THE REPUBLIC OF UGANDA

NATIONAL SCIENCE, TECHNOLOGY AND INNOVATION PLAN 2012/2013 - 2017/2018

Ministry of Finance, Planning and Economic Development

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FOREWORD

Recognising that a nation's development prospects are intricately linked with the pace of generation, adoption and utilization of science and technology, the Government of Uganda has placed science and technology among the four priorities of the National Development Plan (NDP) for the period 2010/11-2014/15. This presents both an opportunity and challenge to scientists, policy makers and development planners to transform scientific knowledge into programmes for the realization of Uganda's development aspirations. Key among the national aspirations is the uplifting of the population from absolute poverty through provision of basic human needs, transformation of the economy from an agrarian to an industrial and knowledge-based economy, and enhancing Uganda's participation in global trade and development processes.

The National Science, Technology and Innovation Plan (NSTP) aims to provide a comprehensive framework for actualizing Uganda's Science, Technology and Innovation (STI) development aspirations that are enshrined in the National Science, Technology and Innovation Policy (2009). The Government of Uganda has, through the National Council for Science and Technology (UNCST), formulated the National Plan in close consultation with various Ministries, departments and agencies, the private sector, civil society and development partners. The process of preparing this plan involved discussions with thematic experts in various fields of science and technology, in-depth sector policy studies and benchmarking with countries that are relatively more successful in developing and implementing STI policies than Uganda.

The priorities of Government of Uganda in this regard include creation of all round capacities in STI infrastructure in universities and research institutions, creating a critical mass of scientists and engineers that are necessary for spearheading and sustaining industrial development and economic transformation, increased research and scientific innovation support mechanisms through capitalization of the STI Fund and an aspirational goal of enhanced budget support of about one percent of GDP expenditure on research and development activities over the next five years, and enhance private-public partnerships and international collaboration.

The Government is committed to implementing the National Science and Technology Policy (2009) through the NSTP across all sectors of the economy starting from fiscal year 2012/2013. Lastly, Government calls upon all stakeholders to join hands in the implementation of this plan.

Hon. Matia Kasaija

Minister of State for Finance, Planning and Economic Development (Planning)

EXECUTIVE SUMMARY

The National Science and Technology Plan (NSTP) has been developed as an instrument for implementing the National Science, Technology and Innovation Policy (2009). The Plan identifies Uganda's short, medium and long term priorities in Science, Technology and Innovation.

In the short term, Government will prioritize the creation of a science and technology fund, improvement of public appreciation of and support for science and technology, establishment of science parks and science centres, establishment of science and technology information management systems, strengthening the intellectual property management system and strengthening the institutional capacity of Uganda National Council for Science and Technology (UNCST).

In the medium term, Government will focus on increasing science and technology financing, human resource capacity building, establishment of centres of excellence, strengthening research and development infrastructure and ensuring excellent quality standards capacity.

Government will align its policies with regional and continental priorities, develop a code of ethics for science and technology, provide a conducive environment for evolution of science and technology culture along with infrastructure development in the long term.

UNCST will coordinate the implementation of the NSTP in collaboration with a cross section of stakeholders guided by the mandates and primary responsibilities of their respective Ministries, departments and agencies (MDAs), private sector institutions and civil society organisations. The Plan will be financed by the government of Uganda in partnership with the private sector, development partners and civil society. The MDAs will plan for and access resources for implementation of the NSTP through their regular budget processes.

ACRONYMS

ABI	- Agro-Biotechnology Institute
ARIPO	- Africa Regional Intellectual Property Organisation
AU	- African Union
CBOs	- Community Based Organisations
CLCs	- Community Learning Centres
COMESA	- Common Market for East and Southern Africa
COMSATS	- Commission on Science and Technology for Sustainable Development in the South
COMSTECH	- Committee on Scientific and Technological Cooperation
CONSENT	- Consumer Education Trust
CSIR	- Council for Scientific and Industrial Research
DST	- Department of Science and Technology
EAC	- East African Community
EASTECO	- East African Science and Technology Council
ECA	- Economic Commission for Africa
EPRC	- Economic Policy Research Centre
EU	- European Union
GAL	- Government Analytical Laboratories
GDP	- Gross Domestic Product
GSS	- Government Support to Scientists
IAEA	- International Atomic Energy Agency
ICD	- Institutional Capacity Development Fund
ICT	- Information Communication Technology
IP	- Intellectual Property
IPD	- Innovation and Product Development
IPR	- Intellectual Property Rights
IRBs	- Institutional Review Boards
ISO	- International Standards Organisation
LCs	- Local Councils
MAAIF	- Ministry of Agriculture, Animal Industry and Fisheries
MDAs	- Ministries, Departments and Agencies
MFPED	- Ministry of Finance, Planning and Economic Development
MGLSD	- Ministry of Gender, Labour and Social Development
MIA	- Ministry of Internal Affairs
MICT	- Ministry of Information, Communication Technology
MJCA	- Ministry of Justice and Constitutional Affairs
MOES	- Ministry of Education and Sports
MOFA	- Ministry of Foreign Affairs
MOH	- Ministry of Health
MOLG	- Ministry of Local Government
MOSTI	- Ministry of Science, Technology and Innovation
MSI	- Millennium Science Initiative
MTIC	- Ministry of Trade Industry and Cooperatives

MTWH - Ministry of Tourism, Wildlife and Heritage
MWLE - Ministry of Water, Lands and Environment
MWT - Ministry of Works and Transport
NAMS&T - Centre for Science and Technology of the Non Aligned and Other Developing Countries
NARC - National Agricultural Research Council
NARO - National Agricultural Research Organisation
NCCI - National Chamber of Commerce and Industry
NDA - National Drug Authority
NDP - National Development Plan
NEMA - National Environmental Management Authority
NEPAD - New Partnership for Africa's Development
NFA - National Forestry Authority
NGOs - Non-Governmental Organisations
NIMES - National Integrated Monitoring and Evaluation Strategy
NITA - National Information Technology Association
NOTU - National Organisation of Trade Unions
NPA - National Planning Authority
NSTP - National Science and Technology Plan
NTR - Non Tax Revenue
NURRU - Network of Ugandan Researchers and Research Users
OP - Office of the President
OPM - Office of the Prime Minister
PSF - Private Sector Foundation
R&D - Research and Development
RDCs - Resident District Commissioners
RDIs - Research and Development Institutions
RTD - Research and Technology Development
SETIs - Science, Engineering and Technology Institutions
S&T - Science and Technology
SMEs - Small and Medium Enterprises
STI - Science, Technology and Innovation
STIF - Science and Technology Innovation Fund
STMIS - Science and Technology Information Management System
TDC - Technology Development Centre
THICK - Technology, Human Resources, Institutions and Infrastructure, Collaboration and Communication, and Knowledge base
TT - Technology Transfer
TTO - Technology Transfer Office
UBOS - Uganda Bureau of Statistics
UCC - Uganda Communication Commission
UCET - Uganda Consumer Education Trust
UCPA - Uganda Consumer Protection Association
UCPC - Uganda Cleaner Production Centre
UIA - Uganda Investment Authority
UIRI - Uganda Industrial Research Institute
UJAS - Uganda Joint Assistance Strategy
ULA - Uganda Library Association

UMA	- Uganda Manufacturers Association
UNBS	- Uganda National Bureau of Standards
UNCST	- Uganda National Council for Science and Technology
UNCTAD	- United Nations Conference on Trade and Development
UNDP	- United Nations Development Programme
UNESCO	- United Nations Educational, Scientific and Cultural Organisations
UNFFE	- Uganda National Farmer's Federation
UNHRO	- Uganda National Health Research Organisation
UNIDO	- United Nations Industrial Development Organisation
URA	- Uganda Revenue Authority
URSB	- Uganda Registration Services Bureau
USSIA	- Uganda Small Scale Industries' Association
UWA	- Uganda Wildlife Authority
WIPO	- World Intellectual Property Organisation

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1.0 BACKGROUND

1.1 Introduction

Science, Technology and Innovation (STI) constitute key elements that drive the growth and development of societies the world over. STI improvements and sophistication have evolved from the Stone Age period, through the Iron Age, to the current knowledge-based societies. The cultural, historical and organizational context in which technology is developed and applied is the key to its success. The history of technological advance is characterized by surprises and unpredicted paradigm shifts. There are many instances where planners and strategists predicted and prepared societies well for their future based on development of science and technology.

Efforts to develop and implement long-term science and technology strategies are complicated by unprecedented flows of information and technological change in the evolving social and economic systems. Long-term strategies need to be flexible to adapt to the changing trends and assume the past as prologue and the current trends as continuing. This is not to suggest that strategy is either undesirable or not required. A characteristic of successful societies has been the flexibility to anticipate, manage, direct and profit from change. It indicates for policy-makers, however, that a science and technology strategy should be viewed and interpreted in light of the above and that the probability of new and unforeseen factors increases over time. It also underscores the fact that a strategy should strive to provide a broad enabling framework and to serve as a reasonably accurate compass rather than a road map.

The past couple of decades have demonstrated in many developing countries the benefits of appropriate technological choice and accurate scientific and technological forecasting. Countries such as Singapore, Hong Kong, Taiwan and South Korea have prospered as a result of continually addressing the scientific, technological and economic systemic failures in a timely manner. In contrast, most developing countries have stagnated due to failure to identify, prioritize and address the challenges within their national systems.

1.2 Rationale for the NSTP

Government of Uganda adopted the National Science, Technology and Innovation Policy in 2009[1] and embarked on formulation of a National Science and Technology Plan (NSTP). The NSTP is premised on the provisions indicated in chapter 5, section 5.1 of the STI Policy as follows:

1 Ministry of Finance, Planning and Economic Development, (2009), National Science, Technology and Innovation Policy for Uganda

"A National Science and Technology Plan (NSTP) will be developed using a sector wide and participatory approach in line with the principles, objectives and strategies provided in this Policy. The NSTP will elaborate the policy actions, provide short-, medium- and long-term priorities and targets for the sector in tandem with the goal and objectives of the National Development Plan (NDP). It will provide a broad framework for development of STI and will be regularly reviewed to incorporate new developments in the sector".

The purpose of the NSTP is to facilitate achievement of Uganda's development aspirations which among others include; uplifting of the population from absolute poverty through provision of basic human needs, transformation of the economy from an agrarian to an industrial and knowledge-based economy, and enhancing Uganda's participation in global trade and development processes. The NSTP builds on the existing initiatives in the various sectors to guide Uganda's STI development path towards achieving the national vision for STI. Essentially, the NSTP translates the national STI policy into strategies, actions and measurable results within a five year dispensation.

1.3 NSTP formulation process

The NSTP was developed in four stages that included: stakeholder consultations, benchmarking studies, sector diagnostic studies, policy studies that have been conducted on Uganda's STI system by UNCST and the international scientific community over the last decade.

1.3.1 Stakeholder consultations

Pursuant to the provisions of the STI Policy (2009), the Ministry of Finance, Planning and Economic Development (MFPED), through the Uganda National Council for Science and [2]Technology (UNCST) launched the process of formulating a National STI Plan in December 2010 in Kampala. A five stage road map for formulating the Plan was developed through stakeholder consultations, solicitation of expert opinions, global benchmarking, model development, stakeholder and resource mapping, and legal reforms where appropriate.

Uganda National Council for Science and Technology (UNCST) subsequently organised 16 specialized expert group meetings, around the thematic areas covered by the STI policy. The draft NSTP was further discussed with both local and international stakeholders at national STI Policy dialogues that were convened by the UNCST in 2011.

