellectual resources, (2) innovation assets, (3) innovation products, (4) services supporting the innovation; the development of multiple forms of funding and government support for innovation activities and the development of advanced technology based innovation clusters

Entrenchment of International Business Standards Project

Greater global competition and growing awareness of social responsibility have led to the formulation of international business standards, which influence workplace practices. Examples are the application of ISO 9000 (Quality Management Systems), ISO 14001 (Environment Management Systems), Occupational Health and Safety Management Systems, ISO 22000 (Food Safety Management Systems) among others. These standards represent international consensus on business practices on quality management, environmental management, occupational health and food safety management. The aim of this project is to increase efficiency in the management of public affairs, adopting international business models in public service delivery.

Governance, Security and Rule of Law Project

The aim of this project will be to use ST&I in enhancing the integrity, transparency and accountability of electoral processes; fostering democracy, public participation in governance, ethical and results-oriented government Institutions. In addition, it will provide information to policy makers for decision making and enforcing the Rule of law, and address internal, external and transnational security threats.

(b) ETHICS AND VALUES PROGRAMME

National Code of Ethics & Values in Science, Technology and Innovation Project

This project will be aimed at promoting ethical code of conducts in ST&I and developing various national codes of ethics to govern and institutionalize ethical behavior in the application of science, technology and innovation for national development. These codes will guide all research, science, engineering and technology Institutes and agencies establish procedures for investigating and judging infringement on defined codes of ethics and values, under the general purview of the codes. Under this project, an Office for Regulation of Ethics and Values in Science, Technology and Innovation (National Research and Surveillance Council - NRSC) will be created. The NRSC will develop a national information and documentation observatory to track, analyze and promote the development of ethical issues in science at national, regional and international level. It will also establish an open dialogue with stakeholders including industry, the scientific community, religions, cultural groups, philosophical schools and other interested groups.

Social Implications of Existing and Emerging Technologies

This project will focus on emerging technologies and aim at analysing the social implications of scientific and technological progress in order to contribute to the understanding of the impact of emerging technologies on individuals and the Kenyan society and help shape public policies that distribute the benefits and reduce the risks of technological advancement. Secondly, the project will aim at developing and promoting substantial and workable ideas on how technological progress can and should lead to increased freedom and high quality of life.

2. GENERATION AND MANAGEMENT OF INTELLECTUAL PROPERTY RIGHTS PROGRAMME

In order to judiciously enforce the national intellectual property regime, this programme will focus on measures that provide an enabling environment for the management and commercialization of intellectual property. The indicative projects under this programme are:

National Code of Practice for Managing and Commercializing Intellectual Property Project

This project will be aimed at developing a National Code of Practice to provide guidelines for management and commercialization of intellectual property from collaborative research between industrial and academic partners as well as to cater for the exploitation of traditional knowledge and resources.

Knowledge Transformation and IPR Project

This Project aims at providing an enabling environment for the management and commercialization of intellectual property. The programme will protect and encourage patenting of new innovations and will attract public-private partnership arrangements.

The objective of the project is to support improvement of the system of protecting and utilizing the intellectual property rights. This project will establish an information database of government-financed R&D results. It will also support and stimulate the activities related to commercialization and popularization of research results.

This project will also periodically investigate and assess the ability of IPR regimes to foster domestic innovation, acquisition of appropriate foreign technologies and supporting SME utilization of technology and will propose supportive policy measures

The expected outcomes of the project will be the provision of an increased opportunity for research organizations and researchers to benefit from their academic work as the result of improved intellectual property utilization and protection; the establishment of information database on R&D results; consequently and consequently increased opportunity to utilize and commercialize these results; and an increase in the number of property rights agreements of R&D results.

Assessment of the Impact of IPR on National Innovation System Project

The aim of this project is to assess and investigate the ability of technology markets to disseminate patented inventions and identifying effective policy measures to strengthen innovation capabilities, notably as regards SMEs; examine exemptions for research use of patented inventions and assessing their effect on the conduct of scientific research.

3 TECHNOLOGY DEVELOPMENT, TRANSFER AND DIFFUSION PROGRAMME

The main objective of this programme is to undertake technology acquisition and diffusion through the following:

- Providing a framework for technological governance in Kenya;
- Promoting public awareness targeting culture and attitudinal change in respect of technology;
- Gaining political will and support for realisation of adequate funding for technology transfer initiatives;
- Building a dynamic forward looking domestic technopreneur base necessary for effective commercialisation of R&D
- Ensuring integration of technological targets in procurement practices of public and other agencies in Kenya; and
- Institutionalizing mechanisms for technology planning for technology transfer activities

Technology Assessment Project

There is a wide disparity in technological capacity and capability between Kenya and the industrialized nations making competitive production and participation by Kenyan companies difficult. This is as a result of lack of inadequate assessment of the potential technological areas that Kenya can competitively participate in and develop a market niche for her products. The objective of this project is therefore to make an assessment of Kenya's technological competitiveness and apply technologies that will support the production processes in national growth priority areas.

Technopreneurship Promotion Initiative

This initiative will involve developing a sustainable pool of indigenous technopreneurs and technology-based enterprises through a technology incubator programme that increases the number of technopreneurs and technology-based enterprises. The technology incubator programme will emphasise the following;

- financial and risk management services,

- networking and technical services,
- promotion of best practices and
- mentoring services in technology evaluation and business plan development.

Technology incubation and business matching initiatives will be implemented to commercialise local R&D output through setting up of start-up companies or technology licensing.

Enhancing Technological Capability and Capacity of SMEs Initiative

Under the Enhancing Technological Capability and Capacity of SMEs Initiative, the strategies will focus on acquiring technologies that will upgrade SMEs in manufacturing, agro-processing and services sectors. The aim will be to enhance technological capabilities to establish technological leadership, achieve product and services design standardization as well as create local technology based companies.

Energy Technologies Project

The energy project will cover research and advisory framework for energy sources for electricity generation, improved energy use efficiency and, alternative and renewable energy. Clean energy production component will focus on research and development of technical and commercial feasibility of the production of electricity and various new products.

