
THE REPUBLIC OF UGANDA

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

*Final Draft*

Ministry of Finance, Planning and Economic Development

November 2011

# STI SECTOR VISION

A prosperous science and technology led Ugandan society

# FOREWORD

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. Therefore, Uganda's development prospects are intricately linked with the pace of generation, adoption and utilization of science and technology in the development process. This presents both an opportunity and challenge to scientists, policy makers and development planners to transform scientific knowledge into development programs 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, achievement of the millennium development goals, transformation of the economy from an agrarian to an industrial and knowledge economy, and enhancing Uganda's participation in global trade and development processes.

The purpose of the National Science, Technology and Innovation Plan (NSTP) is to provide a comprehensive framework for actualizing Uganda's STI development aspirations that are enshrined in the National Science, Technology and Innovation Policy (2009). The Government has through the Uganda National Council for Science and Technology (UNCST) formulated the National STI 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 consultations with thematic experts in various fields of science and technology, in-depth sector policy studies and benchmarking with countries that are relatively successful in developing and implementing STI policies.

The priorities of Government in this regard include strengthening of STI infrastructure capacities in universities and research institutions, creating a critical mass of scientists and engineers that are necessary for industrial development and economic transformation, increased research and scientific innovation support through capitalization of the STI Fund and increased regular budget support to the recommended 1 percent of GDP

expenditure on research and development activities over the next five years, and enhanced 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. Government therefore calls upon the support of all stakeholders in realising the aspirations of this plan to accelerate Uganda's development and societal transformation process.

Hon. Matia Kasaija

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

## EXECUTIVE SUMMARY

The National Science and Technology Plan (NSTP) is 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 and support of 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 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 consider regional and continental priorities, develop a code of ethics for science and technology, develop a science culture along with Infrastructure development in the long term.

The NSTP will be implemented by 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 the required resources for implementing the NSTP through their regular budget processes.

## ACRONYMS

| | |
|---|---|
| ABI | Agro-Biotechnology Institute |
| ARIPO | Africa Regional Intellectual Property Organisation |
| ASM | Academy of Sciences Malaysia |
| 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 |
| CSC | Centre for Science |
| CSIR | Council for Scientific and Industrial Research |
| DPRP | Drugs and Pharmaceutical Research Programme |
| 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 |
| MASTIC | Malaysian Science and Technology Information Centre |
| MDAs | Ministries, Departments and Agencies |
| MEE | Ministry of Employment and Economy |
| MFPED | Ministry of Finance, Planning and Economic Development |
| MGLSD | Ministry of Gender, Labour and Social Development |
| MIA | Ministry of Internal Affairs |

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|---|---|
| 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 |
| MSC | Multimedia Super Corridor |
| 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 |
| NSC | National Science Centre |
| NSRC | National Science Research Centre |
| 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 |
| TDB | Technology Development Board |
| TDC | Technology Development Centre |
| THICK | Technology, Human Resources, Institutions and Infrastructure, Collaboration and Communication, and Knowledge base |
| TIFAC | Technology Information Forecasting and Assessment Council |
| TPM | Technology Park Malaysia |
| 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 punctuated by surprises and unpredicted shifts. There are a few instances where planners and strategists predicted and prepared societies well for their future brought about by technology.

Attempts 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 cautious of 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 ability 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 adequately addressing the scientific, technological and economic systemic failures

whereas 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 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 that reads:

**"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, achievement of the millennium development goals, transformation of the economy from an agrarian to an industrial and knowledge 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 through a sequence of stages in reference to the 4 stage STI development framework and the THICK framework. The stages through which the plan was formulated 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

The Ministry of Finance, Planning and Economic Development (MFPED), within the provisions of the STI Policy (2009) launched the process of stakeholder consultations on the National STI Plan at the National Science and Technology Policy Dialogue that was held in September 2010 in Gulu district. In December, 2010 Uganda National Council for Science and Technology (UNCST) in consultation with stakeholders developed a five stage road map for formulating the Plan which involved stakeholder consultations, expert opinions, global benchmarking, model development, stakeholder and resource mapping, and legal reforms where appropriate.

The Uganda National Council for Science and Technology (UNCST) subsequently organised sixteen (16) specialized expert group meetings around the thematic areas covered by the STI policy building on the challenge mapping and prioritization exercises that were started in 2010. These meetings discussed various aspects of the NSTP and critical considerations for successful policy implementation. The draft NSTP was further discussed with both local and international stakeholders at the National STI Policy Dialogue that was held in September, 2011 in Kabarole district and subsequent stakeholder consultations that were convened in Kampala by the UNCST.

### 1.3.2 STI case studies

Based on their relatively developed STI systems, India, Malaysia and Finland were the three countries that were identified to provide benchmarks for Uganda's STI system. In depth studies were undertaken on each of these countries with specific emphasis on: STI system financing; the institutional structures; coordination mechanisms and delivery systems; policy and programme priorities; human capital development; science infrastructure and linkages between the economy and the STI system. The benchmarking

studies involved physical interactions by Ugandan STI policy experts with their Malaysian and Finnish counterparts regarding S&T planning systems in their respective countries. A summary of the findings, conclusions and recommendations are indicated below.

i. ***Institutional framework:*** Science, technology and innovation cannot be fully integrated into the national development processes and programmes of any country without a properly functional, strong and empowered S&T coordinating agency, such as a Commission, 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 of coordination (preferably at the President's or Prime Minister's office level) in order to ensure synergistic and effective implementation of the National Economic Development Policies and Science and Technology Policies. Effective communication has helped S&T institutes 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) The Science Fund to support research in academia and SMEs; (ii) Innovation Fund to support innovation among the nationals; and (iii) Technology Development Fund to address the existing gaps between innovation and commercialization.

iv. ***Policy Priorities:*** Any STI Policy and the associated STI Plan or Strategy has to be dynamic enough to meet the prevailing and new developments in that nation. Developing 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 and should be backed by a strong legal and institutional framework. The interventions should include financing, human capacity building and market support. Benchmarking against reputable S&T

agencies and firms has greatly helped agencies/firms in the benchmark countries 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). Without knowledge workers, no country can achieve the strategic integration of science and technology into its development processes. Moreover, engagement of experienced S&T professionals can shorten product development cycle and ensure that the products developed are of high standards.

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. This however requires supply of parts by other firms specialized in their production.

## 1.4 New Approaches to STI Development

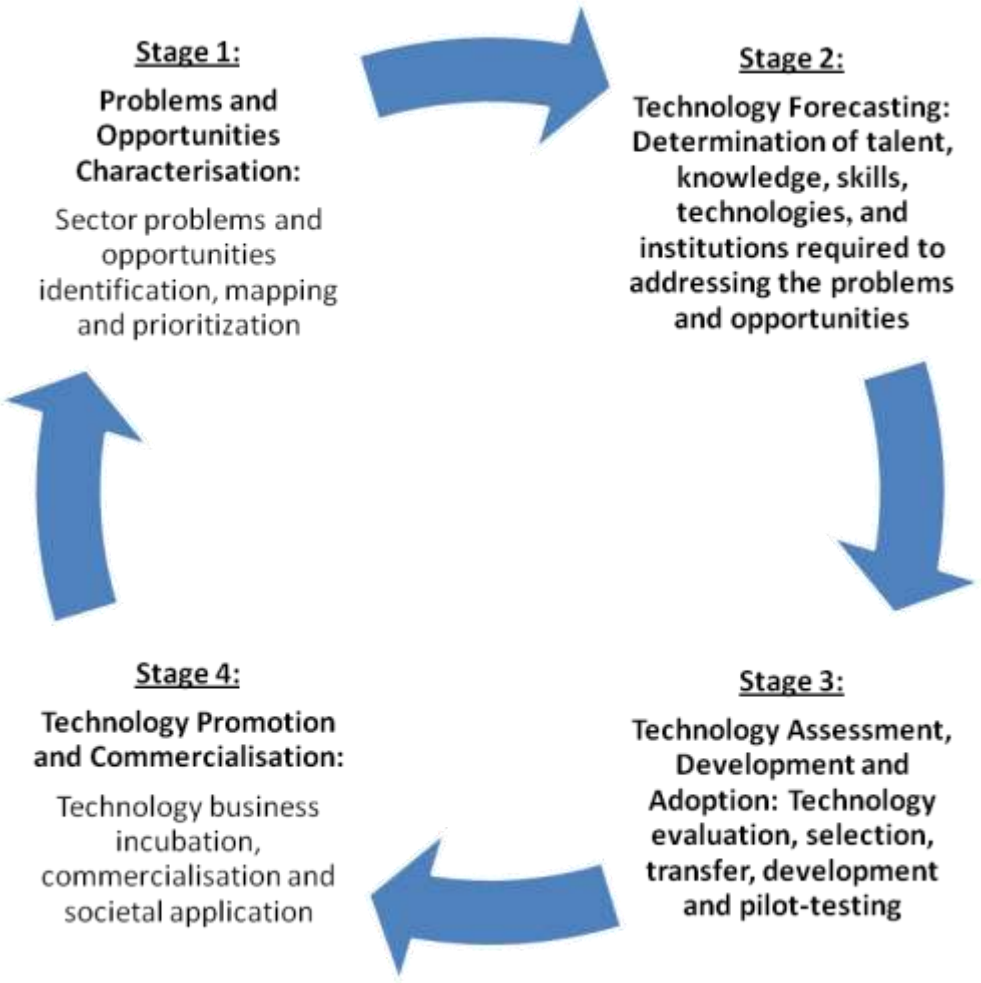
The National STI Plan builds upon previous efforts in the science and technology system that the country has instituted over the years to create an STI-enabled socio-economic growth and transformation. The NSTP recognises that the pace of STI development is directly related to the rate of economic growth and suggests consideration of new approaches for accelerating the achievement of the national aspirations in STI and the economy.