2 Uganda National Council for Science and Technology (2010), Report of the National Science Week, 20-24 September, 2010.

1.3.2 STI case studies

Based on their relatively developed STI systems, in depth studies were undertaken on India, Malaysia and Finland with specific focus on: (1) STI system financing, (2) institutional structures, (3) coordination mechanisms and delivery systems, (4) policy and programme priorities, (5) human capital development, (6) science infrastructure and (7) linkages between the economy and the STI system. A summary of the findings, conclusions and recommendations are:

i. Institutional framework: Science, technology and innovation cannot be fully integrated into the national development processes and programmes of any country without a properly functioning, strong and empowered S&T coordinating agency, such as a Commission, Council, Authority or a Ministry of Science and Technology.

ii. Coordination: The relevant institutions and agencies within the S&T system ought to work in conjunction with one another in the processes of integrating S&T into the national development process. There is need for a very high level coordination mechanism (preferably at the President's or Prime Minister's office level) to ensure synergistic and effective implementation of the National Economic Development Policies and Science and Technology Policies. Effective coordination and communication has helped S&T institutions and agencies to integrate STI into national development processes.

iii. Financing: There is need for properly managed S&T Funds to propel technological development of any nation. These include: (i) a Science Fund to support research in academia and SMEs (ii) an Innovation Fund to support innovation among the nationals and (iii) a Technology Development Fund to address the existing gaps between innovation and commercialization.

iv. Policy Priorities: An STI Policy and the associated STI Plan or Strategy needs to be dynamic enough to meet the prevailing and new developments in that nation. Development of consensus on S&T policy priorities requires substantial time and extensive stakeholder consultations. Government interventions to support STI development need to be multi-sectoral backed by a strong legal and institutional framework and the interventions should include financing, human capacity building and market support. Evidence from the benchmark countries shows that making comparisons of local agencies and firms to reputable S&T agencies and firms helps them to improve their creativity and productivity.

v. Human Resource Capacity: The S&T Plan must be consistent with the existing scientific manpower of the country under consideration (researchers, scientists, engineers and technicians). Knowledge workers are critical to the strategic integration of science and technology into the national development processes. Engagement of experienced S&T professionals can shorten product development cycle and ensure quality.

vi. Infrastructure: Availability of certified multi-media super corridors that can be rented by technology-based start-ups at rates that are not prohibitive is helpful in driving economies through science and technology. It is feasible to develop reasonably high technology products in a highly labour intensive low capacity setting.

1.4 New Approaches to STI Development

The National STI Plan builds on previous efforts in the science and technology system that the country has instituted over the years to create an STI-enabled socio-economic growth and transformation. The NSTP considers new approaches for accelerating the achievement of the national aspirations in STI and the economy.

1.4.1 The 4-Stage STI Development framework

The NSTP adopts a new approach to the conceptualization of the linkages between STI and economic development. The framework illustrates system-wide activities and underlying processes that are necessary to overcome the challenges currently facing Uganda's STI system. It reflects science and technology development processes as a coherent and integrated system whose proper functioning depends upon the coordination and efficiency of the constituent elements.

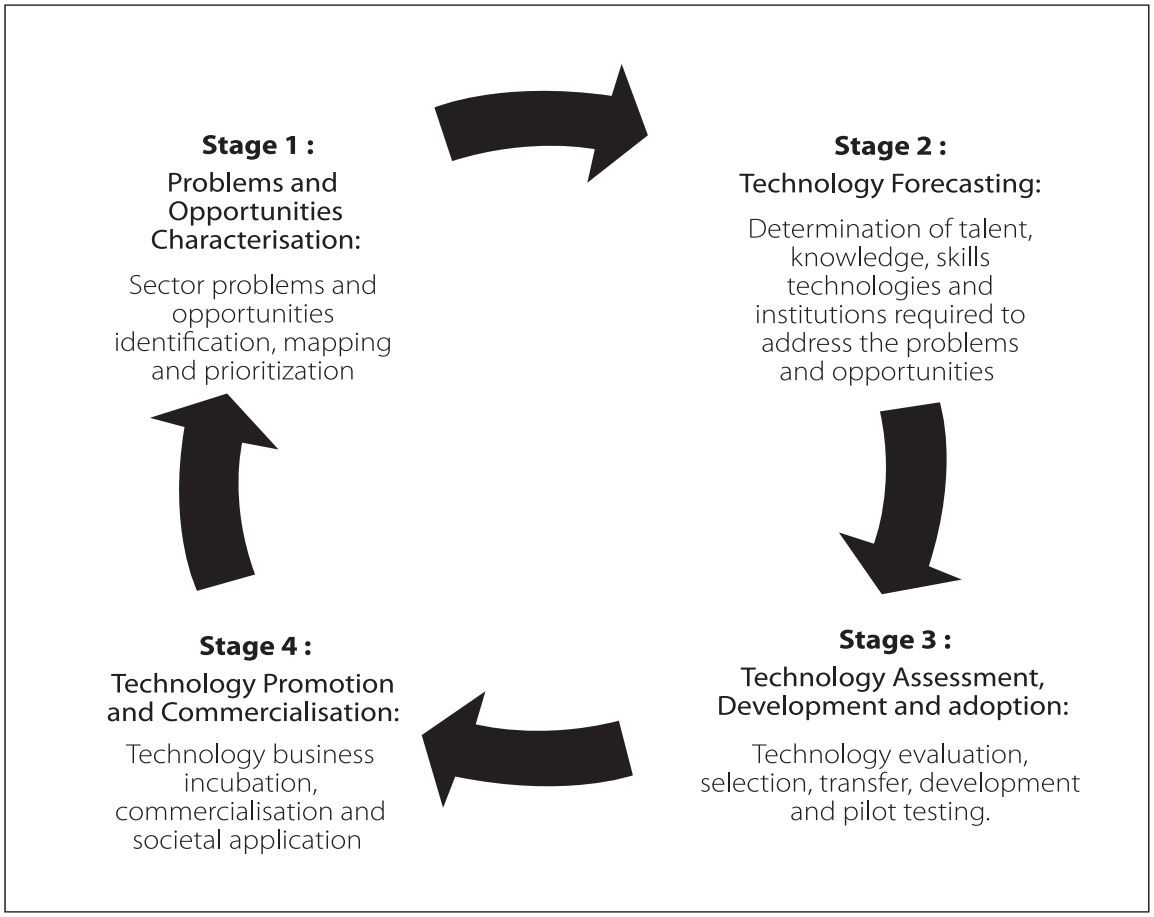

Figure 1. The 4-Stage STI development framework

The following four key drivers are critical requirements to the operationalization of the 4-stage STI development framework:

i. An enabling STI policy and regulatory environment e.g. for strengthened coordination and performance monitoring and evaluation.
ii. A competent critical mass of scientists/technologists and entrepreneurs to champion the technology value chain.
iii. Appropriate institutional infrastructure framework for supporting the technology value chain.
iv. Appropriate/adequate investment in STI development (resource budget).

The approaches that the NSTP envisages include:

i. Nation- wide consultation, involvement and participation of stakeholders at village, community, sub-county, district and national levels.

ii. Continuous engagement with politicians, legislators, policy makers, resource allocators through lobby, advocacy and social marketing.
iii. Wide publicity, dissemination and outreach of STI programmes and results to national, regional and international stakeholders.
iv. Increased networking coordination among and between SETI and other stakeholders through establishment of a science and technology information management system (STMIS).
v. Stronger collaboration at the regional, continental and global level through alignment and strong collaboration with the regional economic communities (EAC, EASTECO, and COMESA), continental bodies (NEPAD, AU), bi-lateral and multi-lateral agencies and nations and other global development partners.

The critical resource requirements for moving the 4-stage framework include: technology, human resources, institutions and infrastructure, collaboration and communication and a stock of accumulated knowledge resources. The level of national investment in these critical requirements determines the pace and extent of STI development in the economy. These resource requirements are explained in detail in the THICK framework that is discussed in the next section.

1.4.2 The THICK Framework

The NSTP adopted the THICK analytical framework developed by the World Bank[3] in 2010 to appraise sector status and identify Uganda's STI priorities. The framework postulates existence of a linear double causality relationship among five elements of an STI system. These are identified as Technology (T), Human Resources (H), Institutions and Infrastructure (I), Collaboration and Communication (C), and Knowledge base (K) as dimensions of the THICK framework. The THICK framework provides a systematic and alternative methodology for appraising STI systems by examining the five dimensions qualitatively and quantitatively. It also provides a scientific and participatory method for arriving at sector priorities and mapping of resource requirements through aggregation of stakeholder preferences. An analysis of Uganda's STI system using the THICK resources is presented in the next section.

1.4.2.1 Technology Resources

These include tools and the knowledge to use them in industry. It mainly considers the technology available in industry, technology needed to move ahead, opportunities for technology transfer and infrastructure that can support technological learning. Most technology resources in Uganda are not proprietary (i.e. they are not patented), nor are they highly advanced or complex.

3 World Bank (2011), Science, Technology and Innovation in Uganda: Recommendations for Policy and Action; A World Bank Study, Washington D.C.

The majority of the industries and manufacturing plants import production technologies from Asia and Eastern Europe. The knowledge required to operate this equipment is still lacking and often industry proprietors bring in skilled personnel to maintain and operate these machines.

1.4.2.2 Human Resources

In recent years, the Government of Uganda has invested heavily in primary, secondary and adult literacy education. In common with other African countries, however, human resource for the transformation of the economy is a major constraint. There are shortages of professionals, skilled and semi-skilled human resources including managerial and entrepreneurial skills across all sectors of the economy. As a result, the shortage of skilled human resources should be addressed by all sectors that are providing goods and services to the nation.

1.4.2.3 Institutions and Infrastructure

Uganda's science and technology infrastructure currently comprises 34 Universities out of which six offer science and engineering courses, 33 science-related vocational and technical institutes, 20 active R&D institutes, two national museums; one functional public library and five private laboratories[4].

Research institutions have a weak financial and technical capacity to undertake applied research. Furthermore, the STI system is governed by a combination of sectoral ministries and numerous autonomous institutions (Councils, Commissions, and Authorities) whose mandates, in some instances, with regard to S&T development, appear to overlap rather than complement and enhance each other. The existence of a plethora of science, technology and engineering institutions (SETIs), often with somewhat parallel mandates, complicates the national STI coordination function of government.

1.4.2.4 Collaboration and Communication

Although Uganda's communication capacity has greatly improved with the increase in mobile telephony access and coverage and, increased computer penetration, the ability to collaborate with partner institutions both within and outside the country is still lacking. The linkage between key actors in knowledge or innovation system such as the link between the research community, public research organisations, universities, industries and users is minimal. Moreover, research collaboration with other countries or institutions that have the requisite capacity and facilities has not been fully exploited.

4 Ministry of Finance, Planning and Economic Development (2011), The State of Science, Technology and Innovation Report for Fiscal Year 2009/2010.

1.4.2.5 Knowledge Resources

Uganda faces a weak and uncoordinated legal framework for the commercialization and protection of innovations in technology, products and processes. There is insufficient capacity for regulation of intellectual property rights, lack of information about the existence or relevance of international rules and regulations and a dearth of trained lawyers equipped to facilitate IPR agreements.

There are also relatively few opportunities for knowledge exchange. These have negatively impacted on the communication capacity, idea sharing, research collaboration and many others. It is therefore evident that knowledge does not circulate through communities and between communities to the degree it should. In addition, knowledge resource materials in terms of journals, study reports and statistics on science and technology are relatively scarce. This is attributed to the limited attention paid to science communication and the use of science statistics in national and business decision making processes.

2.0 OVERALL GOALS

The Overall goals of the NSTP are to:

Goal 1: Create an enabling policy environment to foster STI and augment their contribution to national development.

Goal 2: Build the STI sector capacity to generate and transfer technology.

Goal 3: Establish and strengthen the legal and regulatory framework to ensure ethics and safety in STI development and application.

Goal 4: Strengthen the STI coordination framework to enhance the sector's performance and contribution to national development.

3.0 STRATEGIES

The NSTP will pursue 16 strategies as means of achieving the stated vision and goals for science and technology development and societal transformation.

Strategy 1: Assess, forecast and advise on issues regarding STI, taking into account current and future trends in development, transfer and diffusion of both local and foreign STI outputs.

Strategy 2: Provide a conducive environment for industrial development in Uganda.

Strategy 3: Strengthen the legal framework for Intellectual Property Management to encourage scientific innovation.

Strategy 4: Guide the judicious use and application of traditional, conventional and emerging technologies for sustainable development.

Strategy 5: Mainstream and actively involve the special needs groups, men, women, and children in all STI activities in order to ensure that the resultant impacts are evenly spread across all sections of society.