The component on improved energy use efficiency will focus on developing key energy use efficiency technologies to achieve production and save energy for both conventional and unconventional resources while minimizing environmental impacts. The alternative and renewable energy component will be implemented with the aim of advancing and adapting technology for alternative energy sources like water, wind, sun, geothermal, nuclear energy, gas, oil, coal, domestic waste and biomass so they account for a larger portion of the energy mix. The comparisons will be in engineering process, energy supply, demand for energy sources, ecological assessment, safety aspects and economic importance among other parameters. The fossil fuels and nuclear energy options will be weighed up with the results of the fact that Kenya has come up with national energy data for the application of the Model for Analysis of Energy Demand. Fluctuating supply from hydroelectric sources, economic climate of increasing prices for fossil fuels that are highly polluting and contribute to greenhouse warming leave Kenya with two options. One is geothermal potential of 2000 MW being realized yesterday and the nuclear energy option being seriously taken into account in the context of the national energy plan.

The project will ensure availability of low cost, clean and sustainable energy sources

to meet the energy requirements of the Vision 2030. Of immediate interest is setting up the necessary organs to realize the nuclear and biofuel options. In the short term the aim will be to increase the human resource base, the medium term is to have the necessary infrastructure in place and identify possible sites for building the nuclear power plants and biofuel systems for energy generation.

4. NEW AND EMERGING TECHNOLOGIES PROGRAMME

The programme will focus on developing new scientific understanding and capabilities in emerging fields of ST&I. New scientific and technological opportunities in areas identified by researchers will be developed. Assessment of new discoveries or newly-observed phenomena which could indicate risks or problems to society will be undertaken. Finally, initiatives focusing on specific, highly challenging objectives in emerging scientific and technological fields, and involving groups of complementary projects will be undertaken. The programme will aim at supporting visionary research with the potential to open new fields for ST&I.

Building and construction Materials Project

The aim of this project is the provision of cost effective high quality materials for high-tech infrastructure and transport designs.

Nanotechnology Project

The aim of this project is to develop appropriate high strength materials which are low cost, effective and efficient.

Nanotechnology allows the manipulation of properties of materials at the molecular or atomic level, giving rise to products with enhanced properties, faster production processes, lower production costs, much smaller manufacturing equipment, cleaner environment or new manufacturing systems. Nanoelectronics are expected to create an impact on the local Electrical &Electronics industry. An example is the production of nanoscale devices for semiconductors. Other novel techniques include production of nanoparticles and carbon nanotubes. When these new methodologies are adopted in production, it will result in devices and systems with new levels of performance.

The advantage of nanotechnology is its ability to be applied in diverse industrial use like automobile industry, textile industry, health services among others.

Laser Technology Project

The project's objective is to develop and promote laser technology for efficient and rapid industrial transformation.

Laser technology has a wide application in areas of manufacturing, consumer electronics, telecommunications, data communication, surveying and construction,

medicine and the military among others.

Metal Processing Technologies Project

The histories of the developed and the newly developed economies of the world show that the establishment of material processing industries has, nearly always, had the greatest contribution to the growth of their national wealth. Industrialization has been the direct result of the need for readily available, affordable, adequate and high quality goods and services. Electronic consumer goods, textiles, silverware, industrial machinery, defense machinery, automobiles etc, are examples of end products of certain manufacturing processes. The great demand for these products all over the world is a statement of a large amount of the physical substances used as inputs in their production or manufacturing. In other words, a great demand for 'semi-processed materials'.

The aim of this project is to improve technologies for processing materials for the improvement of the appearance properties of the semi-processed material or to produce new materials and to provide the technologies required for expansion and diversification of the metal industry. The project will also expand capacity for training in metal casting including the development of training programmes at the Craft and Artisan levels. This should enable more utilization of metals available in the country including scrap metal, of which much is being exported.

Biotechnology Initiative

The objective of this project is to develop and promote biotechnology for efficient and rapid industrial, agricultural and health transformation.

The biotechnology project will ensure the development of biomaterials, including polymers, metals, ceramics and composites, which are produced synthetically or biologically, for use in the efficient treatment and management of diseases with growth potential in bio-generics and molecular diagnostics for diseases, as well as vaccines for tropical diseases. The project will also ensure the development of biosensors, which represent a powerful new evolutionary field in analytical measurement technology. The commercial application of biosensors is in the areas of healthcare, industrial process control, agriculture, veterinary medicine, defense and environmental pollution monitoring;

Biopolymers, which are biologically produced polymers with unique functional uses, such as stabilizers, thickeners, gallants, binders, dispersants, lubricants, adhesives and drug delivery agents. The main beneficiary of biopolymers is the food processing industry. Other industries which will benefit include cosmetics, pharmaceuticals, packaging, paper and textiles. Advances in plant genetics and fermentation and purification technologies can eventually influence a shift towards the application of

more biopolymers than synthetic petroleum-based polymers. The project will lead to growth in industrial biotechnology, including the development of biocatalysts for foods, chemicals and pharmaceuticals, and bio-generic manufacturing. Agriculture biotechnology, with nutra-ceutical and cosme-ceutical products as a potential area. In addition, the application of plant biotechnology will be aimed at increasing crop yields, producing pest and drought resistant strains.

The rise in crude oil prices will provide opportunities for the country to develop alternative sources of fuel, for example, biodiesel. Challenges in adopting biotechnology include the high costs of development, lack of availability of funds to finance more sophisticated and expensive health care, the fear of litigation and lack of a national biotechnology strategy to address six key themes that emerged from the national biotechnology policy which are biotechnology in the community, ensuring effective regulation, biotechnology in the economy, Kenyan biotechnology in the Global market, resources for biotechnology and finally maintaining momentum and coordination. In this regard, a National Biosafety Authority and associated legislation for the enhancement of the implementation and coordination of the national biosafety framework and strategy will be established during the plan period to ensure that the potential risks and opportunities from the introduction of genetically modified organisms (GMOs) are accurately assessed and managed effectively.

The project offers opportunities to partner with industry and establish PPPs as well as promote essential foreign investment to add value to Kenyan biotechnology and in developing key regional and international markets.