### 1.4.1 The 4 Stage STI Development framework

A new approach to the conceptualization of the linkages between STI and economic development has been adopted in the NSTP. The framework illustrates system-wide activities and underlying processes that are necessary to overcome the challenges

currently facing Uganda's STI system. It reflects a paradigm shift from perceiving science and technology development processes as disjointed and independent processes that are delinked from the industrial production and economic development systems.

### The 4 Stage STI development framework




The following 4 key drivers are a critical requirement to the operationalization of the 4 stage STI development framework:

i. Enabling STI policy and regulatory environment, e.g. for 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 STI development investment (Resource Budget).

The framework which is applicable at various stages of STI planning and development (ideation, technical design, implementation and performance review) represents Uganda's attempt at new conceptualization of STI development processes and is undergoing further development in terms of identification of parameters (dependent, independent, moderating variables), variable relationships (causality, magnitude and direction of effect) and econometric specification and estimation which is necessary for assessing the outcomes and contribution of STI to the economy.

In addition the framework entails re-orientation of the approaches towards STI programming and development. The new approaches that the NSTP has adopted include the following:

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 4 stage STI development framework is a broad framework for STI comprising the crucial stages in the STI development cycle. 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

An analytical framework has emerged from a 2010 case study on Uganda's STI sector that the NSTP has used in appraising sector status and identifying priorities building on the 4 stage STI development framework presented in section 1.4.1. 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 way of 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 below:

#### 1.4.2.1 Technology Resources

The technology resources include tools and the knowledge to use them in industry. This 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 (meaning they are not patented), nor are they highly advanced or complex. 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 times industry proprietors have to 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. The argument here is that the shortage of skilled human resources should be addressed by all sectors 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.

Research institutions have a weak capacity to undertake applied research both financially and technically. 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. Also research collaboration with other countries or institutions that have the requisite capacity and facilities has not been fully exploited.

#### 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 intellectual property rights with little or no regulatory capacity, a 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 very few opportunities for knowledge exchange. These have negatively impacted on the communication capacity, idea sharing, research collaboration, etc. It is therefore evident that knowledge does not circulate through communities and between communities to the degree it should. Also 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: Facilitate and encourage innovation through the protection and use of Intellectual Property Rights.

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 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 towards 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 programs.

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 at a 2 year interval

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. It is a snapshot of the country's technology infrastructure. These surveys will be conducted by the UNCST after every two years. These surveys shall 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. A 5-10 year technology forecast

"Technology forecasting may be defined as the prediction of an invention, characteristics, dimensions, or performance of a machine serving some useful purpose"[1]. 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.

[1] Martino, Joseph P., *An Introduction to Technological Forecasting*, Gordon and Breach Publishers, 1969.

A 5-10 year technology forecast shall be conducted by the UNCST in collaboration with the Ministry responsible for Industry using both exploratory[2] and normative[3] 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. This 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 harnessing of these technologies will be done through developing partnerships with Uganda Small Scale Industries' Association (USSIA) which has over 1,200 members

[2] Exploratory technological forecasting starts from today's assured basis of knowledge and is oriented towards the future

[3] Normative technological forecasting first assesses future goals, needs, desires, mission, etc., and works backwards to the present.

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 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

The policy note is a document that outlines the rationale for choosing a particular policy alternative or course of action. These notes shall be produced regularly by the UNCST in response to the prevailing technological innovations, sources, forecasts and options. The policy notes will be generated from STI policy studies and technology forecasts. 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 comparatively low to 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[4].

The following measures will be instituted to support technological development:

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

vii. Implement 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, especially 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

[4] Ministry of Finance, Planning and Economic Development – Poverty Eradication Action Plan, December, 2004, Investment Climate Assessment for Uganda, UMACIS, World Bank

nurturing growth of local enterprise, 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.

### 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 programs 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 the 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 programs 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 either 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. Enact appropriate legislation to ensure sustainable use of natural resources, equitable benefit sharing, protection of creativeness and innovation.
ii. Strengthen 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 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. Government shall in addition strengthen the implementation of the IP laws to ensure adequate protection of the inventors and innovators. Ministry of justice 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 undertaking reviews of the intellectual property legislation with a view of amending and up-dating the IP laws. The 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 technological trends.

### c. National IPR office

Section 3 (e) of the UNCST Statute empowers the Council with the function of protecting 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 an office known as the Patents Registry, with all functions relating to the procedure for the grant of patents. This office is meant to register licence contracts, contracts assigning the right to a patent and to provide 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 (through the Office of the Registrar General) in the administration and enforcement of IP rights in Uganda. In this regard, these two institutions will work together and co-ordinate the activities regarding IP management. The Ministry of Justice will handle legal and procedural matters while the UNCST will handle the technical aspects. A national IP support office will be set up at the UNCST under the technology transfer office. This 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; it would 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, assisting with creating IP awareness, providing 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. The UNCST in collaboration with the Ministry responsible for Constitutional affairs will develop and implement a comprehensive public awareness programme on intellectual property issues.

The government will 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 will also be provided to develop IP management capacity and establishment of Technology Transfer Offices (TTOs) at academic institutions. Networked access to URSB patent databases is required to enable UNCST and other stakeholders to disseminate relevant technological information and to

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. The 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 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. There is also need to develop 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. Uganda therefore 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. 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.
ii. Support the development of appropriate methodologies for the application of traditional, conventional and emerging technologies.
iii. Organize and support the development of facilities, manpower, and support centres in order to promote and coordinate traditional and emerging technology activities and their diffusion.
iv. Support 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

The 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, nano technology, 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 will 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 will guide the development of gender sensitive national strategies and programmes include the following:

i. Introduce special programmes to facilitate participation of vulnerable groups through entrepreneurship training to enhance their ability to utilize and commercialise technology.

ii. Promote acquisition of technologies that are suited to the needs of men, women, people with disability and other vulnerable groups.

iii. Ensure equal opportunities for participation in national science and technology programmes.

iv. Introduce innovative mechanisms of S&T service delivery that ensure adequate reach to vulnerable groups such as home based programmes, personal outreach, member associations etc.

v. Introduce specific incentive measures to enhance participation of vulnerable groups in STI.

There have to be 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 highlighting the role of S&T in stimulating socioeconomic development. Nonetheless, S&T funding in Uganda is relatively still inadequate inevitably resulting into low levels of technology development. The R&D intensity is approximately 0.6 percent (2009/2010) compared to the recommended 1 percent of GDP for African countries as 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. Increase STI sector allocations from 3% to at least 10% of total Government expenditure per annum over the medium term.
ii. Identify and access complimentary funds from bilateral and multilateral sources for the support of STI development.
iii. Encourage the private sector, through incentives such as venture capital, export processing zones, to make effective financial contribution to STI development.
iv. Create a national STI Fund to support strategic S&T innovations, acquisition of IP rights for local innovators, and recognition of scientific excellence.
v. Encourage STI institutions to generate funds by commercialising their services and products and utilize these 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 is started therein 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. This S&T Fund is also provided for in the National Science, Technology and Innovation Policy (2009).