Strategy 6: Provide financial support and coordinate STI activities to build capacity and put in place the necessary research, innovation and product development infrastructure.

Strategy 7: Build an education and training system that produces human resources with capacity to generate and effectively apply STI based on contemporary needs of society.

Strategy 8: Provide adequate and state-of-the art STI infrastructure to enable rapid development in the economy.

Strategy 9: Support basic and applied research for enriching the STI information and enhancing both indigenous and imported technology.

Strategy 10: Support development and growth of small and medium enterprises through provision of essential services and infrastructure.

Strategy 11: Apply appropriate safety and health measures in the generation, development and application of STI in all its aspects.

Strategy 12: Ensure that mechanisms are in place to develop and apply STI in accordance with acceptable morals and national societal norms.

Strategy 13: Promote the design, development and commercialization of Ugandan products and services to be internationally competitive by developing and enforcing Ugandan standards in line with the international standards.

Strategy 14: Promote STI awareness and ensure public commitment and support for STI activities in Uganda.

Strategy 15: Develop the STI information management system including the information and communication infrastructure content and services.

Strategy 16: Strengthen the central co-ordinating institution – (UNCST) – to effectively provide a sector-wide framework for planning and coordination; and to establish support linkages with local, regional and international development partners.

4.0 STRATEGIC ACTIONS

4.1 Technology Forecasting, Assessment and Transfer

Studies on Uganda's STI system have shown that technology forecasting, assessment and transfer is the weak link in the technology development chain. Their accelerated development is therefore an important priority under this Plan. Coordination between technology users and developers and between researchers and manufactures is an important element of technology transfer. Access to relevant internal and external resources to individual projects and enterprises shall be enabled. During the initial stages, emphasis will be attached to moving technology from the research laboratories to form new business enterprises.

The following measures will be instituted:

i. Conduct technology audits and forecasts and advice on STI policy and programmes.
ii. Conduct policy studies on topical issues to facilitate evidence-based advice and decision-making in all matters pertaining to STI.
iii. Evaluate and promote technology choices for public and private sector investment.
iv. Create a system to facilitate the transfer, promotion and development of technologies.
v. Strengthen collaboration with Research and Development Institutions (RDIs), professional bodies, private sector, NGOs and civil society in facilitating technology transfer and utilization.

Expected Results

a. STI audits/techno-surveys conducted biennially

A technology survey is an inventory of the country's technological base (hardware, software, and human resources). The audit can help identify strengths and weaknesses in national STI capability. It is a snapshot of the country's technology infrastructure. The surveys will be conducted by UNCST biennially to help inform the national STI policy and planning system, technology acquisition, budgetary allocations and prioritisation (in terms of short, medium and long-term priorities).

b. Five to ten year technology forecast

The rapid pace of technology change makes assessing new technology very challenging and limits the technology time horizon to no more than three to five years. It is therefore imperative that a country plans to update her technology forecasts periodically and assess the current and future technological

needs. A five to ten year technology forecast shall be conducted by UNCST in collaboration with the Ministry responsible for Industry and Technology using both exploratory[5] and normative[6] forecasting methodologies.

The objective of forecasting technologies will be to assess how close an existing technology may change towards the end of its life, identify competing new technologies still in their infancy, assess the opportunities for acquisition/exploitation, provide insights into possible adoption rates of the new technology and advise on the most feasible choice of technology.

c. Inventory of appropriate technologies for Uganda

Technology transfer and utilization shall be accelerated through the maintenance of an inventory of available small scale, medium scale and large scale technologies (plant and machinery) and their sources; the establishment of a pool of technology experts (tact) by sector and scientific discipline; the global search for technologies; maintenance of data bases on technologies, expertise and resources; training and information dissemination of available technologies. The inventory shall be regularly updated to keep pace with the ever evolving STI landscape and made publically available for investment decision making.

d. Technology transfer office

The technology transfer office at UNCST shall be strengthened to facilitate technology identification, transfer and diffusion. The office shall also facilitate commercialization of scientific and technical research products through provision of IP advisory services. Technological choices from abroad will be evaluated, adopted and adapted for local utilisation. SMEs are the largest source of local technological innovation and the technologies shall be harnessed through development of partnerships with Uganda Small Scale Industries' Association (USSIA) which has over 1,200 members countrywide, Uganda Manufacturers Association (UMA) which brings together manufacturers, Uganda Industrial Research Institute (UIRI) for technology incubation, private sector foundation for technology acquisition support and the Uganda Registration Services Bureau (URSB). The office will comprise expert personnel in different S&E fields.

e. Effective technology transfer mechanism

Development of a strategy for effective technology transfer mechanism will require the development of a structured framework on scientific and technological cooperation. However, implementation of the

5 Exploratory technological forecasting starts from today's assured basis of knowledge and is oriented towards the future
6 Normative technological forecasting first assesses future goals, needs, and desires, and works backwards to the present.

technology cooperation strategy should not delay the immediate transfer of relevant technologies in those cases where technology needs and opportunities are identified and the institutional, administrative, policy and legal environment does not prevent their successful transfer and adaptation. Therefore, the following actions will be undertaken to realise this target:

i. Promote the interaction between universities, technical institutes and industry as well as research and development institutions through alliances, joint ventures or public-private partnerships.
ii. Support the set-up of long-term technological cooperation between private firms in developed and developing countries, including the co-financing of technology acquisition, development and commercialization.
iii. Linking the existing STI systems to the national, regional and international information exchange system through the technology transfer office as the clearing house.
iv. Cataloging resources related to business enterprises and connecting would-be entrepreneurs/ researchers and other technology developers to international clusters and organizations which can help in the process of starting new products, companies etc. Such linkages provide referrals for individual business counseling and sources of financing.

f. STI policy notes and advice

UNCST shall produce policy notes regularly in response to the prevailing technological developments. The purpose of the policy notes shall be to provide the target audience with the urgency of the current problem and the need to adopt the preferred alternative or course of action outlined and therefore, serve as an impetus for policy action. The intended audience for the policy notes will be the policy makers, decision-makers, scientists and the public.

4.2 Technological Development

Technological development in Uganda is faced with a myriad of challenges that need to be addressed to ensure sustained economic development. These include inadequate technologies for the processing of agricultural and mineral products; lack of entrepreneurship development and SME support institutions; inadequate industrial institutional support services for the development of a competitive industrial sector; limited scope for forward and backward integration of industries and of industry in relation to other sectors, in particular, the agriculture – industry linkage, which is currently extremely narrow; lack of engineering industries, especially industries producing capital goods intermediate goods, spare parts and components, all of which have restricted Uganda's choice of technologies for industrialization, in particular, for product design, production and maintenance know-how.

Although there are many educated employees in Uganda's agricultural and industrial sectors, they lack the requisite technical and vocational skills. The weak technical skills among industrial workers have been attributed to inadequate capacity of the training institutes. Labour productivity of the workplace in Uganda is lower than that of other countries in the East African sub region and elsewhere in Africa. It is estimated that the country's workforce is 28 percent less productive than the Tanzania workforce and 68 percent less productive than the work force in Kenya[7].

The following measures will be instituted to support technological development:

i. Support to the development of SMEs through facilitation of access to new knowledge, technologies and services.
ii. Support to R&D and innovation efforts in the agricultural and industrial sectors
iii. Mobilizing efforts for increased productivity, improved product quality and quality control.
iv. Fostering linkages among public, private sectors and industry through technology platforms and internship programs.
v. Encouraging linkages between industry - universities and other tertiary institutions for research, innovation, product development and commercialisation.
vi. Adoption of cleaner production technologies and practices.

vii. Implementation of technology transition while addressing climatic change and ensuring acceleration of environmentally sound technology innovation and diffusion.

Expected Results

a. Increased incentives for technology development

The government of Uganda has for long envisioned building an independent, integrated and self sustaining economy. Uganda's economic success, when compared to the rest of sub-Saharan Africa, is impressive, but cannot be sustained without a strong commitment to technological development by putting in place incentive mechanisms for nurturing growth of local enterprise, and moving from basic manufacturing to high-technology production.
There is therefore need to strengthen the current sector-based technological development strategies and to develop a comprehensive and long-term technology development strategy coupled with master plans for individual key sectors. The strategy should enhance productivity and growth, private sector development, value addition and production for export.

7 Ministry of Finance, Planning and Economic Development (2004), Poverty Eradication Action Plan 2004/5-2007/8

b. Increased technology use, labour and firm level productivity

Technology use in Ugandan industrial establishments and business firms has been minimal, at most obsolete or out of production in developed countries. As such, there are high maintenance costs, long down time periods and low productivity. The NSTP creates avenues for acquisition of state of the art and appropriate technology, skills development, retooling of industrial workers and reduction in other impediments to improved industrial efficiency. Technology acquisition schemes among industrial clusters or platforms through group or individual ownership will be introduced and facilitated. Apprenticeship and industrial placements of Ugandan students and industrial workers in developed country firms to enhance their practical skills and productivity is envisaged as part of international exchange programmes under bilateral cooperation agreements that Uganda has entered into with South Africa, Brazil and other countries.

d. Effective linkages among academia, research and industry

Effective linkages involving cooperative research and development activities among industry, academia and research institutions can play an instrumental role in accelerating the development and transfer of new technologies from idea to the market. This requires identification and specification of research needs and knowledge of relevant research that is being conducted. For this to happen, industry needs to be involved at an early stage of research, so as to be able to participate in research definition and design. At the same time, public sector research organizations need to be prepared to support industry in the commercialization process. Other strategies will include;

i. Partnerships and collaborative programmes among research institutions, industry and academia, participatory planning, sharing of best practices and other information.
ii. Upgrading and harnessing of the technological capabilities of the academia in meeting the technology requirements of industries.
iii. Provision of incentives for firms to invest in technology upgrading; assistance in securing international accreditation of quality assurance and standardization.
iv. The government through UNCST and other relevant industrial organizations shall extend S&T support to SMEs through, among others, improvement of their access to available technologies and services, making available technology certification services, and implementing integrated S&T programmes for specific sectors.

4.3 Intellectual Property Management

Intellectual Property (IP) is not yet fully appreciated and embraced as an economic development tool among researchers, policy makers and the public. IP management is also faced with the challenge of weak enforcement capacities due to shortage of financial and skilled human resources, know-how and technology to improve the management, protection, administration, and IPR regulations. The registration procedures are time consuming and costly involving registration at the Uganda Registration Services Bureau (URSB) and the Harare based Africa Regional Intellectual Property Organisation (ARIPO). In addition, the global trade and intellectual property policies tend to disfavour countries that are still in their infancy in terms of technological advancements. This stifles appropriate technology transfer and local innovation leading to, among others, technological balance of payments deficits unfavourable to the low developed economies. Uganda needs to promote and strengthen the intellectual property policy and legal framework, boosting technology creativity, innovation and transfer so as to use intellectual property for development.

The following measures will be instituted:

i. Enactment of appropriate legislation to ensure access to and sustainable use of natural resources, equitable benefit sharing, protection of creativeness and innovation.
ii. Strengthening of the national IPR office to undertake searches, formal and substantive examinations, grant and register patents, trademarks, copyrights and other IPRs.
iii. Encourage membership to regional and global organizations dealing with IPR in order to enhance efficiency and cost effectiveness of the national system.
iv. Facilitate the setting up of institutional support systems for production, protection and commercialisation of innovations and artistic works.
v. Incorporate aspects of IPR in the school curricula at the various levels of education in order to improve awareness.

Expected Results

a. Intellectual property policy

Government shall, within the provisions of the National STI Policy, enact appropriate legislation to ensure sustainable use of natural resources, equitable benefit sharing, protection of creativity and innovation; strengthen the national IPR office to undertake searches, formal and substantive examinations, grant and register patents, trademarks, copyrights and other IPRs and create greater public awareness about intellectual property rights. In addition, Government shall strengthen the implementation of the IP laws

to ensure adequate protection of the inventors and innovators. Ministry of Justice and Constitutional Affairs with the support of other sector agencies shall take the lead in this exercise.

b. Revised IP law

The Uganda Law Reform Commission has been reviewing the intellectual property legislation with a view to amending and up-dating the IP laws. UNCST together with the Ministry of Justice and Constitutional affairs and other stakeholders shall continuously review and update the IP law to take cognisance of the current and future initiatives as well as technology development trends.

c. National IPR office

Section 3 (e) of the UNCST Statute empowers the Council to protect intellectual property rights. The Statute clearly stipulates that one of the functions of the Council "shall be…to protect intellectual property through appropriate patent laws and to operate a national patent office…" In addition, Section 3 of the Patents Statute creates the Office of the Registrar of Patents to supervise the performance of the duties and functions of a Registry of Patents. It also provides for the creation of other officers, including assistant/deputy registrars, as well as examiners. Section 4 of the same Statute creates the Patents Registry with functions related to the procedure for the grant of patents. The office registers licence contracts, assigns the right to a patent and provides patent information services to the public, among other functions.