Peaceful uses of Nuclear Science and Technology Project

The objective of the project will be to facilitate effective utilization of nuclear science and technology in support of Kenya's national development

The project will ensure acquisition and development of the requisite human resources, infrastructure, cooperate with regional and international bodies and agencies and funding mechanisms to support initiatives under the project. Priority areas for applications of nuclear sciences span energy development and planning; agriculture and food security; human health; isotope techniques in water management; nuclear instrumentation; radiation safety and waste management; and manufacturing and industry.

Kenya is obtaining International Atomic Energy Agency's (IAEA) assistance in assessing the country's uranium and thorium resources for future development of nuclear technology for power energy generation. Kenya will deposit the necessary instruments as regards the safeguards Agreement on nuclear proliferation. Spin offs expected include accelerated use and application of nuclear technology in agriculture

and food security, human health both in therapeutic and diagnostic areas in particular radiotherapy, nuclear medicine and communicable diseases, water resources especial in ASAL, manufacturing and industry including isotope production, irradiation facilities, nuclear instrumentation all ably regulated by radiation safety and radioactive waste management infrastructure. A National Nuclear Commission will be established to spearhead this initiative.

Space Sciences and Technology Initiative

The Space project will promote and manage research and development on space technologies and their implications for the nation and will focus on space exploration, information and telecommunications technologies and regulation. Under the Project, the Government will support training courses, workshops, seminars and other activities on applications and capacity building in, geo mapping, remote sensing, communications, satellite meteorology, search and rescue, basic space science and satellite navigation and international space law. The Project will specifically address: basic space science, natural resources management & environmental monitoring, satellite communications, space technology and disaster management; establishment of the Centre for Space Science and Technology Education and Satellite Communications - KENSPACE Project

The aim of this project will be to enhance the understanding and subsequent use of space technology for peaceful purposes in general, and to improve the use of space science and technology for the economic and social development of the nation in particular.

5. SCIENCE, TECHNOLOGY AND INNOVATION FOR EFFICIENTPRODUCTION PROGRAMME

Kenya Tourism Research Audit Project

This project will collect, exchange, analyze and communicate existing tourism studies and research programmes in Kenya

Develop Internet Technology Project

This project will cover the development of a Kenya tourism research website to facilitate wider industry access to Kenya tourism research studies complete with a Search Engine to ensure visits to the site are maximized.

Internet Geographic Information Project

This project will establish detailed specifications for the development of Geographic Information Systems (GIS) on the Internet, creating interactive maps for both tourism professionals and visitors; a full audit and evaluation of existing technological

capability of tourism operators. It will also examine databases for the networking requirements of tourism operators and identify key stakeholder mapping needs (via survey and focus group work with visitors and tourism industry professionals)

Kenya Tourism Activity and Trends Monitoring Project

The objective of this project is to establish a shared tourism activity and trends monitoring service to measure over time tourism industry performance in Kenya. Trends monitoring will provide reasons for downturn or growth to enable the industry can intervene with tactical measures when appropriate. The project will be implemented under the following components: It will also measure the evolution of the market and explore the new research areas identified with partners and establish an operational character for local tourism operators to allow them to adjust their action programmes on new product development, information, promotion and communication to effectively targeted at this market.

Kenya Tourism Niche Markets Development Project

A number of niche markets have been identified. The overall aim of this project is to investigate the potential for the future actions in terms of product development and marketing programmes.

The project will cover Cultural Tourism component to investigate the tourism impact of museums and heritage sites across Kenya; Rural Tourism component to address a range of questions including how tourism and recreation impact on the rural economy, the range and character of rural tourism products in Kenya, the market potential of rural tourism in Kenya, the factors (both supply and demand related) limiting tourism growth in this area, the physical development needed to increase the economic impact of the tourism market, the contribution of rural tourism to conservation; Sports and Activity Tourism component to investigate the potential of developing coherent and complementary offers, including how to extend some elements of the sports/activities offer to transit tourists, thereby increasing the economic contribution of the latter.

Niche Areas of the Manufacturing Sector Project

The aim of this project is to develop technical capacities and capabilities in manufacturing as well as, identify, develop and promote niche areas in advanced manufacturing technology, namely, computer-aided design/computer-aided manufacturing/computer- aided engineering (CAD/CAM/CAE), industrial automation, robotics, and machinery and equipment; and aerospace-related technology, advanced materials which are also recognized as key technology areas in strengthening the technological development capability and generating new sources of growth for the country.

Niche areas in manufacturing technology will ensure a competitive advantage over other players in technology development in the world and will attract public-private partnership arrangements

Food Security and Agriculture Project

Kenya will continue to face challenges that will require focused research into new genotypes to cater for areas like the Arid and Semi Arid of the country. We need to develop appropriate technologies for irrigation to cover dry or marginalized areas which could guarantee sustainable food security

The main objective of this project is to develop new cultivars technologies and practice appropriate technology for maximum crop yield and food security.

Value Addition Initiative

The aim of the project is to develop and promote value addition and agro-processing technologies to ensure high value exports through efficient and effective production.

The project will;

- Ensure low cost production and processing, high productivity and quality of agricultural produce and products as well as encourage growth of rural non-farm enterprises.
- Ensure the exploitation of indigenous foods for consumption and commercialization and will attract public-private partnership arrangements.
- Ensure value addition to farm waste as well as assess and advice on the capabilities and capacities of meteorological services vis a vis the demands in the agricultural sector
- Reduce supply side inefficiencies and improve market access
- Develop skills in agro-processing

Health Initiative

The need to create new medicines, vaccines and diagnostics requires the application of new cutting edge technologies and state-of-art laboratory facilities. Such technologies include Molecular biology, Genomics, Proteomics, nanobiotechnology and Bioinformatics sciences. The aim of this initiative is therefore to develop the Kenyan health system to international standards through ST&I.

It will ensure standards improvement and research in multi-sectoral health issues including infectious diseases, reverse engineering, warning systems, neglected diseases, and nutrition, HIV/AIDS, malaria, TB and emerging infections;, mainstreaming of herbal and traditional medicine into the national health care system and demonstration of their efficacy. In addition, it will ensure commercial

production of traditional plants for medicinal use and streamlining of the inter-sectoral and public-private sector partnerships in hi-tech medical technologies and improvement of cost effectiveness and efficiency of the health care delivery system.

