FOREWORD

Science and Technology (S&T) Statistics are used to assess sector performance and inform national Science and Technology (S&T) policy decisions. Uganda National Council for Science and Technology (UNCST) collects and publishes S&T statistics in a series of Science, Technology and Innovation (STI) statistical and indicator reports. In addition to statistical and indicator reports, UNCST has embarked on the production of annual S&T statistical abstracts to provide data on various aspects of Science and Technology.

The 2010 S&T Statistical Abstract contains statistics that are necessary for measuring Uganda’s achievements in science, technology and innovation. The Technology Achievement Index (TAI) is a composite measure of the performance of nations in relation to technology creation, diffusion of recent and old innovations, and development of human skills in science and technology.

The Abstract is developed from analytical results of both administrative and routine S&T sector surveys conducted by the UNCST during the course of the year. The 2010 S&T Statistical Abstract registers notable improvements in some key elements of technological development. Notable improvement has been registered in human capacity development and investment in research and development; while, Intellectual Property (IP) and STI infrastructure development require specific policy and program intervention.

The UNCST commends the efforts and contribution of stakeholders particularly the Uganda Bureau of Statistics (UBOS) and other Ministries, Departments and Agencies (MDAs) toward the development of this Abstract. The UNCST also encourages wide dissemination, readership and fair use of this document.

Dr. Peter Ndemere
EXECUTIVE SECRETARY
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<tr>
<td>ARIPO</td>
<td>African Regional Intellectual Property Office</td>
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<tr>
<td>BERD</td>
<td>Business Enterprise R&amp;D Expenditure</td>
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<td>BFP</td>
<td>Budget Framework Paper</td>
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<td>BOU</td>
<td>Bank of Uganda</td>
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<td>DFID</td>
<td>Department of International Development</td>
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<td>ERA</td>
<td>Electricity Regulatory Authority</td>
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<tr>
<td>FTE</td>
<td>Full Time Equivalents</td>
</tr>
<tr>
<td>GERD</td>
<td>Gross Domestic Expenditure on Research and Development</td>
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<td>GOVERD</td>
<td>Government R&amp;D expenditure</td>
</tr>
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<td>HC</td>
<td>Head Count</td>
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<td>HERD</td>
<td>Higher Education R&amp;D Expenditure</td>
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<td>HRST</td>
<td>Human Resources in Science and Technology</td>
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<tr>
<td>HSI</td>
<td>Human Skills Index</td>
</tr>
<tr>
<td>IP</td>
<td>Intellectual Property</td>
</tr>
<tr>
<td>IPC</td>
<td>International Patent Classification</td>
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<tr>
<td>ISCED</td>
<td>International Standard Classification of Education</td>
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<tr>
<td>ISCO</td>
<td>International Standard Classification of Occupations</td>
</tr>
<tr>
<td>ISIC</td>
<td>International Standard Industrial Classification</td>
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<tr>
<td>ISP</td>
<td>International Service Provider</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt Hour</td>
</tr>
<tr>
<td>MDAs</td>
<td>Ministries, Departments and Agencies</td>
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<td>MFPED</td>
<td>Ministry of Finance, Planning and Economic Development</td>
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<td>MoES</td>
<td>Ministry of Education and Sports</td>
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<td>MolICTs</td>
<td>Ministry of Information and Communication Technology</td>
</tr>
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<td>NCHE</td>
<td>National Council for Higher Education</td>
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<td>NDP</td>
<td>National Development Plan</td>
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<td>OECD</td>
<td>Organisation of Economic Cooperation and Development</td>
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<td>PNPERD</td>
<td>Private Non-profit R&amp;D Expenditure</td>
</tr>
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<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
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<td>S&amp;T</td>
<td>Science and Technology</td>
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<tr>
<td>SITC</td>
<td>Standard International Trade Classification</td>
</tr>
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<td>STET</td>
<td>Scientific and Technical Education and Training</td>
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<td>STI</td>
<td>Science, Technology and Innovation</td>
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<td>STS</td>
<td>Science and Technology Services</td>
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<td>TAI</td>
<td>Technology Achievement Index</td>
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<td>TCI</td>
<td>Technology Creation Index</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>UBOS</td>
<td>Uganda Bureau of Statistics</td>
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<td>UEDCL</td>
<td>Uganda Electricity Distribution Company Limited</td>
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<td>UCC</td>
<td>Uganda Communications Commission</td>
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<td>UNBS</td>
<td>Uganda National Bureau of Standards</td>
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<td>UNCST</td>
<td>Uganda National Council for Science and Technology</td>
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<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
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<td>URSB</td>
<td>Uganda Registration Services Bureau</td>
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<tr>
<td>USPTO</td>
<td>United States Patent and Trademark Office</td>
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<tr>
<td>WIPO</td>
<td>World Intellectual Property Organization</td>
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</table>
DEFINITIONS OF CONVENTIONS USED

The Frascati Manual is a document setting forth the methodology for collecting statistics on research and development (R&D). The Manual was prepared and published by the Organisation for Economic Co-operation and Development. The document provides fundamental definitions (type of activity: basic research, applied research, experimental development; research personnel: researchers, technicians, auxiliary personnel). It primarily deals with measuring the resources devoted to R&D – expenditure and personnel – in the performing sectors: higher education, government, business enterprise, private non-profit organizations.