This plan proposes to make operational the Science, Technology and Innovation Fund (STIF) to facilitate investment in key science and research initiatives of strategic and sustainable value to the nation. The Fund will aim to make 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 programs

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 and it is therefore necessary to pool resources together to implement national, regional and international programmes. The NSTP will make effort 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 the 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 these 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 counterpart 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 programs to the requirements of global competitiveness of Ugandan industries, promote partnerships with the private sector, harness the potentials 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 be aimed at building future S&T capabilities through focused programs in basic and higher education. Human resource development for S&T will entail the following measures:

i. Strengthening of STI education at all levels of Uganda's education system with a view of 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 support the development of the appropriate professional manpower.
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. Increase the ratio of science graduates

Human resource training is an essential condition for technical progress. Therefore, programs for the enhancement of a scientific and technological human resource capacity shall include; Increasing the enrollment ratio to 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 demanded by the labour market through increased industrial training and curriculum review to emphasize vocational training; increasing enrolments in technical and vocational institutes; and build 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 should 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, 3) the structure of expert knowledge and 4) science as a way of life and knowledge creation - that is science teaching and assessment should focus on what society values as important. The aim of these considerations 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 be contributing towards bridging the existing gap between classroom learning and practical orientation through semi formal and informal learning processes. The centre shall focus on different clusters of science and technology including the basic, applied and future sciences.

### 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 of artisans and highly trained and skilled personnel. The skills development will occur both at the workplace and gazetted public training facilities.

## 4.8 STI Infrastructure

The buildup and maintenance of a good S&T infrastructure shall form an integral part of the long term as well as 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, the upgrading of regional and local capabilities, and the provision of support to encourage and enable the private sector to carry out technological innovation and related activities/services. The following measures will be instituted:

i. Establishment, operation, maintenance and upgrading of major national facilities for research and innovation.

ii. Establishment and adequately equipping of 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 relevant to national development needs. Establishment of new scientific research institution/laboratories/Centres of 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 within 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. The 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 the disjointed and at times absent ICT infrastructure in these 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 focussing on improving the delivery of scientific and technological services, including data and statistics sharing by all institutions in the national STI system. The 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) programs 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 will 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 fund their implementation through competitive research grants for both public and private institutions and research clusters.
iv. Provision of adequate public funds for national research programs 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

The government 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 will 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

The 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 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. The 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-relevant 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 researches conducted are essentially expected to be demand driven or addressing common societal challenges. The UNCST will showcase and facilitate dissemination of research results through appropriate means to foster public uptake 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 the UNCST, Uganda Industrial Research Institute and the ministry responsible for industrial development. The following measures will 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 will 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 & financial consultancy services, technology & business platforms, workshops and business matching to researchers, scientists, innovators and SMEs; and technology commercialization assistance. This will include advisory and consultancy services in technology transfer, project management, market research & opportunity analysis and professional development programmes. The National Science and Technology Park will be constructed in Namanve Industrial Park and other regional Parks constructed 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 the 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 programs,

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 and environment. 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 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 will be instituted:

a) Develop policies, guidelines and regulations on conceivable unintended or detrimental effects of scientific and technological development.
b) Improve facilities for and ensure adoption of best practices in generation and application of STI.
c) Encourage regional and international co-operation in safety on STI.
d) Develop national capacity for risk assessment and management in scientific and technological development.
e) Promote adoption of cleaner production technologies and practices.
f) Raise public awareness on safe use, application and disposal of STI products
g) Strengthen 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 to avenues for publication and dissemination of their findings and recognition and award of scientific research and innovation excellence. In particular, UNCST, the mandated national clearing house for all Research activities in Uganda 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.

## 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 will be instituted:

i. Establish acceptable ethical codes of conduct for undertaking STI applications.
ii. Strengthen the ethical review system through establishment of Institutional Review Boards in all SETIs.
iii. Streamline the procedures for research registration and clearance.
iv. Enhance monitoring and field support for R&D programmes and activities.
v. Establish 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. The 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

The 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

The UNCST shall intensify field supervision of research institutions, innovation centres and individuals researchers to ensure adherence to research regulations. The UNCST will in addition institute research management policies enabling research institutions and the 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 her mandate, the UNCST on behalf of government registers and clears all research activities intended to be carried out in Uganda. The NSTP provides for increased use of the research registry. The register shall assist researchers to identify potential research partners, streamline, harmonise and avoid duplications of the already existing research.

## 4.13 STI Standards and Quality Assurance

Development of a technology or a product should ensure it is of good quality and meets the required specifications. The following measures will be instituted by the NSTP;

i. Strengthen institutional framework for enforcement of quality standards in the development and application of STI.
ii. Establish testing systems to enable laboratories to test both raw materials and manufactured goods for domestic and foreign markets.
iii. Introduce certification systems for products and companies.
iv. Introduce accreditation systems for both laboratories and company certification bodies.
v. 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.
vi. Establish an information system on standards and quality.
vii. Establish an import quality control mechanism to enforce the minimum quality standards for Uganda.
viii. Train personnel from industry, research and development institutions and government departments in all matters related to standards and total quality management.
ix. Ensure that all goods produced and sold in Uganda conform to the national standards.
x. Encourage the use of sustainable technologies, which are environmentally sound and safe to the consumers.
xi. Sensitize the public on process and product quality and standards

## Expected Results

### a. Equipped and functional testing laboratories

The UNBS currently has five functional laboratories although only one is accredited. The 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, the 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. The 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 to national standards requires that locally manufactured products as well as imported products meet quality standards. The Quality Assurance at UNBS shall hold the responsibility for this activity. The department 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. The NSTP will promote/popularize S&T through: dissemination and re-packaging of S&T information in local languages; promotion of the culture of innovation; establish and strengthen 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. The NSTP will:

a) Sensitize policy makers and the public about the critical importance of the STI sector for economic prosperity.
b) Strengthen lobby and advocacy 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 able to successfully claim its 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 the leadership of all the SETIs that have got an 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 will take stock, showcase, reflect upon and make strategies for realising national aspirations for science and technology and economic development. The week will aim at raising awareness to inspire people of all ages to participate in and support science, engineering and technology. The NSTP will ensure that the NSW is gazetted during the month of September of every year and commemorated by SETIs with support from the government, donors, 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. The 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 (4) major languages, media (print, visual and audio), Journals, bulletins and newsletters highlighting 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 should be involved in sensitizing the public.

### 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 programmes that Uganda is implementing are expected to increase the level of scientific literacy in the population. The 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 (phone, cooker, vehicle, sewing machine) and industrial level (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 a popular language (local) and condensed form to improve readership and communication. Popular communication media such as radio, community centres, etc shall be used to disseminate scientific information.

### e. Science culture.

Science culture refers to an attitude of individuals 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 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 build new insights or ideas that will enhance scientific progress through local innovation. Science culture has implications on societal transformation and development through phasing out of traditional practices and norms that bring about under development. The 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 yet to be fully embraced by all institutions. The 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 will be instituted:

i. Establish an ICT network infrastructure that will foster 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 will be established at the UNCST and shall be entrusted with the responsibility of acting as a source and repository of information relevant to the making of policies and decisions on S&T related matters. The centre will 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 the following areas;

- 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 in 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 building 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 such other functions. The data formats and software shall be standardised, user friendly and inter-operable across institutions.

### c. Well stocked public and private libraries

Uganda currently has 30 public libraries. Most of these libraries have small stocks of reading materials, weak ICT infrastructure, and a few qualified personnel. Makerere University has started a merger of libraries with the ICT faculty to improve on the infrastructure and information dissemination at the institution. Private libraries are mainly located at private institutions of higher learning. The NSTP intends to strengthen the repository system, create linkages with international publishers and citation mechanisms. Mbarara University of Science and Technology 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. The 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

The 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 this data will be liberalized for government agencies and in accordance with the applicable level of public dissemination.

## 4.16 Sector Coordination and Partnerships

The NSTP will encourage collaborative programs among government, industry and strengthen SETIs to effectively carry out S&T activities, and promote interaction among sectors. The following measures will be instituted:

i. Strengthen the institutional capacity of the 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 programs.
iii. Establish STI inter-institutional mechanisms for information sharing and collaboration in implementing STI activities.
iv. 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.
v. Gazette a National Science Week as a public forum for review and discussion of national STI activities and programs.
vi. Participate in appropriate and beneficial STI forums and programmes both regionally and internationally.
vii. Enter into agreements with countries that can offer ample opportunities for co-operation in STI.
viii. Develop partnerships for exchange of people, ideas and support facilities.
ix. Enhance 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, the UNCST Statute No.1 of 1990 (Cap 209 of the Laws of Uganda 2002) does not explicitly spell out the UNCST regulatory functions or adequately empower it to undertake the co-ordination function for effective execution of its mandate. The Council, therefore, uses guidance and advice approaches rather than the more effective legal and regulatory approaches in management of science and technology development.