Information and Communication Technology Initiative

The aim of this project is to develop high tech vibrant, affordable and globally competitive ICT infrastructure and technology that will ensure efficient service delivery in all sectors of the economy including supporting the Business Process Outsourcing.

The project will help integrate information management and communication and also drive production systems. ICT sector will intensify training efforts to build capacity in ICT, facilitate development and growth of a robust ICT infrastructure, improve delivery of service through e-government strategy, provide a stable umbrella for public private sector growth, integrate and popularize the use of ICT and establish data sharing and value addition through national spatial data infrastructure and will attract public-private partnership arrangements. The ICT sector will also support development of BPO raw infrastructure and software through ST&I products and services and provide technological capacity and capabilities for business process offshoring.

Advancements in information and communication technology will provide an important infrastructure for information communication to farmers and other stakeholders in terms of current market prices, inputs, weather and other alerts.

National Water Research Development Project

The aim of the Project will be to intensify research, development and promotion in Indigenous technology in the water sector, Integrated Water Resource Management, Ecological sanitation, Water Information systems, irrigation technologies and Wetlands management.

The project will improve the quality and quantity of water using low cost and effective technologies and improve water use efficiency by households, agriculture and industry. The project will also support the water sector reforms to facilitate the mainstreaming of ST&I into the water sector.

National Energy Research and Forecasting Project

The aim of the National Energy Research and Forecasting Project will be to establish affordable, efficient and clean energy sources through intensive research in renewable and non-renewable energy resource and analyze the present and future challenges in

energy. ST&I initiatives will be geared towards renewable energy research, nuclear energy initiative, wind energy, hydrogen fuel cells and bio-fuels.

6. HUMAN RESOURCE DEVELOPMENT PROGRAMME

The programmes objectives will be aimed at identifying, acquiring, developing and retaining highly skilled ST&I human resources to support development and achievement of national priority targets. In addition, it will be aimed at developing key competencies for innovation in identified strategic areas to meet needs.

Review of Science, Engineering and Technology (SET) Skills Project

This project will;

- Assess the existing SET skills
- Determine the requirements of SET skills for the country
- Draw up a strategy for closing the gap

It will include an assessment of new and emerging industries in advanced manufacturing, nanotechnology and bioinformatics. Strengthening of linkage between industry and institutions of higher learning in areas of curriculum review, industry labour requirements, including incentives attracting and keeping SET skills in industry

The project will provide the basis for policy, planning and budgeting for the investment in the improvement of skills and increase the number of ST&I human resource. It shall provide information to support the skills and human resource requirements of new and emerging industries; the development of innovation capabilities and entrepreneurial skills necessary to turn scientific research into commercial products, processes and services; tap the skills, expertise and connections of Kenyans living and working overseas; and attracting talented workers and leading researchers to Kenya.

Engineering Design and Development Initiative

Kenya's manufacturing sub-sector use relatively old technologies. Moreover, only 7 per cent of its manufacturing technologies are sourced within the country. The rest, 93 per cent is imported. Therefore, for the manufacturing sector to become competitive there is an urgent need for manufacturing engineering design and development. Manufacturing design will be aimed at furthering the development of competitive products and systems while manufacturing development will entail cost and quality for manufacturing competitiveness.

The objective of this initiative will, therefore, be to develop and promote capacity in design, development and production of machineries, equipment and tools required by industry for manufacturing. The initiative will also ensure research, training and building of capacity for engineering design and development.

Productivity and Competitiveness Project

Labour productivity is hinged on increased education training within a framework of matching private sector and labour skills while capital productivity is based on increasing capital utilization and investment in appropriate capital technology by all types of investors. Total factor productivity can be increased by the generation, transfer and adoption of appropriate product and process technology. Kenya lags behind in enhanced productivity due to inadequate coordination.

There is need to stimulate research and development and technology transfer in ST&I while at the same time improving productivity and competitiveness of Enterprises. Labour productivity gains will be achieved through continuous upgrading of labour force skills, assessment and possibly the adjustment of production processes. The government will support initiatives aimed at integrating issues related to HRD and efficient production planning in the curriculum of management courses offered by various training institutions. Other initiatives will involve incorporation of HRD and productivity issues in management programmes

7. EDUCATION TRAINING AND RESEARCH PROGRAMME

This programme will focus on science, technology and innovation education and training at all levels.

ST&I Education and Training Assessment Project

The project will aim at assessing trends in supply and demand for ST&I graduates and identifying successful measures for increasing participation, in particular of women, in scientific and technological education and careers; analysing changes in the mobility of students in science and technology fields, and their implications for policy.

In particular it will use the existing data sources and new statistical approaches on the career paths of holders of doctorates and reinforcing the national capability to make science and technology more appealing and attractive from the early stages of education.

It will also promote access and advancement in ST&I by focusing on measures to create an environment to make science, and technology more appealing and attractive from the early stages of education. This will also include creation and implementation of National Science fellowship, post doctorate Research fellowships, postgraduate grant scheme for in-science personnel, and postgraduate scheme for key technology areas, training specialist and consultant grant schemes and attachment for researcher's scheme.

The project entails a national ST&I human resource requirements study to facilitate effective policy and strategy as well as ensuring development of a critical mass of

researchers, scientists and engineers (RSEs) in key technology areas. The survey will also lead to a directory of RSEs that will be published and widely disseminated

Commercialization and Technopreneur Skills Project

The main aim of this project is to facilitate an increase the number of technology-based enterprises within the Kenyan economy.

The objective of this project is to impart commercialization and technopreneur skills to Kenyans to facilitate them in turning domestic and international scientific research into commercial products, processes and services. This project will develop human resources along the innovation value chain relating to technopreneurs, technology licensing officers, and technology business managers amongst others. It will be aimed at closing the human resource gap in terms of skills and competencies related to risk assessment, technology evaluation and business management.

Skills of supervisors, technicians and production workers in handling advanced technologies will be enhanced under this project

Business Support Project for ST&I Startups

The main objective of this project is to identify and support pioneering technopreneurs with business startup capital for commercialization of viable ST&I initiatives.

ST&I Curriculum Review Project

In order to ensure that the education, training and research is grounded in science and technology, a project to support the continuous review of curricula in all levels of education will be implemented in collaboration with the Ministry of Education. The reviews will aim at ensuring that national and industry requirements are met and that a culture of innovation and creativity are nurtured. This project will also aim at promoting education and research in African indigenous knowledge systems within the national education and training system. It will facilitate the integration of indigenous knowledge issues into curriculum and related teaching methodologies.