The foregoing implies a shared responsibility by the Uganda National Council for Science and Technology and the Ministry of Justice and Constitutional Affairs (through the Office of the Registrar General) in the administration and enforcement of IP rights in Uganda. In this regard, the two institutions will work together and co-ordinate the activities regarding IP management. The Ministry of Justice will handle legal and procedural matters while UNCST will handle the technical aspects. A national IP support office will be set up at UNCST under the technology transfer office. The office will work together with the Registrar General's Office to oversee the management and development of IP in the country.

d. Institutional IP offices

A number of Ugandan universities, research institutes and other innovation centers do not have functional policies, structures or mechanisms of managing IP in their respective institutes. In order to properly manage IP, institutions must have IP policies that guide them on how to handle IP as asset holders, users and beneficiaries. The policy would spell out the relationship between the scientist and the institute and how to deal with third parties outside the institute. In addition, it should outline the process of how a scientist in the institute would go about protecting an IP, and how both the scientist and institute would

share revenues when the IP becomes commercially viable. These provisions would also be reflected in the employment contracts of scientists within the institute and in all contractual arrangements with other parties. The institutional IP offices will work in collaboration with the National IP Office. The National IP Office will give support in capacity building, assist with creating IP awareness, and provide essential services such as patent search, guidance in both patent/IP search and application drafting among others.

e. IP Public awareness

An effective public outreach and awareness-building program is an essential component of the IP system. UNCST in collaboration with the Ministry responsible for Constitutional Affairs shall develop and implement a comprehensive public awareness programme on intellectual property issues.
The government shall mainstream IP in the education curriculum at both secondary and tertiary level. Informal avenues of learning will also be fostered through training of SMEs in basic IP concepts and applications. Support shall also be provided to develop IP management capacity and establishment of Technology Transfer Offices (TTOs) in academic institutions. Networked access to URSB patent databases is required to enable UNCST and other stakeholders disseminate relevant technological information and conduct searches of existing technology to design strategies for protection of inventions and innovations.

f. Increased IP applications

The low level of IP applications by Ugandans is largely due to insufficient knowledge among scientists, limited funding for protection and commercialization of research results and lack of coherent IPR policies in Research & Development (R&D) organizations. NSTP proposes the following initiatives to increase IPR applications:

i. Nurturing R&D Capacity for IPR Creation. This shall be accomplished through linking R&D activities to IPR creation such as provision of R&D funds that emphasize protection and commercialization of research results.
ii. Provision of IP Information to entrepreneurs and innovators. This will involve the expansion of IPR information services.

4.4 Traditional, Conventional and Emerging Technologies

Traditional and indigenous knowledge systems play a critical role in the livelihoods of millions of people and are the basis for local based technological advancement. In addition to protecting intellectual property rights over traditional knowledge, there is a need to identify, document and preserve traditional knowledge of relevance to biodiversity and of importance to livelihoods. There is also a need to promote the generation of local technologies that are suited to our local conditions as one of the strategies for spurring locally driven technological development as well as development of local capabilities to identify, effectively transfer, adapt, adopt and diffuse foreign technologies. The emerging technologies come along with a number of opportunities for accelerating national productivity and growth. Therefore, Uganda needs to establish mechanisms for the adoption and commercial exploitation of platform technologies including biotechnology, nanotechnology, information technology and microelectronics. The development and regulation of these promising technologies is a daunting task. The following measures will be instituted:

i. Development of a legal and regulatory framework for R&D activities in traditional, conventional and emerging technologies including among others indigenous knowledge, biotechnology, nanotechnology, information and communication technology, and microelectronics.
ii. Supporting the development of appropriate methodologies for the application of traditional, conventional and emerging technologies.
iii. Organizing and supporting the development of facilities, manpower, and support centres in order to promote and coordinate traditional and emerging technology activities and their diffusion.
iv. Supporting efforts to promote awareness, knowledge and application of traditional and emerging technologies through formulation of relevant policies and other support mechanisms.

Expected Results

a. Policies and regulations

UNCST and other stakeholders shall formulate or strengthen the implementation of policies, regulations and programmes aimed at promoting the use of traditional, conventional and emerging technologies. The expected results from this process will be policies and strategies on traditional, conventional and emerging technologies, legal and regulatory frameworks for R&D activities in traditional, conventional and emerging technologies including among others indigenous knowledge, biotechnology, nanotechnology, information and communication technology, and microelectronics. The legal and regulatory framework shall provide a systematic way for benefit sharing, resource exploitation and utilisation, intellectual property ownership, technology adoption and adaptation.

b. Public awareness

Programmes shall be developed to promote and popularize these technologies within the communities using appropriate media. Community learning centers established by local governments, community bodies and/or non-governmental organizations, programs are some of the mechanisms through with these technologies will be disseminated.

4.5 Gender and Equity

A gender sensitive approach has the potential to define appropriate interventions for men and women. All S&T programs shall aim to systematically address the concerns of both women and men through gender analysis and planning. The interventions shall be designed to enable women and men participate equally in, and benefit from S&T development efforts. The strategic actions that shall guide the development of gender sensitive national strategies and programmes include:

i. Introduction of special programmes to facilitate participation of vulnerable groups through entrepreneurship training aimed at enhancing their ability to utilize and commercialise technology.
ii. Acquisition of technologies that are suited to the needs of men, women, people with disability and other vulnerable groups.
iii. Ensuring equal opportunities for participation in national science and technology programmes.
iv. Introduction of innovative mechanisms of S&T service delivery that ensure adequate access by vulnerable groups such as home based programmes, personal outreach, member associations etc.
v. Introduction of specific incentive measures to enhance participation of vulnerable groups in STI.

There is a need for innovative ways that recognise the challenges faced by the vulnerable groups in the communities such as reaching out to the communities e.g. providing sanitary pads in schools, facilities for visual impairment, deaf, etc.

4.6 Sector Financing and Investment

The Government of Uganda has of recent shown strong commitment to the enhancement and sustainability of S&T funding thus highlighting the role of S&T in stimulating socioeconomic development. Nonetheless, S&T funding in Uganda is still inadequate inevitably resulting into low levels of technology development. The R&D funding is approximately 0.6 percent (2009/2010) compared to the 1 percent of GDP recommended by the African Union. Gross expenditure on science and technology is also still below optimal levels for accelerated development of the STI system.

The following measures will be instituted:

i. Increasing STI sector allocations from 3% to at least 10% of total Government expenditure per annum over the medium term.
ii. Identifying and accessing complimentary funds from bilateral and multilateral sources for the support of STI development.
iii. Encouraging the private sector, through incentives such as venture capital, export processing zones, to make effective financial contribution to STI development.
iv. Creating a national STI Fund to support strategic S&T innovations, acquisition of IP rights for local innovators, and recognition of scientific excellence.
v. Encouraging STI institutions to generate funds by commercialising their services and products and utilizing the funds for the promotion and expansion of STI activities.

Expected Results

a. Science and Technology Budget

Currently, budgetary decision-making within government concerning expenditures on S&T is fragmented as reflected in the budgetary proposals of the existing science, engineering and technology institutions (SETIs). The formulation of the S&T budget will entail identification of elements in sector budgets that could be funded within the overall S&T budget. A Science and Technology budget will be an important tool for priority setting, resource allocation and programme assessment.

b. Science Technology and Innovation Fund (STIF)

Article 20 (3) of the Uganda National Council for Science and Technology Statute provides for establishment of a National Science and Technology Fund to support local research and product innovations. It states that: "There be established a fund to be known as the National Science and Technology Fund to be administered by the Council for purposes of promoting research. The S&T Fund is also provided for in the National Science, Technology and Innovation Policy (2009).

This plan proposes to operationalize the Science, Technology and Innovation Fund (STIF) in order to facilitate investment in key science and research initiatives of strategic and sustainable value to the nation. The Fund will support transformational investments that have a demonstrable potential to generate significant and sustainable economic, social and environmental benefits to the nation.

The Fund is expected to consolidate the current STI financing mechanisms and other adhoc sector support instruments into a single, coherent, consistent and sustainable STI funding instrument. This plan proposes initial capitalisation of the STIF by treasury allocation amounting to UShs 50 billion and annually replenished as guided by the level of sector investment and growth. The fund will also be open to contributions from the private sector, development partners and civil society. STI grants to eligible research institutions, innovation clusters, technology platforms and formally constituted research teams will be accessed on a competitive basis to promote scientific excellence. The fund will support implementation of priorities identified in the National Development Plan and the National Science, Technology and Innovation Policy.

c. Increased Bilateral and Multilateral support to STI programmes

Science and Technology play a significant role in national, regional and international growth and development processes. S&T is also a key instrument for development cooperation; it is therefore necessary to pool resources together to implement national, regional and international programmes. NSTP will serve to identify and harmonise the priorities of these global actors to enable them make a contribution to Uganda's development efforts. Coordinated development partner support will be required to complement government and private sector support for Science and Technology development.

d. Private sector participation

The National Science, Technology and Innovation Plan will support and facilitate the private sector to effectively participate in STI financing and development. The strategies for increasing private sector participation in S&T will include; provision of shared facilities for MSME incubation or development, joint partnerships in research, technology development and diffusion, identification of commercially viable activities, provision of credit facilities for new investments in science and technology activities, provision of adequate local market for R&D products and support for development of technology clusters.

4.7 Human Capital Development and Retention

The current Ugandan education system emphasizes theoretical academic work with little depth of applied science, engineering and technical skills which are central to technological innovation. The ratio of arts to S&T graduates at the Universities is 5:1 and less than 20 PhDs in S&T disciplines are produced by the universities per annum. Apart from Makerere University which was ranked 8th in Africa in 2011, the overall ranking of other Ugandan Universities and specialised STI institutions is extremely low, compared to Universities in the developing world.

The NSTP will strengthen science and technology education, build future S&T capabilities through focused programs in basic and higher education, align vocational, technical and skills development programmes to the requirements of global competitiveness of Ugandan industries, promote partnerships with the private sector, harness the potential of locally available S&T expertise in the different sectors, and maximize the contributions of Ugandan S&T professionals abroad to the national S&T development efforts.

In the medium term, human resource development shall aim at building future S&T capabilities through focused programmes in basic and higher education. This shall be achieved through the following measures:

i. Strengthening of STI education at all levels of Uganda's education system with a view to producing an STI literate society.
ii. Creating a critical mass of STI graduates with adequate intellectual, practical and vocational skills to meet the labour requirements in the various STI sectors.
iii. Nurturing and promoting STI education within the informal sector through adult literacy programs.
iv. Encouraging basic research and supporting development of appropriate professional human resource.
v. Supporting domestic production and maintenance of STI educational equipment and materials.
vi. Improving the welfare and working conditions of practising scientists.
vii. Creating facilities and centres of excellence for training, research and innovation for scientists and engineers.