The NSTP will strengthen the coordination mechanism for science and technology and ensure that STI is reflected in national development policies and programmes. The NSTP 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. The 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. The NSTP will further establish partnerships with CBOs, NGOs and civil society in reaching the vulnerable and hard to reach 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

The government shall support and seek co-operation with regional and international organizations in the promotion of Science and Technology. The 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, the Government will encourage establishment of institutions or associations to manage and implement multinational and national programmes and projects. In addition, the NSTP will provide mechanisms to initiate, lead 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. The NSTP will strengthen Uganda's capacity to cooperate within the international fora by formalising cooperation arrangements. The NSTP will further 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. It is therefore important that Uganda participates in global STI initiatives and creates conditions that are attractive for scientists, engineers and technologists to develop appropriate networks with our 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, etc.

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

The 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 the STI coordination in the country. The 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 the council and the entire science and technology system. The scope of the capacities should be reflective of the national nature of the institution and provide a profile that enables the council to implement its mandate effectively. The programmes will be consistent with regional and international best practices in organizational development and management practices. The UNCST shall continuously carryout assessments and regular STI sector performance audits to ensure continuity of plans and programs, coordination of national STI efforts, strengthening of the monitoring and evaluation and results-oriented sector policy management.

## 5.0 IMPLEMENTATION FRAMEWORK

The 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 following implementation arrangements and mechanisms have been devised for that 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 programs 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 players through the creation of technical working groups to steer and oversee particular NSTP programs 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 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 for implementation of the STI policy is estimated at UG Shs 830 billion. Government has also 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 and economic development. The fund will be replenished by 20 percent contributions of NTR generated from scientific and technical services offered by SETIs.

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. Refinements in existing measurements, strategies, indicators of implementation and performance under the Plan shall also be made. 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 the 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 should be prepared and presented in such a form as to enable the monitoring of trends as well as structural shifts in S&T and a comparison with other countries. The second level is the increased monitoring and value for money evaluation of S&T programs to ensure that the allocation and expenditure of public funds provide the 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.

# ANNEXES

Annex 1: Uganda STI Policy Implementation and Results Framework FY 2011/2012 - 2016/2017

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| **1.1 Technology Forecasting, Assessment and Transfer** | Assess, forecast and advise on issues regarding STI, taking into account current and future trends in developme nt, transfer and diffusion of both local and foreign STI outputs. | Conduct technology audits and forecasts and advice on STI policy and programs.<br><br>Conduct policy studies on topical issues to facilitate evidence-based advice and decision-making in all matters pertaining to STI.<br><br>Evaluate and promote technology choices for public and private sector investment.<br><br>Create a system to facilitate the transfer, promotion and development of technologies.<br><br>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 every after 2 years<br><br>A 5-10 year technology forecast<br><br>Inventory of appropriate technologies for Uganda<br><br>Technology transfer office<br><br>Effective technology transfer mechanism<br><br>STI policy briefs and advice | UNCST, MFPED, NPA MTIC, MAAIF, MOH, EPRC, NARO, UNBS, UIRI, UNHRO, UMA, USSIA, PSF, UIA, URA, NGOs NCCI The private sector, Professional Bodies | 40,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| 1.2 Traditional, Conventional and Emerging Technologies | Guide the 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.<br><br>Support the development of appropriate methodologies for the application of traditional, conventional and emerging technologies.<br><br>Organize and support the development of facilities, manpower, and support centres in order to promote and coordinate traditional and emerging technology activities and their diffusion.<br><br>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<br><br>Policies and regulations<br><br>Public awareness | UNCST, MJCA, RDIs, Universities, Private Sector, Professional bodies, URA, UNBS, MTWH, MOH, MIA, MGLSD, Local communities, The media, | 100,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| 2.1 Support Research and Development | Support basic and applied research for enriching the 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.<br><br>Support local institutions to conduct research on strategic STI issues.<br><br>Establish national research priorities and fund their implementation through competitive research grants for both public and private institutions and individuals.<br><br>Provide adequate public funds for national research programs and financial incentives for researchers.<br><br>Strengthen existing and establish new R&D institutions in strategic areas of STI for national development<br><br>Commercialisation of results and products of research.<br><br>Strengthen regional and international collaboration | National research priorities,<br><br>Effective research funding program<br><br>Increased research productivity (research outputs, IPR)<br><br>Increased utilization of research findings for policy and program decision making | UNCST MFPED, MOES, MTIC, MAAIF, MOH, MWLE, UIRI, UNBS, MICT, Universities, Technical institutes, the private sector, Professional Bodies, Donors, NGOs, CBOs. | 400,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| **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.<br><br>Improve facilities for and ensure adoption of best practices in generation and application of STI.<br><br>Encourage regional and international co-operation in safety on STI.<br><br>Develop national capacity for risk assessment and management in scientific and technological development.<br><br>Promote adoption of cleaner production technologies and practices.<br><br>Raise public awareness on safe use, application and disposal of STI products<br><br>Strengthen the research registration and clearance function of Government | STI guidelines<br><br>Increased compliance with research clearance regulation<br><br>Reduced incidence of research risks on humans, livestock and the environment<br><br>Increased public awareness in the application of STI products | UNCST, NDA, NEMA, NFA, MTWH, UWA, UNBS, UCC, UBC, UCPA, UCET, MGLSD, NOTU, MIA, MOLG, MOH, MAAIF, NARC, GAL, MJCA, MPS, MWT, UCPC, URA, | 80,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| **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.<br><br>Strengthen the ethical review system through establishment of Institutional Review Boards in all SETIs.<br><br>Streamline the procedures for research registration and clearance.<br><br>Enhance monitoring and field support for R&D programmes and activities.<br><br>Establish a National Research Register. | Code of conduct for STI<br><br>Institutional Review Boards in all SETIs,<br><br>Increased research inspection and field level support<br><br>National Research register<br><br>Reduced incidence of unethical research activities | UNCST,<br>OP,<br>RDCs,<br>LCs,<br>Local Communities,<br>Univerisites,<br>RDIs,<br>Professional bodies, | 40,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| 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.<br><br>Strengthen lobby and advocacy mechanisms for STI at various levels within the executive, the legislature and the public.<br><br>Support the development of an environment that will boost the status of STI in Uganda.<br><br>Establish and support forums through which policy makers, political leaders and stakeholders can deliberate on topical STI matters on a regular basis.<br><br>Conduct school visits at all levels of learning to improve the perception towards STI careers.<br><br>Promote STI literacy and promote science journalism in Uganda.<br><br>Publication of STI journals | STI lobby group<br><br>STI advocacy forum.<br><br>Increased public support and participation in STI activities.<br><br>Increased scientific literacy and public readership of scientific publications<br><br>Evolution of a science culture. | UNCST, MFPED, NPA Parliament, Sector Ministries, Professional Bodies The Media, Civil society NGOs, CBOs | 20,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| 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.<br><br>Encourage efficiency through open competition in the provision of information and communications service.<br><br>Encourage and support the development of information technology skills required to provide the maintenance and support services needed for global competitiveness of local enterprises.<br><br>Promote access to STI information through public and private libraries<br><br>Promote high national productivity and greater efficiency through use of modern technology information systems.<br><br>Develop national on-line database systems as part of the e-government strategy. | STI information management system<br><br>Integrated STI Information system with the wider e-government network<br><br>Well stocked public and private libraries<br><br>Increased information dissemination and sharing across government departments<br><br>Reduced duplication of efforts<br><br>National STI resource centre | UNCST, UBOS, MICT, MOLG, LCs, Local communities, ULA, NITA, UCC, UBC, The media, Professional bodies | 90,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| 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 programs.<br><br>Streamline the institutional framework for STI to enhance coordination and synergies in implementing STI activities and programs.<br><br>Establish STI inter-institutional mechanisms for information sharing and collaboration in implementing STI activities.<br><br>Foster public-public, public-private and private-private partnerships in research and innovation, product development and commercialisation.<br><br>Gazette a National Science Week as a public forum for review and discussion of national STI activities and programs. | Functional institutional coordination framework,<br><br>public-public, public-private and private-private partnerships<br><br>Regional and international STI programmes<br><br>International cooperation protocols in STI<br><br>Increased global relevance of Uganda's STI efforts.<br><br>National Science Week<br><br>Strong coordinating body | UNCST, MFPED, NPA OP, OPM, MOFA, SETIs, UNHRO, NARC, UIRI, UMA, USSIA, PSF, UNFFE, NGOs, CBOs, Civil society, Professional Bodies, | 60,000 |

| Policy Objective | Policy Statement | Policy Actions | Expected Results | Responsible Institution(s) | Cost Estimate (UG Shs. '000'000) |
|---|---|---|---|---|---|
| Total Funding Requirement for Policy Coordination | | | | | 830,000 |