Under this project, there will be regular continuous training needs assessment in every sector, regular reviews of curricula, development of demand driven curricula, and associated training/learning materials.

ST&I Capacity Building Project

This project aims at developing a scheme of service that attracts and retains qualified and competent ST&I personnel in the civil service. It will also involve the review of staff development policies to promote further training for better service delivery, professional growth, and motivation. The project will also aim at imparting relevant skills to managers of TIVET institutions to prepare resource needs and capacity plans.

It will also facilitate preparation of resource requirements proposals for support and procurement based-plans.

The project will ensure a pool of qualified personnel for efficient and effective service delivery.

The Brain Gain Project

The role of the Diaspora in the development of countries of origin is getting more recognition. The international migration and development debate has increasingly emphasized the important role played by citizens of various countries working in the Diaspora. Consequently some countries have put in place policies, legislation and other measures encourage the participation and contribution of their Diaspora. For example, the Diaspora's economic contribution through remittances constitutes large sources of external capital for many countries.

Despite remitting close to KShs 70 Billion annually (or 0.46% of GDP) Kenyans in the Diaspora face a lot of constraints that inhibit their effective participation in socio-economic development of the country. Kenya lacks statutory provisions and institutional framework for attracting the resources of as well of addressing concerns of her nationals in the Diaspora.

With regard to S&T, there is need to put in place structures and mechanisms that enable the country to evaluate the scientific and technological potentials of her nationals in the Diaspora. In this regard, a project that involves the development and maintenance of a database on individual competencies in S&T professions would help isolate those to involve on matters of S&T.

This project will be initiated with the goal of developing and implementing policies for attracting effective participation and contribution of Kenyan S&T professionals in the Diaspora. The main objective is to develop comprehensive multi-dimensional ST&I strategies for harnessing the Diaspora resources and mainstreaming it to national development. In addition there will be need to;

- Identify and provide opportunities for participation in national ST&I activities to Kenyans in the Diaspora.
- Establish necessary mechanisms for ST&I institutions in Kenya to collaborate with those in the Diaspora on national issues of ST&I.

8. ST&I AWARDS PROGRAMME

The programme goal will be to identify, recognize and award outstanding ST&I initiatives in order to create a culture of a country that appreciates and promotes its researchers, scientists, engineers and innovators.

The project will reward outstanding (eminent) Kenyan researchers, technopreneurs and policy makers in the identified national priority areas. The outputs of this project include:

President's Award for Science, Technology and Innovation Project

These will be national awards to an institution that exhibits outstanding achievement in research and technopreneurship in the identified national priority areas

Distinguished Women Scientists Award Project

These awards are aimed at recognizing and enhancing the role of Kenyan women researchers and scientists, technopreneurs, engineers, and innovators in ST&I.

In Kenya, women play and continue to play significant, but often unrecognized roles in the national development processes. In this regard, various biannual awards to celebrate "Women in the Kenyan Science, Technology and Innovation Milieu" are proposed, namely "Distinguished Women Scientists Awards" and "Women Scientists Fellowships".

Young Scientists Awards and Prizes Project

In Kenya, the youth constitute the largest and fastest growing component of the population. They are also the bedrock upon which the countries future success will be built and sustained.

Young Scientists and Students Awards are aimed at attracting and retaining the youth, both men and women, at all levels of education and training into the wide science, technology and innovation field.

Distinguished Technologist Award Project

These awards are aimed at recognizing the role of technologists the award will also recognize contributions to innovation and scientific development by lower cadre individuals.

Technopreneurs' Awards Project

The award will recognize innovation and scientific development by entrepreneurs – individuals and firms - in the application of science, technology and innovation, including the commercialization of Kenyan science, technology and innovation. This will encourage innovations and entrepreneurship in ST&I.

Government of Kenya Science, Technology and Innovation Fellowships

This is a Kenyan Government ST&I Fellowships awarded to emerging leaders in engineering, science or technology. The award will also recognize talented young scientists through fellowships.

9. TIVET DEVELOPMENT PROGRAMME

Programme objectives

- Promotion of access and equity in TIVET institutions and Communities
- Development, promotion and sustainability of quality and relevance of TIVET programmes
- Strengthening and streamlining of corporate Governance and management of the TIVET system
- Development and enactment of an Act governing the TIVET system.
- Promotion of the development of and use of ICT tools in the TIVET system.
- Developing and sustaining active strategic collaborations and linkages with local stakeholders and international organizations.
- Institutionalization of research and development as a major function of TIVET institutions.
- Enhancement of Resources for sustaining TIVET Sector development.

Upgrading and expansion of TIVET facilities Project

The aim of this project is to expand existing TIVET facilities. The Government will rehabilitate, upgrade and construct/establish additional physical facilities and equipment to ensure equitable distribution on district basis. Through partnership with the private sector, the government will expand capacity of TIVET institutions through Build-Operate-Transfer, Build-Operate-Own or Government build-private sector-operate arrangements.

Establishment of Centres of Excellence Project

The aim of this project is to carry out a survey to identify TIVET institutions for establishment of centres of excellence. This will be followed by a needs assessment that will identify requirements for the centres. Resources for establishment of the centres of excellence as per the needs identified will be provided. Finally benchmarking programmes for TIVET managers and trainers will be undertaken to enhance international competitiveness.

Development of Institutional Capacity for Research and Development Project

This project will aim at developing institutional capacity for promotion of research and development in TIVET. The project will provide institutions with research equipment in all areas of training and develop staff on research methodology. In addition, the project will provide requisite advisory service and infrastructure for research and

development. The project will develop and sustain strong collaborations between industry, government and TIVET institutions in areas of research and development by promoting the creation and activities of professional associations to stimulate professional advancement of institutional and industry personnel.

Harmonization of quality assurance and standards Project

The legal framework governing registration, qualifications, training and development of trainers for TIVET institutions will be reviewed while examinations system, certification, credit transfers and accreditation in the TIVET system will be harmonised. This project will aim at centralizing quality assurance and standards functions under the TIVET authority by developing and implementing a national qualifications framework and enforcing a statute to empower TIVET Authorities.