Expected Results

a. Increased number of science graduates

Human resource training is an essential condition for technical progress. Therefore, programmes for enhancement of Uganda's scientific and technological human resource capacity shall include increasing the enrollment level in STE courses from the current 20 percent to 50 percent of total tertiary enrolment by building science, research and technical infrastructure at all levels of education; creating a critical mass of scientists, technologists and engineers with practical skills that are demanded by the labour market through increased industrial training and curriculum review to emphasize vocational training; increasing enrolments in technical and vocational institutes; and building a critical mass of well trained, skilled and adequately motivated faculty teachers, instructors and lecturers.

b. Revised science education curriculum

The government will support the Ministry in charge of Education, Universities and other institutions of learning to redesign, upgrade and or modify the science teaching curriculum. The principles governing the development and design of this curriculum shall build upon the following 1) active construction or practical learning within the existing environment 2) learner-centered and enquiry based teaching approaches 3) social interactions – finding solutions to the existing societal problems 4) the structure of expert knowledge and 5) science as a way of life and knowledge creation - that is science teaching and assessment shall focus on values that society regard as important. The aim of these efforts will be to generate a workforce which is practical oriented and able to address the needs of a growing economy.

c. Science Centers

The government shall develop Science Centers in all districts whose goal shall be "to advance the levels of scientific and technological literacy in the population, especially the youth and the elderly, by presenting functional scientific knowledge and skills in their most palatable forms". In so doing, the government will contribute towards bridging the existing gap between classroom learning and practical orientation through semi formal and informal learning processes. The Centres shall focus on different clusters of science and technology including basic, applied and future sciences to promote technology diffusion and utilisation by the local communities.

d. Labour force Skills development

Development of the knowledge and skills that make the workforce more efficient and productive is imperative for Uganda. The NSTP provides for skills development and re-tooling of the workforce in both the private and public sectors. The aim of the plan is to develop an effective S&T workforce comprising artisans and highly trained and skilled personnel. Skills development shall occur at the workplace, in gazzetted training facilities in various ministries and private sector organizations.

4.8 STI Infrastructure

The buildup and maintenance of a good S&T infrastructure shall form an integral part of the long and short-term strategy for implementation of this plan. In building the country's S&T infrastructure, emphasis shall be given to strengthening the capabilities of the existing centers of excellence in S&T priority areas, upgrading of regional and local capabilities, and provision of support to encourage and enable the private sector to carry out technological innovation and related activities/services.

The following measures shall be instituted:

i. Establishment, operation, maintenance and upgrading of major national facilities for research and innovation.
ii. Establishment and adequately equipping science laboratories in public research and training institutions.
iii. Encouragement of increased private sector participation in the development of STI infrastructure.
iv. Establishment, operation and maintenance of technical services (e.g. metrology, standardisation, and calibration).
v. Establishment of electronic networking for STI information dissemination and knowledge sharing among Ugandan universities and centres of excellence.

Expected Results

a. New and improved R&D facilities

Research, development and innovation institutions or centres will provide training facilities at the highest level and undertake major projects to address national development needs. Establishment of new scientific research institutions (energy, environment and space science), laboratories (teaching, research and analytical), appropriate technology development and incubation centres, centres of innovation and scientific excellence will be prioritised in this plan. Attention shall be given to the judicious utilization of the already available resources for rehabilitating, upgrading and equipping the existing institutions such as universities, incubation centres and research institutes. Given the existence of a handful of research institutions within the regions, the government shall set up science parks in the four regions of the country.

b. Adequately developed S&T facilities

The NSTP shall support the rehabilitation, equipping and maintenance of research and development institutions, technology product development incubators, technology development centres, university and secondary school laboratories to provide fully functional and accessible research, product development and incubation infrastructure for students, scientists, and innovators. This will complement on-going government efforts to develop research infrastructure in several sectors of the economy. The NSTP will also encourage sharing of infrastructure across institutions or sectors through provision of centralised multi-purpose research infrastructure in the various regions of the country. State-of-the-art science and technology infrastructure is expected to improve the quality of science education and product innovation among the students, academia and career researchers.

c. Effective STI Information management system

Information sharing among SETIs is currently very limited due to disjointed and at times absent ICT infrastructure in the institutions. The NSTP will create a platform across the STI system for information sharing, management and networking. The system will constitute part of the existing e-government efforts by focussing on improvement of delivery of scientific and technological services, including data and statistics sharing by all institutions in the national STI system. UNCST will follow up with the Ministry responsible for ICT and actively participate in the roll out of the e-government master plan.

d. Increased networking among SETIs

The network infrastructure will include local and wide area networks linking SETIs. It will have standardization of software and user platforms for networking of scientists and engineers. This will be complemented by other mechanisms for formal collaboration and knowledge sharing across SETIs. Professional associations and research networks are also expected to thrive on the well developed and functional STI infrastructure.

4.9 Research and Development

The majority of high quality scientific research activities in the country are carried out in a small number of research institutes especially in the fields of agricultural and medical sciences. World-class discoveries have been made in HIV/AIDS prevention and vaccine trials, cassava mosaic eradication, and development of clonal coffee. These are supported mainly by foreign sources of funds.

The research and development (R&D) programmes aim to stimulate and support technological innovations which have applications in several economic sectors. Resources and activities shall be directed to maximizing S&T's contribution to the creation of wealth and addressing the pressing societal problems. Private-sector investment and participation in R&D activities shall likewise be encouraged.

The following measures shall be instituted:

i. Promotion and enhancement of basic, applied and development research and research on culture, norms and values relating to STI development.
ii. Provision of support to local institutions to conduct research on strategic STI issues.
iii. Establishment of national research priorities and funding their implementation through competitive research grants for both public and private institutions and research clusters.
iv. Provision of adequate public funds for national research programmes and financial incentives for researchers.

v. Strengthening the existing and establishment of new R&D institutions in strategic areas of STI for national development.
vi. Strengthening and supporting training and research skills of scientific staff to ensure a key role for local scientists in application of imported technology and development of indigenous technology.
vii. Ensuring the application and commercialisation of results and products of research.
viii. Encouraging and strengthening collaboration with regional and international research institutions.

Expected Results

a. National research priorities

UNCST will, in consultation with all sectors of the economy, spearhead the development of national research priorities. The priorities which will be derived from the National Development Plan (NDP), the NSTP, the sector plans and other strategic documents shall be regularly reviewed and aligned with prevailing STI and economic development directions. A wide cross-section of STI stakeholders shall evaluate research processes, create triage lists and priorities, evaluate and select the research priorities for each sector and provide strategies for implementation of the research programmes. Choices about research priorities and approaches shall be informed by demand, shared interests and national development priorities.

b. Research productivity and commercialisation

NSTP shall develop a holistic system where independent researchers working on related research projects will be clustered under a single research initiative in order to improve research collaboration, synergy and productivity. The research productivity will be enhanced by a strong product development support mechanism that involves incubation centres, technical and business mentoring and product marketing partnerships.

c. Collaborative Research

The correlation of the national need for innovation with the evolution of science and technology in the world takes place through research-action networks, where the multidisciplinary international cooperation is targeted to the resolution of specifically identified problems. NSTP shall promote strategic local and international partnership in research and development.

d. Increased utilization of research findings

The use of research results for decision support in business and public policy will be encouraged through increased support to policy-oriented research conducted by academic and research and development institutions. Also increased involvement and dissemination of research results to policy makers, planners and entrepreneurs is expected to improve the uptake and utility of research results. The research is expected to be demand driven or geared towards addressing common societal challenges. UNCST will showcase and facilitate dissemination of research results through appropriate means to foster public uptake and utilization of research results.

4.10 Technology Incubation

In technologically advanced countries, the development of industries or technologies does not happen in isolation from other industries or technologies. Rather, technological development occurs on a relatively narrow front and often in clusters of related interacting or supporting industries. Considering the resource limitations, the forward and backward linkages of industries will be an important criterion in prioritizing industries to be provided with technological assistance and other available incentives. Therefore, industry clusters will be supported under a collaborated arrangement among UNCST, Uganda Industrial Research Institute and the Ministry responsible for industrial development.

The following measures shall be instituted:

i. Establishing and maintaining science and technology parks with state-of-the art infrastructure.
ii. Supporting researchers and innovators to develop prototypes from results of their research.
iii. Facilitating the establishment of central research infrastructure facilities to incubate commercially viable innovations.
iv. Promoting the creation of innovative technology-based companies by assisting them to access funding facilities and viable partnerships.
v. Providing entrepreneurial and business skills through training and consultancy.

Expected Results

a. Science and Technology Parks

The science and technology parks shall provide a unique comprehensive balance of technology support and R&D capabilities including incubator facilities suitable for scientists, researchers, innovators and SMEs including technology assessment and transfer programmes. Other offerings shall include business

mentoring and apprenticeship services, marketing and financial consultancy services, technology development and business platforms to researchers, scientists, innovators and SMEs; and technology commercialization assistance. This will include advisory and consultancy services in technology transfer, project management, market research and opportunity analysis and professional development programmes. The National Science and Technology Park will be constructed in Kampala and other regional Parks distributed nation-wide to extend the aforementioned services to entrepreneurs and the private sector.

b. Incubation centres

Technology incubation and development centres shall be set up within the Technology Park specifically focusing on nurturing key sectors in the national development agenda. The incubation centres will be designed to accelerate successful development of entrepreneurial companies/ individuals through an array of business support resources and services, developed and orchestrated by incubator management. The technology incubators will offer support services and resources for nurturing start-up science and technology enterprises with the goal of developing them into financially viable businesses equipped with the tools for long-term survival and growth. The Incubation Centres will build collaborative capacities between the universities and industrialists and provide business start up services, nurturing and development, marketing assistance, access to funding, establish strategic partnerships, comprehensive business training programmes, scientific and business mentors, technology commercialization assistance, and help with intellectual property management. Specific guidelines and procedures on entry, duration of stay and exit shall be developed and publicized.

c. Spin off companies

Technological innovation efforts shall provide an important impetus for the emergence and growth of technology-based spin-off enterprises. With the growth of such enterprises, venture capital will play an increasing role in technology development and commercialization, especially among small and medium enterprises (SMEs).

4.11 STI Safety Regulations

Uganda has developed regulatory frameworks for STI such as the Research Registration and Clearance Policy and Guidelines (2007), National Guidelines for Research involving Humans as Research Participants (2007), and the National Environment Regulations (2005). Instruments to regulate application of the frameworks are embedded in provisions of sectoral laws that relate to broader areas such as agriculture, environment and health. As a result, various institutions implement elements of STI as stipulated within

their mandates. However, this has in some instances, led to duplication of effort, conflict of interest and disjointed coordination of regulation aspects of science, technology and innovation.

Safety in research, science and technology involves the safety of the scientist developing the idea, the infrastructure, the consumer of the product and the environment. Public awareness about the technological developments and the associated safety considerations is of paramount importance if scientific developments are to be safe, socially acceptable, economically viable and sustainable. Equally important is the independence of the regulatory system for influences originating from within and outside the economy. The national safety standards need to be harmonised with the regional and international standards.

The following measures shall be instituted:

a) Development of policies, guidelines and regulations on conceivable, unintended or detrimental effects of scientific and technological development.
b) Improvement of facilities for and to ensure adoption of best practices in generation and application of STI.
c) Encouragement of regional and international co-operation in safety on STI.
d) Development of national capacity for risk assessment and management in scientific and technological development.
e) Adoption of cleaner production technologies and practices.
f) Raising public awareness on safe use, application and disposal of STI products.
g) Strengthening the research registration and clearance function of Government.

Expected Results

a. STI guidelines

The NSTP shall provide for strengthening of regulatory mechanisms including institutional, human skills, technological and infrastructure capacities to minimise the likely adverse effects of STI development. The STI guidelines will be regularly reviewed and updated to keep in line with the state of development of science and technology. Government will, in collaboration with other stakeholders, develop effective mechanisms for implementing these guidelines.

b. Increased compliance with S&T regulations

The NSTP aims to increase compliance with S&T regulations through increased public awareness, inter-institutional collaboration, field inspections, non compliance penalties and provision of incentives such as enabling researchers to access avenues for publication and dissemination of their findings and recognition and award of scientific research and innovation excellence. In particular, UNCST will intensify efforts to increase registration of all persons and institutions carrying out research in Uganda.

c. Reduced incidence of research risks

The adoption of new technologies comes with increased need for safety precaution by the country. These potential risks will be effectively managed under a strict and adoptive regulatory regime that adequately empowers the scientists, STI institutions and the public to constantly assess the risks and adequately prepare for their mitigation. Inspection and supervision of research facilities by certified STI inspectors will be prioritised and executed.