## Annex 2: Results of STI Benching Studies on India, Malaysia, Finland and Uganda

| Issue | India | Malaysia | Finland | Uganda |
|---|---|---|---|---|
| **Level of Gross Domestic Expenditure on Research and Development (GERD)** | 0.9%, India still lags behind the emerging economies of Brazil and China in R&D expenditure as a percentage of GDP. In 2010, India had a 2.9% Share of Total Global R&D funding way below 12.3% for China in the Same Period.<br><br>(Source:Batelle, R&D Magazine) | 0.64% in 2006 and still less than one percent in 2010 at 0.69% | Gross expenditure on R&D (GERD) was 3.7% of GDP in 2008 with industry financing 70.3% of GERD, government was 21.8%, and Business expenditure on R&D (BERD) was 2.8% of GDP in 2008. | 0.6 %( Expenditure of R &D as a percentage of GDP at Constant 2002 Prices) in 2009 |
| **Financing System** | -Technology Development Board (TDB), a Government constitutional body for funds administration.<br>-Department of Science and Technology (DST) provides funding to the following programmes.<br>-Instrumentation Development | -Ministry of Science, Technology and Innovation (MOSTI) which controls funds for all the 26 agencies under it.<br>-The MOST also controls about 28% of Malaysian Research Funds the rest of which are controlled by other Ministries, Departments and | -Public R&D funding is by the Ministry of Education (MoE) and the Ministry of Employment and the Economy (MEE).<br>-Under the Ministry of Education are all the universities, polytechnics and the Academy of Finland.<br>-Universities receive about 59% of direct public research and development funding | - Government through the Ministry of Finance Planning and Economic Development (MFPED).<br>-Uganda National Council For Science and Technology<br>-Uganda Industrial Research Institute<br>Ministry of Education and Sports<br>- Universities and Tertiary Institutions of |

| Issue | India | Malaysia | Finland | Uganda |
|---|---|---|---|---|
| | Programmes(IDP)<br>-Drugs and Pharmaceutical Research Programme(DPRP)<br>-Grand in-aid to Industry<br>-TIFAC'S Mission Mode Programme(Technology Information, forecasting and Assessment Council)<br>-Public Research Funding is controlled by six central Scientific Research Departments. | Agencies. | allocated by the Ministry of Education.<br>-The Academy of Finland receives about 30% competitive research funds from the Ministry of Education.<br>-The Academy of Finland also provides project funding (Statistics Finland, 2009).<br>-Research funding by the Ministry of Employment and the Economy (MEE) was about 38% in 2008, of the total government R&D expenditure.<br>-Private Sector Funding | learning. |
| **Financing Sources** | -Central Government Ministry of Science and Technology.<br>-Department of Science and Technology.<br>Private and business sector<br>-Department of Bio Technology | -Government<br>- Ministry of Science, Technology and Innovation (MOSTI).<br>-Research Fund Innovation Fund<br>-Commercialization Fund<br>-Tax incentives.<br>-Government | -Ministry of Employment and the Economy (MEE).<br>-Finnavera Pla (Financing Solutions for Enterprises.)<br>Industry Investment Ltd(Government – owned Capital Investor<br>-Foundation for | -Government (Ministry of Finance Planning and Economic Development.(MFPED)<br>-Development partners/World Bank<br>-Universities<br>-Research organizations |

| Issue | India | Malaysia | Finland | Uganda |
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| | -The Indian Renewable Energy Development Agency (IREDA) and New Delhi under the Ministry of NEW and Renewable Energy Provide Financial Assistance for the Development of Renewable energy sources | Human Capital Development Fund Programme. | Finnish Inventions. Finpro('business solutions Worldwide') -Sitra,The Finnish Innovation Fund -Tekes ,Finnish Funding agency for technology and Innovation | |
| **Institutional Structures** | The Ministry of Science and Technology is at the apex of the structure as the supreme S&T governing body.<br><br>The DST is headed by a Secretary who is also the Chief Vigilance Officer (Vigilance Officers are on the lookout for corruption and fraud in public institutions).<br><br>There are also 12 divisions ranging from the Secretary to the controller of | -Ministry of Science ,Technology and Innovation(MOSTI) -26 agencies established by and under the MOSTI. The MOSTI also sets policy for all agencies. -Academy of Sciences Malaysia (ASM) under the MOSTI but reports to the National Assembly/ Senate and gives Objective Advise to Government. -National Science Research Council (NSCR) to improve S&T governance | -The highest-level governance takes place at the Parliament and at the national government. The Government is Supported by the Research and Innovation Council, a high level Advisory body that supports Government. -Research Policy key Ministries that's Ministry of Education and the Ministry of Employment and the Economy - The R&D funding agencies that's the Academy of Finland and Tekes, the Finnish | -Cabinet -Ministry of Finance Planning and Economic Development (MFPED) for co-ordination of national development planning, to mobilise public resources, and to ensure accountability of public funds. - The Uganda National Council For Science and Technology within MFPED For S&T development. -Regions -Districts -Research Institutions -Universities -Tartiary Institutions |

| Issue | India | Malaysia | Finland | Uganda |
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| | accounts with seven division heads.<br><br>Over half (58%) of the division heads have a PhD qualification.<br><br>The DST also has different units like the Climate Change Unit which oversees all issues regarding to climate change and its effect.<br><br>There are also 'Cells' like the Disaster Management Cell and the Solar, Energy and Water Cell. | and national capability.<br>-Office of the Prime Minister's Science Advisor who oversees the Research Council.<br>-Agro-Biotechnology Institute (ABI) which works with various Universities, Research Institutions and Industry on Agro-Biotechnology Research, Development and Commercialization Projects. | Funding Agency for Technology and Innovation.<br>-Research Organizations like Universities, public research institutes, private research organizations and business enterprises.<br>-Finland has 20 universities and 26 polytechnics owned and basically funded by the state | -Schools |
| **System Coordination and Delivery System** | -At the macro level, all S&T activities are controlled by the Central government | -At the Macro level, The MOSTI formulates Science, Technology and Innovation policies.<br><br>-MOSTI is guided and advised by the National Council for Scientific | -Research and Innovation Council, responsible for S&T strategic development and Coordination of Finnish research and | -National Development Plan which recognizes Science and Technology as Core for National |

| Issue | India | Malaysia | Finland | Uganda |
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| | through different departments, councils and the Ministry of Earth Sciences<br><br>-S&T Coordination and Delivery System is by the Department of Science and Technology, The Council of Scientific and Industrial Research (CSIR) is India's largest R&D organization, with 39 laboratories and 50 field stations or extension centres spread across the nation, The Department of Atomic Energy, Department of Space, the Department of Biotechnology and the Department of Ocean Development.<br><br>-However, S&T | Research and Development (NCSRD).<br><br>-The Science and Technology Division is mandated to plan, develop, implement the National S&T policy and also serve as the NCSRD Secretariat. | Innovation Policies.<br>-Ministry of Education and Ministry of Employment and the Economy (MEE) for Public R&D Funding.<br>-Research and Development funding agencies, the Academy of Finland and Tekes,the Finnish Funding Agency for technology and Innovation<br>The Academy of Finland which funds Basic Research. | Development in next 30 years.<br>-Ministry of Finance Planning and Economic Development for Government S&T funding.<br>-Science and Technology is coordinated by the Uganda National Council For Science Technology(UNSCT) a semi-autonomous government agency established in 1990 by an Act of Parliament (CAP 209) mandated to facilitate and coordinate the development and implementation of policies and strategies for integrating Science and Technology (S&T) into the national development process |