ICT Infrastructure and Capacity within TIVET System Project

This will involve countrywide needs assessment and provision of infrastructure and equipment needed for ICT. In addition, it will involve enhancing the capacity of trainers in ICT to ensure sustainability as well as improving quality of skills acquisition in TIVET system and introduction of new modes of training using ICT supported programmes. The project will also involve identification and establishment of ICT centres of excellence to be used for Research and Development for TIVET systems and dissemination of TIVET information to the public and the industry. The necessary staffing will also be provided through direct recruitment and training.

10. SCIENCE, TECHNOLOGY AND INNOVATION INFRASTRUCTURE PROGRAMME

Infrastructure Support Programme

The existing large gaps in infrastructure constitute a ST&I challenge in Kenya. This programme will respond to this challenge by aligning resources to develop critical infrastructure for ST&I. The indicative projects under the programme will be as follows;

The Science, Technology and Innovation Infrastructure Fund Project

The project is aimed at securing adequate local and international funding in support of national ST&I infrastructure development, upgrading and maintenance. It will involve setting up of the Institutional framework and legal framework for establishing the fund. ST&I infrastructural requirements will be determined. Programmes targeting both local and international support will be established and implemented.

The project will ensure continuous availability of funds for ST&I infrastructure.

Establishment of Science and Technology Parks and Industrial Incubators project

The development of these parks in Kenya will focus on promoting the public and private sector partnerships. The Government will assist in the acquisition or

facilitation of strategic core assets - the assembly of 'SMART infrastructure' components of the park. The private sector will be encouraged to contribute to the construction of the parks, and the provision of service infrastructure. The proposed parks will be a partnership between the Government and various public and private institutions.

Among the parks will be a model project aimed at attracting investment in high technology industries & Stimulate local high-tech industries. It will be a component part of the envisaged Nairobi Metropolitan Region Growth strategy focusing on making Nairobi a regional and global services hub. It is expected that this park will make Nairobi and its metropolitan region, the premier destination in Africa for cutting edge research and development work.

Centres of Excellence Support Project

The aim of this project is to strengthen existing laboratories, Institutes and research facilities that have high potential, and established track records. These centres will be facilitated to attract students from Institutions of higher education to assist in research activities and provide meaningful engagement for ST&I graduates.

Under the Centres of Excellence Support Project, the Ministry responsible for Science and Technology proposes the development of an International Centre of Excellence. The centre will be effectively integrated into global nodes and hubs of networks and shall form the vanguard for enhancing Kenya's regional and global competitiveness in the national priority areas identified. Its operation will be based on strong commitment by enterprises, universities, research Institutes and funding organisations. Existing and new R&D resources will be allocated for effective operation and expansion. The proposed centre will focus on following areas:

- Agriculture and rural development
- Health and life sciences
- Information and communication industry and services
- Materials sciences
- Natural resources management

11. ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT PROGRAMME

The programme will focus on the potential of ST&I to effectively manage natural resources and environment, and mitigate against natural and man-made disasters. The indicative projects under the programme will be as follows

Climate Change Project

The aim of this project will be to develop technologies and capacities to predict, monitor and mitigate impacts of climate change and the appropriate institutional and legal frameworks for implementation of the scientifically rationalized responses.

The project will ensure reduced rate of desertification. Specific research areas addressing impact, adaptation and vulnerability to global climate change as well as greenhouse gases mitigation require to be identified and pursued in order to strengthen the national basis to cope with climate change problems in Kenya. Some of the priority areas of research should include health, agricultural and forestry sectors as well as water resources.

Space Technology Initiative

The main aim of this project will be to Support development of early warning systems and knowledge based mitigation for natural and technological emergencies. In addition, increased awareness will be undertaken among Kenyans to build the national capacity in order to effectively apply space technology-based solutions to disaster management challenges.

The use of space technologies has been proven useful in the risk assessment, mitigation and preparedness phases of disaster management as demonstrated by the recent tsunami disaster in the Indian Ocean. The technologies have a central role to play in providing early warning to communities that are at risk. The project will also address environmental monitoring and natural resources management issues on the platform of space-based solutions through the body KENSIGHT.

Remotely sensed data, in particular, provide an unparallel view of the Earth for studies that require synoptic or periodic observations such as inventory, surveying, and monitoring in agriculture, hydrography, geology, mineralogy, land cover, land use and environment. Remote sensing is a rapidly growing technology and is one of the important spin-offs of space applications and space science, having evolved into a discipline working side-by-side with other disciplines such as photogrammetry, cartography, geodetic reference systems, global navigation satellite systems, and geographic information systems.

Natural Resources Management and Environmental Monitoring project

The project will address environmental monitoring and natural resources management issues. Space technologies play important roles in the areas of natural resources management and environmental monitoring. Remotely sensed data, in particular, provide an unparallel view of the Earth for studies that require synoptic or periodic observations such as inventory, surveying, and monitoring in agriculture, hydrography, geology, mineralogy, land cover, land use and environment. Remote sensing is a rapidly growing technology and is one of the important spin-offs of space applications and space science, having evolved into a discipline working side-by-side with other disciplines such as photogrammetry, cartography, geodetic reference systems, global navigation satellite systems, and geographic information systems. Specifically the following will be targeted;

- Increased forest cover from current 2% to 10 % by 2030 through reforestation.
- Product development (aloe, gums and resins, biofuels and biotechnology)
- Commercial tree plantations and carbon sinks
- Ecosystem rehabilitation and management of wildlife
- Human and Wildlife conflict resolution

Development of a National Mineral Industry Project

The aim of this project is to build Capacity and capabilities for mineral resource exploration and exploitation, establish and implement Resource based human conflict mechanisms in the mining zones and determine the national mineral resource base. In addition, it will ensure efficiency in mining and value addition in mineral processing.

12. ST&I PUBLIC COMMUNICATION AND ADVOCACY PROGRAMME

Information is a crucial component for achieving development goals. Given the critical role of science, technology and innovation, it is important that ST&I receives priority in communication and advocacy.