4.12 Ethics in STI

Current global developments in science and technology raise a host of moral and ethical issues that need to be handled judiciously in order to fully exploit the positive attributes of scientific and technological advancement. Considering the fact that ethics is subjective in nature, there is need to assess the ethical code and agree on what constitutes unethical behaviour and put in place regulations that will uplift the ethical standards of scientific and technological endeavours.

The following measures shall be instituted:

i. Establishment of acceptable ethical codes of conduct for undertaking STI applications.
ii. Strengthening of the ethical review system through establishment of Institutional Review Boards in all SETIs.
iii. Streamlining the procedures for research registration and clearance.
iv. Enhancing the monitoring and field support for R&D programmes and activities.
v. Establishment of a National Research Register.

Expected Results

a. Code of conduct for STI

Government has developed guidelines on research involving human participants and guidelines on research registration. This plan provides for expansion of the guidelines to include animals and plants. UNCST shall, in consultation with other regulatory agencies, professional bodies and relevant stakeholders develop, publish, disseminate and institutionalize the code of conduct for scientists, science entrepreneurs and researchers. The code of conduct shall spell out the incentive mechanisms for compliance as well as penalties for non compliance.

b. Institutional Review Boards

UNCST will facilitate the establishment and strengthening of Institutional Review Boards (IRBs) in universities, technical institutes, innovation centres and research institutes. The IRBs shall review research activities within their institutions and protect the safety and welfare of research subjects.

c. Increased inspection of research facilities

UNCST shall intensify field supervision of research institutions, innovation centres and individual researchers to ensure adherence to research regulations. UNCST shall, in addition, institute research management policies enabling research institutions and district local governments to provide field level support to the individual researchers. The field inspectors shall be empowered to enforce research regulations with some level of independence. The scientific and local communities will also be empowered to monitor and report on research activities in their localities.

d. National Research Register

In executing its mandate, UNCST on behalf of government shall register and clear all research activities intended to be carried out in Uganda. NSTP provides for increased coordination and use of the research registry. The National Research Register shall consolidate records of the various disciplinary and sector-based research registries in the country. The register shall assist researchers to identify potential research partners, streamline, harmonise and avoid duplications of the already existing research activities.

4.13 STI Standards and Quality Assurance

Development of a technology or a product is aimed at ensuring that it is of good quality and meets the required specifications.

The following measures shall be instituted by the NSTP:

i. Strengthening institutional framework for enforcement of quality standards in the development and application of STI.
ii. Establishment of testing systems to enable laboratories to test raw materials and manufactured goods for domestic and foreign markets.
iii. Introduction of certification systems for products and companies.
iv. Introduction of accreditation systems for both laboratories and company certification bodies.
v. Ensuring development of national standards for all products to assist in establishing programmes for orderly evaluation, selection, acquisition and adaptation of appropriate traditional and contemporary technologies.
vi. Establishment of an information system on standards and quality.
vii. Strengthening the import quality control mechanism to enforce the minimum quality standards for Uganda.
viii. Training personnel from industry, research and development institutions and government departments in all matters related to standards and total quality management.
ix. Ensuring that all goods produced and sold in Uganda conform to the national standards.
x. Encouraging the use of sustainable technologies, which are environmentally sound and safe to the consumers.
xi. Sensitization of the public on process and product quality and standards.

Expected Results

a. Equipped and functional testing laboratories

UNBS currently has five functional laboratories although only one is accredited. NSTP will provide for the development of all round capacities in product standardization and quality assurance.

b. Certification system for all nationally produced products

Uganda's competitiveness in the global market economy is dictated by its ability to comply with international standards and industry best practices. In line with the national strategy to sustain and

enhance the competitiveness of local products and exports, NSTP will enhance industrial efficiency and productivity through national certification of all products, testing, measurements and international standardization.

c. Increased capacity for standards enforcement

Standards enforcement has been limited by the inability to regularly inspect and ensure compliance by the producers, traders, regulators and consumers of products and services. NSTP will strengthen the capacities of stakeholders through skills development and standards sensitization. Inspectors will be adequately empowered to enforce the national standards and regulation with incentives for compliance and non-compliance.

d. Production and importation of quality products

Compliance with national standards requires that locally manufactured and imported products meet quality standards. UNBS shall, in collaboration with other regulatory agencies and stakeholders, be responsible for this activity. UNBS' activities and programmes shall be aimed at ensuring that imported and locally manufactured products that are sold on the market conform to national, regional and international standards.

4.14 Public Awareness and Appreciation of STI

S&T is an esoteric or remote subject to many Ugandans rather than an important part of their daily activities or existence. NSTP will popularize S&T through dissemination and re-packaging of S&T information in local languages; promotion of culture of innovation; establishment of and strengthening the interface platforms between scientists and policy makers; promotion of inter and intra disciplinary competition in S&T; recognition and reward for S&T achievers and achievements. NSTP shall be implemented to:

a) Sensitize policy makers and the public about the critical importance of the STI sector for economic prosperity.
b) Strengthen lobby and advocacy capacity and mechanisms for STI at various levels within the executive, the legislature and the public.
c) Support the development of an environment that will boost the status of STI in Uganda.
d) Establish and support forums through which policy makers, political leaders and stakeholders can deliberate on topical STI matters on a regular basis.
e) Conduct school visits at all levels of learning to improve the perception towards STI careers.
f) Encourage and support efforts to promote STI literacy.

g) Promote and encourage science journalism in Uganda.
h) Encourage and support the publication and marketing of books, research features, journals and periodicals of STI.

Expected Results

a. STI advocacy forum

Science and technology has not been accorded the rightful position in national development agenda due to absence of a consistent voice in the executive, legislative and judicial arms of government and the private sector. The advocacy forum will comprise of leadership of all the SETIs that share common interest and stake in promoting and implementing different science and technology aspects. Additional forums for science and technology in schools, universities, research institutions, MDAs and the public will be organised to discuss topical issues that affect the public whose solutions could be found in the judicious application of science and technology. Think tank forums will also be organised to bring together scientists, researchers, policy makers, politicians, advocacy groups and the public to engage in shaping the country's science and technology development. The advocacy exercise will be premised on empirical evidence and follow acceptable public sector management channels, procedures and principles.

b. National Science Week

National Science Week (NSW) will provide opportunity for taking stock, showcasing, reflecting upon and mapping strategies for realising national aspirations for science and technology and economic development. NSW events will aim at raising awareness to inspire people of all ages to participate in and support science, engineering and technology. NSTP will ensure that the NSW is gazetted and held in September of every year and commemorated by SETIs with support from government, development partners, private sector, NGO and well-wishers.

c. Increased public support and participation in STI

Public support to science and technology is expected to result from increased awareness and appreciation of the role of science and technology in the development process. It is expected that the publicity and advocacy activities will garner public support for science and technology. NSTP aims to increase public participation and support for STI activities through translation of the STI Policy and Plan into popular versions using the four major local languages, media (print, visual and audio), journals, bulletins and newsletters that highlight key scientific events and issues, use of interactive web blogs, roadside shows, and several other effective avenues. The level of public support and participation will be gauged from

the level of students' interest and performance in science and technology subjects at all levels, the level of public patronage of science facilities and events, public readership of scientific materials and resources and prioritization of science and technology in the national budgeting and expenditure plans. CONSENT, UCPA, NGOs, CBOs, etc that protect consumers rights shall be involved in sensitizing the public on the importance of science and technology.

d. Increased scientific literacy and public readership of scientific publications

Scientific literacy is normally a result of intermediate and advanced formal education in scientific and technological disciplines. There is a strong linkage between scientific literacy and the economic wellbeing of individuals in society such as health, environment, etc. The current universal education programmes, including the adult literacy that Uganda is implementing are expected to increase the level of scientific literacy in the population. NSTP provides for semi-formal and informal methods of increasing scientific literacy such as short-term tailor made courses and vocational training in functioning and practical application of technological utilities at household (such as phone, cooker, vehicle, sewing machine etc) and industrial level (such as automated teller machines, street parking machines, public pay phones etc) that improve individual functioning in a modern setting and civic responsibility of citizens. Scientific materials and results shall be communicated in major local languages and in condensed form to improve readership and communication. Popular communication media such as radio, community centres, etc shall be used to disseminate scientific information and popularize science and technology.

e. Science culture

Science culture refers to attitude of an individual in a given socio-cultural environment. The spirit of inquiry and the degree of acceptance of the right to question and be questioned is considered fundamental to the development of a scientific and cultural temperament. It calls upon one to seek the "how", "what" and "why" of everything that goes on in the society. This culture of inquisition is capable of building a community which is scientifically cautious of their surroundings and create new insights or ideas that enhance scientific progress through local innovation. Science culture has implications on societal transformation and development through transformation or phasing out of traditional practices and norms that bring about under development. NSTP envisages gradual introduction of this culture in a manner that appeals to the norms of the Ugandan society.

4.15 STI Information Management System

Most information management systems are isolated and unshakeable among SETIs. Efforts to develop information portals and websites for public institutions are still ongoing and remain to be fully embraced by all institutions. NSTP provides for creation of an intranet for SETIs with standard or interoperable system software to enable standardized data management and sharing for policy, business and educational purposes.

The following measures shall be instituted:

i. Establishment of an ICT network infrastructure that will provide an enabling environment to support quality learning, research, management and business.
ii. Encourage efficiency through open competition in the provision of information and communications service.
iii. Encourage and support the development of information technology skills required to provide the maintenance and support services needed for global competitiveness of local enterprises.
iv. Promote access to STI information through public and private libraries with adequate stocks of STI reading materials.
v. Promote high national productivity and greater efficiency through use of modern technology information systems within government and private sector.
vi. Develop national on-line database systems on the broad spectrum of the economy as part of the e-government strategy for STI system.
vii. Establish a national STI resource centre and information Management system for decision support and performance monitoring.
viii. Strengthen and network the information units of the existing STI institutions.

Expected Results

a. An operational STI information management system

STI information is a major component for coordination and information sharing by all SETIs. A national STI information management centre shall be established at UNCST and act as a source and repository of information relevant to the making of policies and decisions on S&T related matters. The centre shall provide an interface between three major groups of players in the S&T system, namely, the policy making and research funding organisations, researchers and research product users. Scientific and Technological services provided by the centre will include:

- Development and maintenance of an on-line S&T database.
- National S&T Indicators development and forecasting (status, trends and future directions).
- National research and development survey data.
- Public awareness of S&T survey data.
- STI performance indicators.

b. Integrated STI Information system with the wider e-government network

The science and technology management information system (STMIS) will provide access rights for networked SETIs for uploading and editing of content and build on the existing e-government network infrastructure. It will support e-government applications such as data sharing, research registration, research grant applications, patent and other IP applications, technology transfer applications and other functions. The data formats and software shall be standardised, made user friendly and inter-operable across institutions.

c. Well stocked public and private libraries

Uganda currently has 30 public libraries; most of these have small stocks of up-to-date reading materials, weak ICT infrastructure, and a few qualified personnel. Makerere University, for instance, has started a merger of libraries with the School of Computing and Informatics to improve the infrastructure and information dissemination. Private libraries are mainly located at private institutions of higher learning. NSTP intends to strengthen the repository system, create linkages with international publishers and citation mechanisms. Mbarara University of Science and Technology, on the other hand, promotes the use of e-library and other e-applications that support wide readership of scientific materials. These include e-journals, e-books and e-granary with visual and audio capacities to support use by the persons with visual or auditory impairment or those that prefer to see and listen rather than read voluminous materials.

d. Increased information dissemination and sharing across government departments

In Uganda, access to information is not satisfactory. Information is available but not accessible across MDAs. The communication systems among MDAs are too bureaucratic; most libraries are still manual and frustrating to users when searching for archived information. Government shall, therefore, develop a framework to promote information sharing across MDAs. This will involve implementation of the access to public information law and roll-out of the e-government infrastructure programme.

f. National STI resource centre

NSTP supports the efforts to establish a national resource centre and databank to act as a repository of key national information, data and statistics. Access to the data will be liberalized for government agencies and in accordance with the applicable level of public dissemination.

4.16 Sector Coordination and Partnerships

NSTP will encourage collaborative programmes among government, industry and strengthen SETIs to effectively carry out S&T activities, and promote interaction among sectors.