| Issue | India | Malaysia | Finland | Uganda |
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| | system mainly driven by the five thematic sectors ranging from NGOs, independent research institute and the private and public sectors. | | | |
| **Policy/Programme Priorities** | The S&T policy pasted in 2003. The policy recognizes the central role of S&T in raising the quality of life of the people of the country, particularly of the disadvantaged sections of society, in creating wealth for all, in making India globally competitive, in utilizing natural resources in a sustainable manner, in protecting the environment and ensuring national security. | A Comprehensive, National Science and Technology Policy (NSTP) was formulated and approved by the Government in 1986.<br><br>-The Policy moved the economy from agricultural to resource and finally knowledge based Economy.-At the Macro level, The Ministry of Science, Technology and Innovation(MOSTI) is the executive arm of Government in Policy Formulation and Implementation | -National science, technology and innovation policy formulated by the Science and Technology Policy Council, chaired by the Prime Minister.<br>- Major building blocks of the Finnish Science and technology policy doctrine were the national innovation system and the knowledge based society.<br>-Finland has largely adopted its policy doctrines and instruments from the legitimate and successful countries, which from the | Ugandan National Science and Technology policy was adopted by Cabinet in 2009 and the Plan for operationalizing the Policy is underway.<br>Other Policies that have impacted S&T include; Health Policy, 2001/02,<br>ICT Policy, 2003<br>Constitution of the Republic of Uganda, 1995<br>Plan for Modernisation of Agriculture, 2006/07<br>Science Education Policy, 2005<br>Poverty Eradication Action Plan, 2004/05-2007/08<br>National Development |

| Issue | India | Malaysia | Finland | Uganda |
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| | | | | Plan, 2010/11-2014/15 |
| **Science Infrastructure** | The National Science, Technology and Information Management System (NSTIMS) is responsible for collection, collation, analysis and dissemination of information on resources devoted to S&T activities in the country.<br>-3960 R&D Institutions in the Country.<br>Fees based Laboratories.<br>-Science and Technology parks. | -National Science Center responsible for Public awareness, appreciation, interest and Understanding of Science and Technology.<br>-Multi-Media Development Cooperation(MDeC) an agency Under the (MOSTI)which advises Government on Legislation and Policies<br>Malaysian Science and Technology Information Centre (MASTIC) for STI information.<br>Technology Park to increase the wealth of the community by promoting culture of innovation and competitiveness. | -IT Centre for Science Ltd (CSC) which develops and offers high quality information technology services.<br>-Finland Research Institutes<br>-Finnish Universities and Polytechnics. | -Universities like Makerere and Mbarara University of Science and Technology.<br>-Research Institutions like the Uganda Industrial Research Institute and National Agricultural Research Organization(NARO)<br>-Tertiary Institutions of Learning |
| **Human Capital** | -According to UNESCO (2009), | -Mean years of Schooling are 6.8 | Finland was ranked 3rd in the Global | -4.7 mean Years of Schooling in 2009 |

| Issue | India | Malaysia | Finland | Uganda |
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| Development | India spends 4.4 percent of GDP on education expenditure.<br>-Knowledge Economy Index of 3.09 in 2009 and ranked 100th in 2008 with a score of 3.04<br>-The National Council of Educational Research and Training (NCERT) is the apex body for Human Capital Development.<br>-The state government boards, in which the majority of Indian children are enrolled.<br>-The Central Board of Secondary Education (CBSE) board.<br>-The Council for the Indian School Certificate Examinations (ICSE) board.<br>-The National Institute of Open | years.<br>-Knowledge Economy Index of 6.07 in 2009.<br>-Academy of Sciences of Malaysia (ASM) ensures excellence in the fields of science, engineering and technology.<br>Technology park Malaysia for innovation development.<br>-Malaysian Science and Technology Information Center provides S&T and R&D information.<br>-Government S&T Human Capital Development Fund Programme for Strengthening S&T Human capacity and capability. | Knowledge Index rankings with a score of 9.37.<br>Research centres include,<br>Technical Research Centre of Finland, Optoelectronics Research Centre.<br>Finnish Universities like Aalto University School of Science and Technology and Helsinki University of Technology. | -Knowledge Economy Index of 2.36 in 2009.<br>Research Centers include;<br>-Joint Clinical Research Center, Technology Development Center(UIRI),<br>National Agricultural Research Organization, Center for Integrated Research and Community Development and Uganda Malaria Research Center.<br>Universities.<br>Universities like Mbarara University of Science and Technology and Makerere University |

| Issue | India | Malaysia | Finland | Uganda |
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| | Schooling (NIOS) board.<br>International schools affiliated to the International Baccalaureate Programme and/or the Cambridge International Examinations.<br>Islamic Madrasah Schools, whose boards are controlled by local state governments.<br>Autonomous schools like Woodstock School.<br>-According to UNESCO (2009), India spends 4.4 percent of GDP on education expenditure. | | | |
| **Linkage between Science, Technology and the Economy** | -Service Industry and Industrial Sector contribute 62.5% and 20% respectively of GDP. | Falls in the Potential Leaders Category. Malaysia outpaces Sweden and other long Industrialized | -Finland tops the Technology Achievement Index (Leaders) Category attributed to her high invention index and | -Falls in the Marginalized Category of the Technology Achievement Index (TAI) with a TAI of 0.17 in 2009 |

| Issue | India | Malaysia | Finland | Uganda |
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| | -Falls in the Potential leaders' category of the TAI attributed to high levels of human skills investment and old technology diffusion.<br>14% of India total Workforce is engaged in manufacturing activities.<br>-In the Global Competitive Index 2010, India with a score of 4.33 was ranked 51st out of 139 emerging economies.<br>-The STI Sector makes Supercomputers for economic Development.<br>-India's Pharmaceutical Industry is the second largest only after China.<br>-India is only second to U.S in community software | countries in High Technology Exports.<br><br>Ranked 26th in the Global Competiveness Index 2010 with a score of 4.88.<br><br>Gross National Income Per capita is $3,311,76 per person | technology innovation that is Self-sustaining.<br><br>-Ranked 7th in the Global Competitiveness Index 2010 with a score of 5.37<br>-Gross National Income Per capita is $23,549,70 | -Ranked 118th in the Global Competitive Index 2010 with a score of 3.51.<br>-Gross National Income per capita is $217,40 per person |

| Issue | India | Malaysia | Finland | Uganda |
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| | development and Paved Highways.<br><br>-Gross National Income(per capita) is $441,56 per person | | | |
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## Annex 3: Science and Technology Stakeholders Consulted

| Name | Organisation |
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| **Policy Analysts/Facilitators** | |
| 1. Mr. Ismail Barugahara | Assistant Executive Secretary, UNCST |
| 2. Mr. Bashir Kagere | STI Policy Coordination Division, UNCST |
| 3. Ms. Immaculate Nakamya | STI Policy Coordination Division, UNCST |
| **Convenors/Reviewers** | |
| 1. Dr. Peter Ndemere | Executive Secretary, UNCST |
| 2. Dr. Maxwell Otim | Deputy Executive Secretary, UNCST |
| 3. Mr. Julius Ecuru | Assistant Executive Secretary, UNCST |
| 4. Mr. Richard Lutalo | STI Policy Coordination Division, UNCST |
| 5. Ms. Catherine Munabi | STI Policy Coordination Division, UNCST |
| 6. Mr. Patrick Mafabi | STI Policy Coordination Division, UNCST |
| 7. Ms. Suleiman Sebbale | STI Policy Coordination Division, UNCST |
| 8. Ms. Noeline Basiime | STI Policy Coordination Division, UNCST |
| **Sector Experts** | |
| 1. Hon. Omach Jachan | Ministry of Finance Planning and Economic Development |
| 2. Hon. Prof. Ephraim Kamuntu | Minister of State for Finance, Planning and Economic Development (Planning) |
| 3. Ms. Kyampaire Dorothy | Ministry of Justice and Constitutional Affairs |
| 4. Dr. Bananuka John | BIO-EARN |
| 5. Mr. Christain Gronlund | Cyber School Technology Solutions |
| 6. Ms. Pamela Kadama | Uganda Communications Commission |
| 7. Mr. Francis Mukunya | Ministry of Finance, Planning and Economic Development |