The objectives of this programmes include:

- Enhancing public awareness of the importance of science, technology and innovation in everyday life, and the directions where science, technology and innovation is taking us;
- Dissemination of scientific knowledge, especially to the youth;
- Popularizing and promoting science, technology and innovation in all parts of the country, with special emphasis amongst women and disadvantaged groups.
- Promoting simplified and demonstrative learning and dissemination of science and technology.

- Promoting a closer interaction between the natural sciences and technology, social sciences.

Public Awareness Project

The project aim is to enhance public awareness of the importance of science, technology and innovation in everyday life, disseminate and popularize scientific knowledge, and promote a closer interaction between the natural sciences and technology, social sciences, humanities. This project will also popularize ST&I and TIVET through advocacy for positive TIVET image. Guidelines for more attractive methods of training will be developed and implemented. Sensitization programmes for the public, professional associations, parliamentarians, policy makers, schools, provincial administrators etc. will be formulated and implemented. The project will establish and maintain partnerships with the media to market TIVET programmes. Admission on guidelines that recognize achievement in technology education will be developed.

The project will help Kenyans to understand and appreciate ST&I issues, media, researchers, research Institutions as well as industry must be capable of communicating and engaging in debate on scientific issues in a comprehensive and professional manner.

Round Table Series on, "Science, Technology and Innovation Project

This project will aim at a series of bi-annual roundtables bringing together participants from across the country, region and internationally drawn from governments, parliaments, academia, media and international organizations.

The project will ensure discussion on the present and future issues, problems and challenges concerning science and technology legislation, exchange information in science, technology and innovation; examine the process of decision-making on issues of science legislation and the role of various stakeholders; and make future-oriented recommendations to key stakeholders including governments, private sector and international organizations;

ST & I and Community Outreach Project

Encouraging students to recognize the possibilities in science and research, ensuring affordable, accessible post-secondary learning opportunities in established and emerging fields of study, and helping Kenya's small and medium-sized science, technology communities enterprises and communities to compete in world markets provides tangible returns such as developing a skilled workforce; building prosperous companies in diverse sectors and creating vibrant communities. Outreach efforts help them dream the big dreams, inspire new ideas, and help people see that Kenya is the place to make those ideas become reality. That is what makes ST&I outreach

absolutely critical to our future prosperity.

The project aims at providing a wide range of ST & I services to Kenyans in partnership with the NGO, CBO and Industry sector.

It will also strengthen the ST&I skills and to enhance the early numeracy and creativity of pre-school children, and to enhance community-based partnerships that support the development of ST&I skills of families. The programme includes initiatives to raise awareness about the importance of ST&I literacy for increasing food security and household incomes

The project will ensure up scaling community ST&I technological capacities and address community ST&I issues, as well as other lifelong learning opportunities. The Project will provide opportunities for adults to take part-time learning opportunities through Community Based organizations and volunteer tutors

13. ST&I FUNDING SUPPORT PROGRAMME

This programme will provide for the development and constant review of guidelines for Government funded ST&I projects and will also focus on public/private funding as well as general financing of ST&I initiatives. The funding sought will be for basic and applied research in recognition of the fact that today's basic research is tomorrows applied technologies; enhancing the role of women and the disadvantaged; technology transfer initiatives, and supporting venture capital funding.

ST&I Endowment Fund Project

The aim of this project is to set up a revolving and sustainable source of income for financing ST&I programmes. It will involve establishment of the Institutional framework as well as development and implementation of resource mobilization strategies including community fundraising, direct contribution by community members, savings from income generating activities, constituency development fund, bursary funds and other devolved funds. The primary source of monies for setting up the endowment fund would be treasury who would commit a one-off allocation of billion Kenya shillings; this would then be invested by the Fund Trustees in various ST&I initiatives and will attract public-private partnership arrangements.

The project will ensure continuous and sustainable availability of research funds.

The Kenyan National Research Fund Project

The project will focus on establishing legal and Institutional frameworks for establishment and operationalization of the Kenya National Research fund. It will also focus on survey on resource requirement for ST&I research and undertake resource mobilization for the fund.

The project will ensure existence of a legal mandate to mobilize resources for research.

The Science, Technology and Innovation Infrastructure Fund Project

The project is aimed at securing adequate local and international funding in support of national ST&I infrastructure development, upgrading and maintenance. It will involve setting up of the Institutional framework and legal framework for establishing the fund. ST&I infrastructural requirements will be determined. Programmes targeting both local and international support will be established and implemented.

The project will ensure continuous availability of funds for ST&I infrastructure.

Kenya National Venture Capital Fund Project

The aim of the Kenya National Venture Capital Fund is to increase the amount of private investment capital for Kenyan companies in early stage of business development. It aims at securing adequate local and international funding in support of requirements for ST&I venture capital funding. It will be the main engine for driving techno-entrepreneurial growth, job creation and economic prosperity. The requisite legal and Institutional frameworks for establishing the fund will be established.

The project will ensure continuous availability of venture capital funds for ST&I development and will attract public-private partnership arrangements.

Tax Concessions for Research and Development Project

The aim of the Tax Concession for Research and Development (R&D) is to improve the international competitiveness of Kenyan companies by increasing investment in R&D, encouraging better use of existing research facilities and giving enterprises greater incentive to acquire and improve technology

14. ST&I PERFORMANCE MANAGEMENT IMPACT ASSESSMENT PROGRAMME

The aim is to develop quantifiable targets and tools to measure the implementation and performance of this policy in achieving the national developmental goals.

Investments required for effective science, technology and innovation policy demand a constant review of outputs and outcomes through a performance management framework. This will require;

- A comprehensive performance-management approach with a focus on program outcomes that are linked to long-term impacts.
- Valid and reliable measures for assessing and evaluating the impact of ST&I policy interventions on the economy and facilitating management of performance.

Good Practice Sharing Project

This project will be to develop and support mechanisms for identifying and sharing ST&I based good practice approaches to the development. It will therefore address the question of identifying best practices in S&T policies to respond to the challenges and opportunities of increased globalization

Monitoring and Evaluation of Public Funded Research

Under this project, the Government will establish mechanisms to ensure that public funded research is targeted to priority areas identified and a framework to monitor, disburse and monitor public funds in research is established to ensure its effective use.