The Frascati Manual is very important for understanding the role of science and technology in economic development. The definitions provided in this document have become internationally accepted and serve as a common language for discussions of science and technology policy. Originally an OECD standard, it has become an acknowledged standard in R&D studies all over the world and is widely used by various organizations associated with the United Nations and European Union.

The Oslo Manual contains guidelines for collecting and interpreting innovation data. The Oslo manual is a method for measurement of scientific and technological activities. The Oslo Manual is the foremost international source of guidelines for the collection and use of data on innovation activities in industry. The Oslo Manual is a joint publication of OECD and Eurostat, and has been published three times.

Over time the nature and landscape of innovation have changed, and so has the need for indicators to measure those changes and provide policy makers with appropriate tools for analysis. A considerable body of work was undertaken during the 1980s and 1990s to develop models and analytical frameworks for the study of innovation. This led to the first edition of the Oslo Manual in 1992, and focused on technological product and process innovation in manufacturing. The second edition published in 1997 which, expanded coverage to service sectors, focuses on the technological innovation as a main engine to economical growth. The third edition published in 2002 focused on the non-technological innovation. As a result, the scope of what is considered an innovation, has now been expanded to include marketing and organizational innovation.

The Canberra Manual on the Measurement of Human Resources devoted to S&T (the “Canberra Manual”) was issued in 1995. It was prepared in close co-operation between the OECD and the DGXII/Eurostat of the European Commission, other OECD Directorates, UNESCO and the International Labour Office (ILO), with the support of national experts. Drawing on best international and national practices and classifications, the “Canberra Manual” provides definitions of human resources devoted to science and technology in terms of qualification (levels and fields of study) and occupation and discusses a number of variables of policy interest.
DESCRIPTION OF CONVENTIONS USED

Statistics on Research and Development (R&D) are compiled in line with international statistical classifications such as International Standard Industrial Classification of Economic Activities (ISIC) for the classification of activities, International Standard Classification of Occupations (ISCO), International Standard Classification of Education (ISCED), and are adapted to the system of national accounts according to the Frascati Manual recommendations (OECD 2002). Statistics and indicators are further classified by fields of science, sector of performance and by source of funds.

Patents are classified according to the International Patent Classification (IPC). The International Patent Classification is based on an international multilateral treaty administered by the World Intellectual Property Organization (WIPO), i.e. the Strasbourg Agreement concerning the International Patent Classification. The groups classified as high-technology products are aggregated on the basis of the Standard International Trade Classification (SITC, Rev.3).
ACKNOWLEDGEMENTS

The Uganda National Council for Science and Technology (UNCST) profoundly acknowledges contributions from the various Ministries, Departments and Agencies (MDAs) that made the compilation of this Abstract possible. Also acknowledged are all institutions that contributed data that enriched the Abstract.

UNCST is grateful to the Department for International Development (DFID) of the United Kingdom for its financial support toward production of this S&T Statistical Abstract, and to the Uganda Bureau of Statistics (UBOS) for facilitating the production process.

The Abstract was authored by the S&T Policy Coordination Division of the UNCST comprising of Ismail Barugahara, Richard B. Lutalo, Catherine Munabi Tukacungurwa, Bashir Kagere, Noeline Basiime, Patrick Mafabi, Sulaiman Ssebbale, and Immaculate Nakamya. The authors acknowledge with thanks the technical contributions that were made by UNCST staff and management toward preparation of this Abstract.
GLOSSARY

**Business Enterprise R&D Expenditure (BERD)** - accounts for contributions to R&D activities made by firms, organizations and institutes that primarily produce goods and services (excluding higher education) for sale to the general public, as well as the non-profit private institutions that service them. Contributions to R&D by public sector enterprises are also included within this category.

**Development** - is defined as “the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems, or methods, including design and development of prototypes and processes.”

**Diffusion of old innovations index** - is a measure of the changes in the number of active telephones (mainline and cellular) per capita and electricity consumption per capita.

**Diffusion of recent innovations index** - is a measure of changes in the number of Internet hosts per capita and the share of high- and medium-technology exports in total goods exports.

**Electricity consumption** - comprises total electricity consumed annually plus imports and minus exports expressed in kilowatt-hours. The discrepancy between the amount of electricity generated and/or imported and the amount consumed and/or exported is accounted for as loss in transmission and distribution.

**Extra-national contributions** - are contributions by organizations and individual residents abroad. This would include international organizations and any physical assets and activities they may deploy within national borders.

**GERD per capita** - is the Gross Domestic Expenditure on R&D divided by the total population of the country.

**Government R&D expenditure (GOVERD)** - incorporates R&D expenditure by agencies, offices, and other entities that offer public goods and services (excluding higher education), as well as those that oversee governmental, economic, and social policies of the country or community in question. This indicator also includes expenditure by non-profit institutions funded and directed by the government.