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| 8. Dr. John R.S.Tabuti | Makerere University Institute of Environment and Natural Resources |
| 9. Dr. Peter Lating | Makerere University-Faculty of Technology |
| 10. Eng. Kayanja John | Ministry of Information and Communication Technology |
| 11. Dr. M. K. Musaazi | Makerere University, College of Engineering, Design, Art and Technology |
| 12. Mr. Usamara Kaggwa | Ministry of Energy and Mineral Development |
| 13. Dr. George Byarugaba Bazirake | Kyambogo University |
| 14. Eng. Charles Lwanga | Ministry of Information and Communication Technology |
| 15. Mr. Wesonga Lamech | Uganda Manufacturers Association |
| 16. Ms. Agnes Kaye | World Bank |
| 17. Ms. Sukhie Brar | World Bank |
| 18. Ms. Sara Farley | Global Knowledge Initiative |
| 19. Ms. Lily Amanda | Global Knowledge Initiative |
| 20. Ms. Prossie Nalule | Uganda National Bureau of Standards |
| 21. Dr. Tusubira K | National Drug Authority |
| 22. Mr. Francis Buwembo | Uganda National Academy of Sciences |
| 23. Mr. Asiimwe Savina | Makerere University |
| 24. Dr. Turahi David | Ministry of Information and Communication Technology |
| 25. Dr. Luke Okumu | Economic Policy Research Center |
| 26. Mr. Nsubuga Emmanuel | Government Analytical Laboratories, Ministry of Internal Affairs |
| 27. Mr. Japhes Mukiibi | Uganda Small Scale Industries Association |
| 28. Dr. Dorothy Nakimbugwe | Makerere University School of Food, Nutrition and Bioengineering |
| 29. Mr. Innocent Akampurira | UNCST |
| 30. Prof. P.E. Mugambi | Uganda National Academy of Sciences |

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| 31. Peter Otim Odoch | Otis-Garden Seed |
| 32. Ms. Jane Nabutto | UNCST |
| 33. Mr. Micheal Kawoya | Uganda Manufacturers Association |
| 34. Mr. George Opiyo | Uganda National Bureau of Standards |
| 35. Dr. J. Sekajugo | Ministry of Health |
| 36. Mr. Edward Tujunirwe | UNCST |
| 37. Mr. Nilesh Kanabar | Madhivan International |
| 38. Ms. Aber Jacqueline | Natural Chemotherapeutic Research Institute |
| 39. Ms. Leah Nawegulo | UNCST |
| 40. Mr. Peter Wakabi | National Planning Authority |
| 41. Mr. Kizito Suudi | Ministry of Trade, Industry and Cooperatives |
| 42. Mr. Partrick Sekitoleko | Uganda National Bureau of Standards |
| 43. Mr. Ssali Godfrey | Uganda Manufacturers Association |
| 44. Ms. Nabatanzi Rebecca | Uganda Cleaner Production Center |
| 45. Mr. Turyamwijuka Julius | Uganda Industrial Research Institute |
| 46. Dr. Edward Mukasa Bukenya | Kyambogo University |
| 47. Mr. Ogoa Nelson | National Chamber of Commerce and Industry |
| 48. Mr. Deogratius Kawoya | Private Sector Foundation Uganda |
| 49. Mr. Wanyama Aaron | Kyambogo University |
| 50. Mr. Golooba Ibrahim | Islamic University in Uganda |
| 51. Mr. Vincent Operem | National Planning Authority |
| 52. Mr. Kabanda Dennis Kamoga | Institute of Surveyors and Architects |
| 53. Dr. Julianne Sansa Otim | Makerere University |
| 54. Mr. Abel Kaahwa | Uganda Christian University |
| 55. Capt. Bitature Vincent | Office of the President |
| 56. Ms. Akello Juliet | Uganda Debt Network |
| 57. Ms. Magoba Sarah | Young Empowered And Healthy (YEAH) |
| 58. Mr. Anguyo Robert | Uganda National Association of the Blind |
| 59. Mr. Kagugube Ronald | Uganda Communications Commission |
| 60. Ms. Proscovia Nanyanzi | Ministry of Energy and Mineral Development |

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| 61. Dr. Kitooga Fredrick | National Information Technology Authority |
| 62. Dr. Matovu David | Economic Policy Research Centre |
| 63. Prof Eriabu Lugujjo | Makerere University |
| 64. Mr. Mweru Isaac | National Forestry Authority |
| 65. Mr. Ssentumu Joseph | Uganda National Health Research Organisation |
| 66. Sarah K.Kabasinguzi | Private Sector Foundation Uganda |
| 67. Dr. Bananuka John A | SCIFODE |
| 68. Prof. William Isharaza | Mbarara University of Science and Technology |
| 69. Ms. Harriet Pamara | Centre for Basic Research |
| 70. Mr. Shaun Stuart | Research Africa, South Africa |
| 71. Hon. Mugambe Joseph | Former Chair, Science and Technology Committee, Parliament of Uganda |
| 72. Mr. Bwango Smart | Kabarole District Local Government |
| 73. Mr. Anguyo William | Uganda Bureau of Statistics |
| 74. Dr. Mohamed Babu | Islamic University in Uganda |
| 75. Capt. Charles Oluka | Office of the President |
| 76. Mr. Omari Bashir | Kenya National Council for Science and Technology |
| 77. Dr. Eric Mwangi | Min. of Higher Education, Science and Tech, Kenya |
| 78. Mr. Rwanbuhinga Richard | District LC5 Chairperson, Kabarole |
| 79. Mr. Mubiru William | Office of the President |
| 80. Mr. Abigaba John | Uganda Small Scale Industries Association |
| 81. Mr. Japhet Magyembe | National Agricultural Research Organisation |
| 82. Prof. Jonathan Baranga | Mbarara University of Science and Technology |
| 83. Mr. Mulumba Mutema Mathias | National Curriculum Development Centre |

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| 84. | Eng. Akankwasa Justus | Ministry of Education and Sports |
| 85. | Ms. Annet Muyama | SCIFODE |
| 86. | Dr. Muge George | Uganda Prisons Service |
| 87. | Capt. Manyire Odo | Office of the President |
| 88. | Mr. Mugabe Robert | Uganda Registration Services Bureau |
| 89. | Dr. Samuel Bakor Kucol | Busitema University |
| 90. | Prof. M. Buyinza | National Forestry Authority |
| 91. | Dr. Julius Lejju | Mbarara University of Science and Technology |
| 92. | Mr. Simon. K. Anguma | Mbarara University of Science and Technology |
| 93. | Mr. Micheal Olupot-Tukei | Office of the President |
| 94. | Mr. Talenga Justin | Network of Ugandan Researchers and Research Users |
| 95. | Mr. Tumuramye Francoe | Ministry of Agriculture Animal Industry and Fisheries |
| 96. | Mr. Tom Byaruhanga | UNCST |
| 97. | Prof. Sospeter Muhongo | University of Dar-es-salaam |
| 98. | Brig. Micheal Bossa | Uganda Peoples Defence Force |
| 99. | Ms. Phiona Kitakule | Uganda Industrial Research Institute |
| 100. | Mr. Bamu Banturaki George | State House |
| 101. | Prof. Nyeko Pen-Mogi | Vice Chancellor, Gulu University |
| 102. | Mr. Robert Epaye | UNCST |
| 103. | Mr. Munyambonera Ezra | Economic Policy Research Centre |
| 104. | Prof. Johnson Nkuuhe | United Nations Development Programme |
| 105. | Prof. William Kyamuhangire | Makerere University |
| 106. | Mr. Kato Tucker | UNCST |
| 107. | Mr. John Byaruhanga | Ministry of Finance Planning and Economic Development |
| 108. | Dr. Peter Tindemans | World Bank |

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| 109. | Prof. Byaruhanga Akiiki | Makerere University |
| 110. | Dr. Erika Kraemer-Mbula | University of Brighton , United Kingdom |
| 111. | Ms. Kamusiime Catherine | Agro-Genetic Technologies Laboratories |
| 112. | Mr. Mukose Muhammed | Agency for Science and Technology Advancement in Uganda |
| 113. | Mr. Muhidin Noor | Makerere University School of Women and Gender Studies |
| 114. | Prof. Katunguka Rwakishaya | Makerere University |
| 115. | Mr. Charles Kalule | Uganda National Bureau of Standards |
| 116. | Mr. Anthony Okimat | UNCST |
| 117. | Mr. William Balikudembe | Uganda Science Journalists Association. |
| 118. | Mr. Noel Bisamaza | Office of the President |
| 119. | Prof. Huq Mozammel | University of Strathclyde, UK |
| 120. | Mr. Kintu Joseph | National Curriculum Development Centre |
| 121. | Dr. Denis Byarugaba | National Agricultural Research Organisation |
| 122. | Mr. Biryabalema Elijah | Resident District Commissioner, Kabarole |
| 123. | MR. Opedun Peter Mark | National Water and Sewerage Corporation/Fort Portal |
| 124. | Dr. Fredrick Ntale Kisekka | Makerere Institute of Social Research |
| 125. | Mr. Gaston Kironde | Uganda National Bureau of Standards |
| 126. | Ms. Arthur Makara | SCIFODE |
| 127. | Prof. John Kasenene | Mountains of the Moon University |
| 128. | Hon. Ruhunda Alex | Parliament of Uganda |
| 129. | Ms. Elizabeth Tamale | Ministry of Trade, Industry and Cooperatives |
| 130. | Ms. Helen Naluyima Opolot | UNCST |
| 131. | Ms. Namanya Ruth | Nyakasura School |
| 132. | Mr. Aloysius Chebet | East African Community |
| 133. | Mr. Muhebwa Martin | Auditor General |