Performance Framework for Public Engineering, Science and Technology Institutions project

Kenya's public engineering, science and technology Institutions are not performing to their full potential The Government's aim is to foster a strong, vibrant research base which attracts both talented individuals and corporate investment in Kenya. The government will therefore endeavour increase the rate of knowledge transfer and level of interaction with business. This will secure continued growth of centres of excellence in Science, technology and Innovation through the provision of adequate facilities and competent human resource.

Development of Online Web-based Performance Score Card

In this project, a Comprehensive Web Based Performance Management System will be developed by the Ministry responsible Science and Technology to provide a more robust mechanism for translating the overall strategic priorities for the science base into specific aims and objectives for the various implementing agencies of this policy.

Biannual ST&I / Reviews Project

This project will be aimed at reviewing the progress and/or economic/social impact of the various programmes/projects implemented in support of realizing the strategic objectives of the science, technology and innovation policy.

Research, Science and Engineering Indicators Almanac project

This project will be aimed at producing high quality quantitative data on the Kenya's research, science and engineering enterprise. The project is expected to provide data in respect the following amon others

- basic and secondary education
- science and engineering in higher education
- Kenya's science and engineering labour force
- research and development
- expenditure and technology linkages
- academic research and development
- industry, technology, and the global marketplace
- science and technology
- public attitudes and understanding.

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Global Benchmarking of Kenyan ST&I Education Project

This project is aimed at benchmarking Kenyan science, technology and innovation education with global best practice and providing stakeholders in science, technology and innovation with issues impacting on the quality of education and skills development for their deliberation and further action.

This will be accomplished within the following terms;

- Describe, under a common set of benchmarking parameters, primary and second level ST&I education provision and practice in the Kenyan Education system and that of other successful knowledge-based societies;
- Raise awareness of the issue of ST&I education and skills development and to Stimulate informed debate, by disseminating the findings widely among the stakeholders;
- Provide the basis for advice to be given to Parliament, government ministries/ departments and other public offices

15. INDIGENOUS RESOURCE, PRACTICE AND KNOWLEDGE PROGRAMME

Links between science and indigenous knowledge can be understood via answers to various questions and information on certain parameters. These include:

- Who owns indigenous knowledge and who may use it?
- Who decides how to use indigenous knowledge and for what purpose? - and how should its owners be compensated?
- Documentation of Kenya's indigenous knowledge and technologies;
- Integration of Kenya's indigenous knowledge and technologies into the education & training curriculum; and
- Establishing of legal framework for the exploitation of indigenous knowledge and technologies for the benefit of Kenyans.

The objective of this programme will be to tap into the indigenous scientific and technological viability. Awareness of the value of indigenous knowledge particularly its potential contribution to sustainable development is also growing at a time when such knowledge is being threatened as never before. Under this programme, the following projects will be undertaken;

Indigenous Knowledge and Technologies Documentation project

This project will aim at establishing a Kenyan Indigenous Knowledge and Technologies Databank. This will be the main source of information on the various forms of knowledge and technologies held and used by traditional and/or local Kenyan communities.

Auditing, documenting and supporting research are some of the ways of protecting and promoting the use of indigenous knowledge and technologies. Once the knowledge and technologies are in the public domain, it is relatively difficult for corporate actors and individuals to misappropriate them or illegally acquire intellectual property rights. This project will therefore undertake;

- Preparation of comprehensive guidelines and methodologies for auditing and documenting indigenous knowledge and technologies. The guidelines and methodologies will be based on world best practices and targeted at securing the interests of Kenya and her citizens.
- Development of a common protocol for access and use of traditional knowledge and technologies in the proposed databank to ensure that the benefits are fairly and equitably shared.
- Training courses on auditing, collection and documentation of indigenous knowledge and technologies by identified and accredited Institutions and experts.

Indigenous Knowledge and Technologies On-line project

This project will be closely linked to the Kenyan Indigenous Knowledge and Technologies Databank and ensure the protection of the same for the benefit of Kenyan people. It will allow citizens to have easier access to information.

The "Indigenous knowledge and technologies on-line" project is aimed at actively acquiring and disseminating Kenya's tangible and intangible indigenous knowledge and technology

Integration of Indigenous Knowledge, Technologies and Practices in Education Curriculum

This project aims at promoting education and research in African indigenous knowledge systems within the national education and training system. It will facilitate the integration of integration of indigenous knowledge issues into curriculum and related teaching methodologies.

Generations are passing away without endowing the incoming ones with the wealth of information and skills on the use and management of African ecological and agricultural systems. This threatens the future cultural well being of Kenyan communities. Specific actions to implement this project will include:

- Reviewing the indigenous knowledge content in the current curricula of African education systems and identification of international best practices on the integration of indigenous knowledge issues into formal education:
- Conduct research on indigenous knowledge systems and technologies.
- Conduct workshops, symposia and conferences for educationists to consider proposals on the best approaches to integrating indigenous knowledge systems into curriculum and teaching practices, guided by international best practices.
- Development and promotion of a body of methodology and guidelines for integrating indigenous knowledge systems into formal education and training.

Protection of Indigenous Knowledge, Technologies and Practices Project

This project will focus on reviewing the legal, Institutional and regulatory framework to facilitate protection and beneficial exploitation of indigenous knowledge, technologies and practices for the benefit of Kenyan people.

Commercialization of Indigenous Resources and Knowledge Project

This project aims at enhancing exploitation and commercialization of indigenous resources and knowledge. This will result in increased economic growth, employment creation, increased variety in terms of products and services and will attract public-private partnership arrangements.

16. COLLABORATION AND PARTNERSHIP PROGRAMMES

Collaboration programmes are vital for sharing information, experiences and knowledge. The following projects will be implemented in this programme;

Strategic Partnerships for Enhanced ST&I Linkage and Collaboration

This project will aim at enhancing local, regional and international partnerships. This will provide new and increasing prospects for Kenya's scientific and technological development. If well organized and used, it will provide the basis for mobilizing resources, improving infrastructure for research and development, and for human resource capacity building.

Institutional Framework for International and Regional Cooperation in ST&I

This project is meant to focus on addressing Institutional arrangements used for implementing provisions of international agreements that avail co-operation between Governments for sustainable development, growth and prosperity based on science and technology.