The following measures shall be instituted:

i. Strengthening of the institutional capacity of Uganda National Council for Science and Technology to effectively coordinate the formulation and implementation of STI policies and programs.
ii. Streamline the institutional framework for STI to enhance coordination and synergies in implementing STI activities and programmes.
iii. Establishment of STI inter-institutional mechanisms for information sharing and collaboration in implementing STI activities.
iv. Promotion of linkages between sectors and among stakeholders by fostering public-public, public-private and private-private partnerships in research and innovation, product development and commercialisation.
v. Gazetting National Science Week as a public forum for review and discussion of national STI activities and programmes.
vi. Participation in appropriate and beneficial STI forums and programmes both regionally and internationally.
vii. Entering into agreements with countries that can offer ample opportunities for co-operation in STI.
viii. Development of partnerships for exchange of people, ideas and support facilities.
ix. Enhancing international partnerships and cooperation in STI.

Expected Results

a. A functional institutional coordination framework

Uganda's STI system is fragmented and governed by a combination of sectoral ministries and numerous autonomous institutions (Councils, Commissions, and Authorities) whose mandates, in some instances, with regard to S&T development appear to overlap rather than complement and enhance each other. The existence of a plethora of SETIs, often with somewhat parallel mandates, complicates the national STI coordination function of government. Moreover, UNCST Statute No.1 of 1990 (Cap 209 of the Laws of Uganda 2002) does not explicitly spell out UNCST's regulatory functions or adequately empower it to undertake the co-ordination function for effective execution of its mandate. UNCST, therefore, uses guidance and advice approaches rather than the more effective legal and regulatory approaches in management of science and technology development in the country.

NSTP will strengthen the coordination mechanism for science and technology and ensure that STI is reflected in national development policies and programmes. In addition, it will provide for coordination across SETIs in policy, R&D, innovation programmes and international cooperation.

b. Increased STI Partnerships

Government recognises the complementary role of the private sector in national development and has instituted a wide range of incentives to increase private participation in various economic and social sectors. NSTP will provide for mutually beneficial partnerships in the development of the national science and technology system in ways that provide an acceptable trade-off between public and private interests. NSTP will further establish partnerships with CBOs, NGOs and civil society organizations in reaching out the vulnerable and hard to access areas. Such partnerships are envisaged in establishment and upgrade of infrastructure, research and product development, industrial production and commercialisation.

c. Regional and international STI programmes

Government shall support and seek co-operation with regional and international organizations in the promotion of science and technology. NSTP will utilize the regional, continental and other international organizations to strengthen Uganda's scientific and technological capability. Through sub-regional and regional co-operation, Government will encourage establishment of institutions or associations to manage and implement multinational and national programmes and projects. In addition, NSTP will provide mechanisms to initiate and actively participate in regional STI activities and programmes.

d. Protocols for International cooperation in STI

The NSTP will continue to support Uganda's cooperation with developed and developing countries to attract increased international investments in STI. Such protocols will build and supplement previous cooperative arrangements in STI. In addition, joint technical cooperation projects, sharing, training and exchange of experts among the relevant S&T institutions will be promoted to strengthen collective STI capacity. NSTP will strengthen Uganda's capacity to cooperate within the international fora by formalising cooperation arrangements. Furthermore, NSTP will ensure that Uganda initiates international protocols on mutually acceptable terms and in areas where it has a competitive advantage in science, technology and development.

e. Increased global relevance of Uganda's STI efforts

The advancement of science is based on a system of peer review and common exploration of issues through conferences and seminars, journal publications and exchange of scientists through post-doctoral research fellowships and sabbaticals, exchange of artisans and other technical personnel. Therefore, it is important that Uganda participates in global STI initiatives and creates conditions that are attractive and motivate foreign scientists, engineers and technologists to develop appropriate networks with Ugandan counterparts for internationalisation of research, innovation and industrial production. The results of the research shall be published in the Ugandan and international journals, showcased in international fora and disseminated through other appropriate media as widely as possible.

It is not possible to undertake these activities without increasing the mobility of scientists, through conferences, industrial training, exchange programmes, stronger inter-institutional relationships and directing resources towards programmes that would specifically enhance technological cooperation, technology transfer and diffusion.

f. Strong coordinating body

NSTP provides for institutional capacity strengthening of UNCST in terms of the legal and institutional framework, infrastructure facilities, human and financial resources and inter-sectoral collaboration to improve STI coordination in the country. The STI capacity enhancement programmes will look into the ideal state of the capability dimensions in terms of numbers, functionality, efficiency, effectiveness, adequacy, results and development impact of UNCST and the entire science and technology system. The scope of the capacities shall reflect the national nature of the institution and provide a profile that enables UNCST to implement its mandate effectively. The programmes will be consistent with regional and international best practices in organizational development and management practices. UNCST shall continuously carryout assessments and regular STI sector performance audits to ensure continuity of plans and programmes, coordination of national STI efforts, strengthening of monitoring and evaluation and results-oriented sector policy management.

5.0 NSTP IMPLEMENTATION FRAMEWORK

NSTP is intended to serve as the national strategic planning framework for the country's S&T development in the coming five years. The attainment of its objectives and targets will depend upon its level, pace and extent of implementation. The implementation arrangements and mechanisms in the next section have been devised for this purpose.

5.1 Institutional Arrangements

The National Council for Science and Technology which has the mandate to develop policies, plans, programs and budgets as well as guide the development of science and technology in Uganda will coordinate the implementation of NSTP. A number of programmes and projects within the NSTP will be implemented under the line ministries, departments and agencies that are mandated to oversee their development. UNCST shall develop partnerships and networks among different stakeholders through creation of technical working groups to steer and oversee particular NSTP programmes and projects. It will also spearhead the establishment of systems and processes like, the preparation of an STI budget, STI plans and programmes to enable roll-out of the NSTP across all sectors of the economy.

5.2 Operational Plans

Operational Plans shall be prepared every year to define the detailed activities and courses of action to be taken for each identified strategy and area thrust arising from the NSTP. As in the formulation of the NSTP, these plans will be prepared by the mandated Ministries, Departments and Agencies (MDAs) that are specifically responsible for a particular thrust and the private sector in close consultation and collaboration with UNCST and other relevant stakeholders.

5.3 Financing

Implementation of the NSTP will build on current Government of Uganda (GoU) commitments for the STI sector although more funding commitments in the short-, medium-, and long-term perspective are envisaged. While the bulk of the resources can be obtained from the current sector allocations, new funding sources for long-term development of the sector are required. The science, technology and engineering institutions (SETIs), which are responsible for implementing this policy, will budget for and

directly access funds through their sectoral budgeting processes. The initial five year cost forecast for coordinating the implementation of the STI policy is estimated at UG Shs 830 billion. Government has already committed an annual allocation of UG Shs 8 billion starting from fiscal year 2007/2008 towards scientific research and innovation activities conducted by distinguished local researchers.

In addition to current financial commitments to research and development through support to SETIs, Government will endeavour to capitalise the STI Fund with up to Ushs.50 billion over the short term to competitively finance cutting-edge scientific research and innovations of strategic national importance; acquisition of intellectual property rights by local innovators; and recognition of scientific excellence among local scientists. The funding for these usually falls outside the scope of any donor funding priorities but are very critical in enhancing national capability in science, technology and economic development. The fund will be annually replenished up to 20 percent of STI sector budget allocations.

Furthermore, Government will continue to explore mechanisms for creating basket funding for the STI sector via the Uganda Joint Country Assistance Strategy (UJAS) and by increasing both foreign and local investment in STI by fostering private-private and public-private sector partnerships for financing the sector.

6.0 PERFORMANCE MONITORING AND EVALUATION

To ensure its continued relevance and successful implementation, mechanisms shall be adopted to regularly monitor, assess and review the NSTP. Existing measurements, strategies, indicators of implementation and performance under the Plan shall also be refined. The following activities shall be undertaken:

6.1. Measurement of Results

Measuring performance of the NSTP implementation shall be pursued at two levels. The first level is enhancement of the country's national S&T statistical indicators. The collection and dissemination of S&T statistics shall be made more regular, systematic and efficient as part of the National Statistical Development Plan. National S&T statistics shall be prepared and presented in such a form as to enable the monitoring of trends as well as structural shifts in S&T and comparison with other countries. The second level is the increased monitoring and value for money evaluation of S&T programmes to ensure that allocation and expenditure of public funds provide maximum benefit to the citizens. The M&E process of the NSTP will be consistent with the NIMES framework that monitors and evaluates performance of government programmes across all sectors of the economy. The initial set of S&T indicators showing current and target figures are highlighted in the M&E framework.

6.2. Dissemination and Utilization of Results

An annual S&T Status Report will be prepared to provide policy makers and the public with a regular assessment of the status and trends of Uganda's STI developments and other pertinent policy directions. This will be publically disseminated for reference to government, development partners and the public through policy dialogues, circulars, and institutional website.