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| 134. | Mr. John Okumu | Uganda National Bureau of Standards |
| 135. | Mr. Wandii Masiga | Association for Agricultural Research in East and Central Africa |
| 136. | Ms. Deborah Kasule | UNCST |
| 137. | Mr. James Mubiru | Civil Aviation Authority |
| 138. | Amos Ngabirano | Uganda Police Force, Ministry of International Affairs |
| 139. | Dr. Jesudas Mwanje | Ministry of Defence |
| 140. | Dr. P. Tukamuhabwa | Makerere University College of Agriculture and Environmental Sciences |
| 141. | Ms. Mylia Rubanzana | UNCST |
| 142. | Dr. David Ogong | Uganda Communications Commission |
| 143. | Mr. Akeny Robert | Uganda Communications Commission |
| 144. | Mr. Vincent Katutsi | Uganda Registration Services Bureau |
| 145. | Mr. Kivunike Godfrey | Ministry of Agriculture, Animal Industry and Fisheries |
| 146. | Eng. Orach Benard | Ministry of Works and Transport |
| 147. | Mr. Bbuye Abubaker | Ministry of Education and Sports |
| 148. | Ms. Maria Nakachwa | National Council for Higher Education |
| 149. | Ms. Kituyi Betty Mukhalu | Cafe Scientifique |
| 150. | Ms. Aminah Bukenya | UNCST |
| 151. | Mr. Fred Kakooza | Uganda Investment Authority |
| 152. | Mr. Julius Torach | National Information Technology Authority |
| 153. | Mr. Dickson Avutia | UNCST |
| 154. | Ms. Gertrude K. Mulindwa | National Libraries Union |
| 155. | Ms. Loi Namuganyi | UNCST |
| 156. | Mr. Robert Kayiki | East African School of Library and Information Sciences |
| 157. | Mr. Colins Mwesigwa | UNCST |

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| 158. | Mr. Jimmy Amatre | Ministry of Local Government |
| 159. | Mr. Joseph Kabi Redi | Uganda Bureau of Statistics |
| 160. | Mr. Jagwe Ronald | UNCST |
| 161. | Ms. Annet Atuhurire | Uganda Industrial Research Institute |
| 162. | Mr. Moses Bagyendera | Ministry of Information and Communication Technology |
| 163. | Mr. Steven Ojangole | National Agricultural Research Organisation |
| 164. | Ms. Ruth M. Tugume | UNCST |
| 165. | Ms. Susan Oketcho | Ministry of Education and Sports |
| 166. | Prof. Joseph Obua | Inter-University Council of East Africa |
| 167. | Mr. Erostus Nsubuga | Agro- Genetic Technologies Laboratories |
| 168. | Mr. Ssebaggala M. Kigozi | Uganda Manufactures Association |
| 169. | Mr. H.M Nsubuga | Office of the President |
| 170. | Dr. Louis Mukwaya | Uganda Virus Research Institute |
| 171. | Ms. Naome N. Baketunga | Office of the Prime Minister |
| 172. | Dr. Rufus Wesi Osizweni | Meraka Institute, South Africa |
| 173. | Mr. H.S. Opika Opoka | Chairman Gulu University Council |
| 174. | Dr. T.E.E. Areke | National Semi-Arid Resources Research Institute-Serere |
| 175. | Mr. Jay Makan | Council for Scientific and Industrial Research, Meraka Institute, South Africa |
| 176. | Dr. Gatama Gichini | Ministry of Higher Education, Science and Technology, Kenya |
| 177. | Dr. David Phaho | Technology Innovation Agency, South Africa |
| 178. | Mr. Isaac Meradi | Department of Science and Technology, South Africa |
| 179. | Mr. Enoch Ndyabanawe | The National Heritage Uganda Limited |
| 180. | Ms. Patricia E. Odoch | Gulu University |

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| 181. | Ms. Annet Atuhaire | Uganda Industrial Research Institute |
| 182. | Dr. Kilama Justine Luwa | Gulu University |
| 183. | Mr. Geresome Mugisha | Ministry of Health |
| 184. | Mr. Kirigwajjo Moses | Uganda Red Cross Society |
| 185. | Mr. Peter Olowo | National Commission for UNESCO |
| 186. | Mr. Jim Kabeho | Madhvani Group |
| 187. | Hon. Oceng D. Alex Penytoo | Member of Parliament |
| 188. | Eng. Dr. Lawrence A. Kato | Kampala International University |
| 189. | Mr. Renny Kato | Ministry of Local Government |
| 190. | Hon. Regan R. Okumu | Member of Parliament |
| 191. | Mr. Patrick Ongom | SCIFODE |
| 192. | Mr. Abemigisha Gadson | Ministry of Finance, Planning and Economic Development |
| 193. | Prof. Edward J.B. Kakonge | Uganda Debt Network |
| 194. | Mr. Okullu D. Alfred | Uganda Prisons Service |
| 195. | Prof. Charles Kwesiga | Uganda Industrial Institute |
| 196. | Johannes van Niekerk | South African High Commission |
| 197. | Dr. Nassuuna .M. Musoke | Uganda Martyr's University |
| 198. | Prof. Joseph Okello-Onen | Gulu University |
| 199. | Dr. Luku Okumu | Economic Policy Research Centre |
| 200. | Ms. Clare Nafula | Ministry of Internal Affairs |
| 201. | Dr. J. Crysostom Katongole | Uganda Martyrs' University |
| 202. | Dr. Joseph Oonyu | Makerere University |
| 203. | Prof. John Rwomushana | Uganda AIDS Commission |
| 204. | Prof. C.W. Baliddawa | Gulu University |
| 205. | Prof. H. Oryem Origa | Makerere University |
| 206. | Mr. Wilson Wafula | Ministry of Energy and Mineral Development |
| 207. | Ms. Doreen Anyango | Agro-Genetic Laboratory Ltd |
| 208. | Prof. David Osiru | Makerere University |

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| 209. | Dr. Jude Lubega | Makerere University |
| 210. | Mr. Pater Wakabi | National Planning Authority |
| 211. | Dr. Daudi Mugisha | Kyambogo University |
| 212. | Hon. Tolit Simon Akecha | Member of Parliament |
| 213. | Dr. Phil. M. Majwara | Department of Science and Technology, South Africa |
| 214. | Mr. Mabano Godwin Okokie | State House |
| 215. | Ms. Harriet Pamara | Africa Technology Policy Studies Network |
| 216. | Mr. Lugemoi. B. Wilfred | Uganda Management Institute |
| 217. | Dr. John Rubaihayo | Mountains of the Moon University |
| 218. | Prof. John Muyonga | Makerere University |
| 219. | Mr. John Okumu | Uganda National Bureau of Standards |
| 220. | Mr. Dhizaala Sanon Moses | National Planning Authority |
| 221. | Mr. Onduri Machulu Fred | Ministry of Foreign Affairs |
| 222. | Ms. Aber Jacqueline | Natural Chemotherapeutic Research Institute, Ministry of Health |
| 223. | Mr. Milton Odongo | Deputy Resident District Commissioner, Gulu District |
| 224. | Dr. A.K. Banya | St. Mary's Hospital Lacor |
| 225. | Mr. Yasuke Takahashi | Japan International Cooperation Agency |
| 226. | Mr. Richard Todwong | Special Presidential Assistant for Northern Uganda |
| 227. | Mr. John Opio | Gulu District Local Government |
| 228. | Mr. Ashby Patrick | The Amnesty Commission |
| 229. | Mr. Patrick Muhumuza | Office of the President |