ANNEX

National STI Plan Implementation and Results Framework FY 2012/2013 - 2017/2018

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
1.1. Technology Forecasting, Assessment and Transfer	Assess, forecast and advise on issues regarding STI, taking into account current and future trends in development, transfer and diffusion of both local and foreign STI outputs.	Conduct technology audits and forecasts and advice on STI policy and programmes. Conduct policy studies on topical issues to facilitate evidence-based advice and decision-making in all matters pertaining to STI. Evaluate and promote technology choices for public and private sector investment. Create a system to facilitate the transfer, promotion and development of technologies. Strengthen collaboration with Research and Development Institutions (RDIs), professional bodies, private sector, NGOs and civil society in facilitating technology transfer and utilization.	A comprehensive STI audit/techno-survey after every 2 years. A 5-10 year technology forecast. Inventory of appropriate technologies for Uganda. Technology transfer office. Effective technology transfer mechanism. STI policy briefs and advice.	UNCST, MFPED, NPA MTTI, MAAIF, MOH, EPRC, NARO, UNBS, UIRI, UNHRO, UMA, USSIA, PSF, UIA, URA, NGOs NCCI private sector.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
1.2 Industrial Development	Provide an enabling environment for industrial development in Uganda.	Support the development of SMEs through facilitation of access to new knowledge, technologies and services. Support R&D and innovation efforts in the industrial sector. Encourage efforts for increased productivity, improved product quality and quality control. Foster linkages among public, private sectors and industry through technology platforms and internship programs. Encourage linkages between industry-universities and other tertiary institutions for research, innovation, product development and commercialisation. Promote adoption of cleaner production technologies and practices.	Innovation fund revived Strengthened industrialization strategy. Increased technology use and firm level productivity. Effective public-private partnerships Effective linkages among academia, research and industry.	MTTI, UIRI, MFPED, NPA, UNCST, UIA, UMA, USSIA, NCCI, PSF Private Sector NEMA, UNBS Cleaner Production Centre, MWE, MLUP, MEMD.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
1.3 Intellectual Property Management	Facilitate and encourage innovation through the protection and use of Intellectual Property Rights.	Enact appropriate legislation to ensure sustainable use of natural resources, access to resources and equitable benefit sharing, protection of creativeness and innovation. Establish a fully-fledged national IPR office to undertake searches, formal and substantive examinations grant and register patents, trademarks, copyrights and other IPRs. Encourage membership to regional and global organizations dealing with IPR in order to enhance efficiency and cost effectiveness of the national system. Facilitate the setting up of institutional support systems for production, protection and commercialisation of innovations and artistic works. Incorporate aspects of IPR in the school curricula at various levels of education in order improve awareness.	Intellectual property policy. Revised IPR law. National IPR office. Institutional IP support offices. Increased public awareness of IPR. Increased IPR applications. Increased research, innovation and product development.	MJCA, UNCST, RDIs, Universities, Private sector, NGOs, Civil society Donors.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
1.4 Traditional, Conventional and Emerging Technologies	Guide judicious use and application of traditional, conventional and emerging technologies for sustainable development.	Develop a legal and regulatory framework for R&D activities in traditional, conventional and emerging technologies including among others indigenous knowledge, biotechnology, nano technology, information and communication technology, and microelectronics. Support development of appropriate methodologies for application of traditional, conventional and emerging technologies. Organize and support development of facilities, manpower, and support centres in order to promote and coordinate traditional and emerging technology activities and their diffusion. Support efforts to promote awareness, knowledge and application of traditional and emerging technologies through formulation of relevant policies and other support mechanisms.	Formal recognition and support for new and emerging technologies. Policies and regulations. Public awareness.	UNCST, MJCA, RDIs, Universities, Private Sector, Professional bodies, URA, UNBS, MOH, MIAF, MGLSD, Local communities, the media.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
1.5 Gender and Equity	Mainstream and actively involve special needs groups, men, women, and children in all STI activities in order to ensure that resultant impacts are evenly spread across all sections of society.	Introduce STI education and training at all levels of schooling and incorporate special efforts to facilitate participation of disadvantaged groups in science and technical areas. Intensify educational programmes that support continued participation of girls in the field of STI at secondary and tertiary levels of schooling in order to counteract the effects of other negative factors, such as teenage pregnancies and traditional gender stereotyped attitudes. Promote participation of disadvantaged groups in development of STI programmes, and provide advice and information to these groups through NGOs and CBOs on the acquisition and use of technology. Provide entrepreneurship training to disadvantaged groups to enhance their ability to utilize and commercialize technology.	Gender sensitive STI policies, strategies and programmes Improved gender balance in STI activities, e.g. education, employment, participation in STI programmes. Recognition of special needs persons and perspectives in STI activities.	MGLSD, UNCST, MOES, NUDIPU, UNISE, UNAB, NGOs, CBOs, Professional bodies, Civil society, Development partners.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
2.1 Increase STI Sector Financing and Investment	Provide financial support and coordinate STI activities to build capacity and put in place the necessary infrastructure.	Increase STI sector allocations from 3% to at least 5% of total Government expenditure per annum. Identify and access complimentary funds from bilateral and multilateral sources for the support of STI development. Encourage the private sector through various incentives to make effective financial contribution to STI development. Create a national STI Fund to support strategic S&T innovations, acquisition of IP rights for local innovators, and recognition of scientific excellence. Encourage STI institutions to generate funds by commercialising their services and products and utilize the funds for promotion and expansion of STI activities.	Allocation of at least 5% of the total government expenditure by 2012. STI Fund. Increased bilateral and multilateral support to STI programmes.	MFPED, Parliament, UNCST, UIA, PSF, The Private sector Development partners, NGOs.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
2.2 Develop and Maintain STI Human Capital	Build an educational and training system that produces human resources with capacity to generate and effectively apply STI based on contemporary needs of society.	Strengthen STI education at all levels of Uganda's education system with a view of producing an STI literate society. Create a critical mass of STI graduates with adequate intellectual, practical and vocational skills to meet the labour requirements in the various STI sectors. Nurture and promote STI education within the informal sector through adult literacy programmes. Encourage basic research and support the development of the appropriate professional manpower. Support domestic production and maintenance of STI educational equipment and materials. Improve welfare and working conditions of practising scientists. Create facilities and centres of excellence for training, research and innovation for scientists and engineers.	Increase the ratio of science graduates from 5:1 to 2:1 by 2012. Redesigned science curriculum and increased practical content of science programmes. Improved welfare of scientists, technologists and engineers.	MOES, NCHE, ESA, NCDC, Universities, Technical Colleges, MFPED UNCST, NPA, MGLSD, EFAG.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
2.3 Build and Maintain STI Infrastructure	Provide adequate and state-of-the art STI infrastructure to enable rapid development in the economy.	Establish, operate and maintain major national facilities for research and innovation. Establish and adequately equip science laboratories in public research and training institutions. Encourage increased private sector participation in the development of STI infrastructure. Establish, operate and maintain technical services (e.g. metrology, standardisation, and calibration). Establish electronic networking for STI information dissemination and knowledge sharing among Ugandan universities and centres of excellence.	New and improved R&D facilities. Adequately equipped and functional RDI's, incubators, TDCs, university/ school science laboratories and libraries. Effective STI information management system and electronic network. Increased networking, collaboration and knowledge sharing among SETIs.	MFPED, UNCST MOES, MTTI, MAAIF, MOH, MWLE, UIRI, UNBS, MICT, MWHC, RDIs, Universities Private sector NGOs.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
2.4 Support Research and Development	Support basic and applied research for enriching STI information and enhancing both indigenous and imported technology.	Promote and enhance basic, applied and development research and research on culture, norms and values relating to STI development. Support local institutions to conduct research on strategic STI issues. Establish national research priorities and fund their implementation through competitive research grants for both public and private institutions and individuals. Provide adequate public funds for national research programmes and financial incentives for researchers. Strengthen existing and establish new R&D institutions in strategic areas of STI for national development. Strengthen and support training and research skills of scientific staff to ensure a key role for local scientists in application of imported technology and development of indigenous technology. Ensure application and commercialisation of results and products of research. Encourage and strengthen collaboration with regional and international research institutions.	National research priorities, Effective research funding programme. Increased research productivity (research outputs, IPR) Increased utilization of research findings for policy and programme decision making.	UNCST (MFPED, MOES, MTTI, MAAIF, MOH, MWE, UIRI, UNBS, MICT, Universities, Technical institutes, the private sector, Development partners, NGOs, CBOs.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
2.5 Technology Incubation	Support development and growth of small and medium enterprises through provision of essential services and infrastructure.	Establish and maintain science and technology parks with state-of-the art infrastructure. Support researchers to develop prototypes from results of their research. Facilitate establishment of central research infrastructure facilities to incubate commercially viable innovations. Promote the creation of innovative technology-based companies by assisting them to access funding facilities and establish viable partnerships. Provide entrepreneurial and business skills through training and consultancy.	Science and Technology Park. Incubation centres for various technologies. Spin off companies (SMEs initially). Technology development centre.	UIRI, MTTI, MFPED, UNCST, Universities, Technical institutes, Private sector, Enterprise Uganda, Development partners.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
3.1 STI Safety Regulations	Apply appropriate safety and health measures in the generation, development and application of STI in all its aspects.	Develop policies, guidelines and regulations on conceivable unintended or detrimental effects of scientific and technological development. Improve facilities for and ensure adoption of best practices in generation and application of STI. Encourage regional and international co-operation in safety on STI. Develop national capacity for risk assessment and management in scientific and technological development. Promote adoption of cleaner production technologies and practices. Raise public awareness on safe use, application and disposal of STI products. Strengthen the research registration and clearance function of Government.	STI guidelines. Increased compliance with research clearance regulation. Reduced incidence of research risks on humans, livestock and the environment. Increased public awareness in the application of STI products.	UNCST, NDA, NEMA, NFA, UWA, UNBS, UCC, UBC, UCPA, UCET, MGLSD, NOTU, MIA, MLG, MOH, MAAIF, NARC, GAL, MJCA, MPS, MWT, UCPC, URA.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
3.2 Ethics in STI	Ensure that mechanisms are in place to develop and apply STI in accordance with acceptable morals and national societal norms.	Establish acceptable ethical codes of conduct for undertaking STI applications. Strengthen the ethical review system through establishment of Institutional Review Boards in all SETIs. Streamline the procedures for research registration and clearance. Enhance monitoring and field support for R&D programmes and activities. Establish a National Research Register.	Code of conduct for STI. Institutional Review Boards in all SETIs. Increased research inspection and field level support. National Research Register. Reduced incidence of unethical research activities	UNCST, (OP, RDCs, LCs, Local Communities, Universities, RDIs, Professional bodies).

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
3.3 Standards and Quality Assurance in STI	Promote the design, development and commercialization of Ugandan products and services to be internationally competitive by developing and enforcing Ugandan standards in line with the international standards.	Strengthen institutional framework for enforcement of quality standards in the development and application of STI. Establish testing systems to enable laboratories to test both raw materials and manufactured goods for domestic and foreign markets. Introduce certification systems for products and companies. Introduce accreditation systems for both laboratories and company certification bodies. Ensure national standards are developed for all products to assist in establishing programmes for orderly evaluation, selection, acquisition and adaptation of appropriate traditional and contemporary technologies. Establish an information system on standards and quality. Establish an import quality control mechanism to enforce the minimum quality standards for Uganda. Train personnel from industry, research and development institutions and government departments in all matters related to standards and total quality management. Ensure that all goods produced and sold in Uganda conform to the national standards. Encourage the use of sustainable technologies, which are environmentally sound and safe to the consumers. Sensitize the public on process and product quality and standards.	Fully equipped and functional national standards testing laboratories. Certification system for all nationally produced products. Increased national capacity for standards inspection Production and importation of quality products. Increased value-for money procurement. Increased consumer choice and welfare.	UNBS, UNCST, NDA, UCC, NITA, ESA UCPA, PPDA UCET RDIs, UNCHE, NCDC, UBC, URA, MAAIF, UCPA, professional bodies.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
4.1 Increase Public Awareness and Appreciation of STI	Promote STI awareness and ensure public commitment and support for STI activities in Uganda.	Sensitize policy makers and the public about the critical importance of the STI sector for economic prosperity. Strengthen lobby and advocacy mechanisms for STI at various levels within the executive, the legislature and the public. Support the development of an environment that will boost the status of STI in Uganda. Establish and support forums through which policy makers, political leaders and stakeholders can deliberate on topical STI matters on a regular basis. Conduct school visits at all levels of learning to improve the perception and attitudes towards STI careers. Encourage and support efforts to promote STI literacy. Promote and encourage science journalism in Uganda. Encourage and support the publication and marketing of books, research features, journals and periodicals of STI.	STI lobby group. STI advocacy forum. Increased public support and participation in STI activities. Increased scientific literacy and public readership of scientific publications. Evolution of a science culture.	UNCST, MFPED, NPA Parliament, Sector Ministries the Media, Civil society NGOs, CBOs.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
4.2 Information Management System	Develop the STI information management system including the information and communication infrastructure content and services.	Establish an ICT network infrastructure that will foster an enabling environment to support quality learning, research, management and business. Encourage efficiency through open competition in the provision of information and communications service. Encourage and support the development of information technology skills required to provide the maintenance and support services needed for global competitiveness of local enterprises. Promote access to STI information through public and private libraries with adequate stocks of STI reading materials. Promote high national productivity and greater efficiency through use of modern technology information systems within government and private sector. Develop national on-line database systems on broad spectrum of the economy as part of e-government strategy for STI system. Establish a national STI resource centre and information management system for decision support and performance monitoring. Strengthen and network information units of existing STI institutions.	STI information management system. Integrated STI Information system with the wider e-government network. Well stocked public and private libraries. Increased information dissemination and sharing across government departments Reduced duplication of efforts. National STI resource centre.	UNCST, UBOS, MICT, MOLG, LCs, Local communities, ULA, NITA, UCC, UBC, the media, professional bodies.

Policy Objective	Policy Statement	Policy Actions	Expected Results	Responsible Institution(s)
4.3 Sector Coordination and Partnerships	Strengthen the central co-ordinating institution – (UNCST) – to effectively provide a sector-wide framework for planning and coordination; and to establish support linkages with local, regional and international development partners.	Strengthen the institutional capacity of the Uganda National Council for Science and Technology to effectively coordinate the formulation and implementation of STI policies and programmes. Streamline the institutional framework for STI to enhance coordination and synergies in implementing STI activities and programmes. Establish STI inter-institutional mechanisms for information sharing and collaboration in implementing STI activities. Promote linkages between sectors and among stakeholders by fostering public-public, public-private and private-private partnerships in research and innovation, product development and commercialisation. Gazette National Science Week as public forum for review and discussion of national STI activities and programmes. Participate in appropriate and beneficial STI fora and programmes both regionally and internationally. Enter into agreements with countries that can offer ample opportunities for co-operation in STI. Develop partnerships for exchange of people, ideas and support facilities. Enhance international partnerships and cooperation in STI.	Functional institutional coordination framework, public-public, public-private and private-private partnerships. Regional and international STI programmes. International cooperation protocols in STI. Increased global relevance of Uganda's STI efforts. National Science Week. Strong coordinating body.	UNCST, (MFPED, NPA OP, OPM, MOFA, SETIs, UNHRO, NARC, UIRI, UMA, USSIA, PSF, UNFFA, NGOs, CBOs, Civil society, Professional),