**Gross Domestic Expenditure on Research and Development (GERD)** - is the total intramural expenditure on R&D performed on the national territory during a given period.
Gross tertiary science enrolment ratio – refers to the number of students enrolled in technical and scientific tertiary education as a share of the population in the relevant age range (19-24 years for most countries).

Higher Education R&D Expenditure (HERD) - accounts for R&D expenditure by higher education institutions, including universities and colleges, irrespective of their source of funding, degree of dependence on public policies or legal profile. This is also inclusive of expenditure by research centers, experimental stations and clinics that operate under the wing of higher education institutions or are affiliated to such institutions.

High-technology exports - are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. Data are in current U.S. dollars.

Human Resources in Science and Technology (HRST) - are persons that have either successfully completed education at the third level in an S&T field of study or not formally qualified as above, but employed in an S&T occupation where the above qualifications are normally required.

Human Skills Index - is a measure of the changes in mean years of schooling in the population aged 15 and above and the gross tertiary science enrolment ratio.

Internet hosts - are computers connected directly to the Internet; normally an Internet Service Provider’s (ISP) computer is a host. Internet users may use either a hard-wired terminal, at an institution with a mainframe computer connected directly to the Internet, or may connect remotely by way of a modem via telephone line, cable, or satellite to the Internet Service Provider’s host computer. The number of hosts is one indicator of the extent of Internet connectivity.

Intramural expenditures – are all expenditures for R&D performed within a statistical unit or sector of the economy during a specific period, regardless of the source of funds.

ISCED97 5A: International Standard Classification of Education 1997, Level 5A - includes all Bachelor or Masters degrees. However, S&T statistics in Uganda capture ISCED97 5A at Masters degree level only.

ISCED97 5B: International Standard Classification of Education 1997, Level 5B - includes shorter occupancy oriented programmes. S&T statistics in Uganda capture ISCED97 5B at Bachelor degree level only.

ISCED97 6: International Standard Classification of Education 1997, Level 6 - includes all PhD, Doctorate or similar level.

Mean years of schooling - is the average number of years of school completed in the population of age 15 and older.
Other supporting staff includes skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects.

Patent - is defined by the Oslo Manual as a legal property right over an invention, which is granted by national patent offices. Patent statistics are increasingly used in various ways by technology students as indicators of the output of invention activities.

Private Non-profit R&D expenditure (PNPERD) - includes expenditure by non-profit institutions that serve the public sector, as well as those by individual donors to R&D activities.

R&D personnel: All persons employed directly on Research and experimental development (R&D), as well as those providing direct services, such as R&D managers, administrators and clerical staff. Persons providing an indirect service, such as canteen and security staff, are excluded.

Research - is defined as “systematic study directed toward fuller scientific knowledge of the subject studied”.

Research and experimental Development (R&D) - comprises “creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications.”

Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned.

Royalty and license fees, receipts - are payments and receipts between residents and nonresidents for the authorized use of intangible, nonproduced, nonfinancial assets and proprietary rights (such as patents, copyrights, trademarks, industrial processes, and franchises) and for the use, through licensing agreements, of produced originals of prototypes (such as films and manuscripts). Data are in current U.S. dollars.

S&T Education and Training (STET) - are all activities comprising specialized non-university higher education and training, higher education and training leading to a university degree, postgraduate and further training, and organized lifelong training for scientists and engineers. These activities correspond broadly to ISCED levels 5A, 5B and 6, and may include some ISCED level 4 programmes.

Scientific and Technological Services (STS) – are activities concerned with R&D and contributing to the generation, dissemination and application of scientific and technical knowledge.

Scientists and engineers - are defined as persons engaged in scientific and engineering work at a level requiring a knowledge of sciences equivalent at least to that acquired through completion of a 4-year college course.
Technicians and equivalent staff - are persons with technical knowledge and experience who participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers.

Technology Achievement Index - is a composite index of technological achievement that measures the level of technological progress and thus the capacity of a country to participate in the network age.

Technology Creation Index - used to capture the level of innovation in a society, and measures changes in the number of patents granted to residents per capita and the receipts of royalties and license fees from abroad per capita.
EXECUTIVE SUMMARY

This Statistical Abstract was prepared using survey and administrative data on various aspects of S&T within the national system of innovations. It covers the period from 2005 to 2009 although the available and most recent data was used. It presents statistics which are used to measure Uganda’s technological progress and performance.

The abstract depicts an improvement in S&T sector performance in the areas of human resources in R&D and expenditure on S&T activities. Intellectual Property (IP), technology creation, diffusion of recent and old innovations, and science education achievement ratings are identified as areas for improvement to enhance Uganda’s technological achievement. The Abstract is presented in five sections.

The introductory section provides an overview of the coordinating agency for Science and Technology in Uganda.

Section 2 presents statistics on scientific and technical education and training. It focuses mainly on S&T human resource capacity through education and training by Ugandan institutions for the period 2007-2008. It provides gender disaggregated on student enrolments and graduates in Science, Mathematics and Engineering.

Section 3 discusses statistics on human resources in research and development relating to R&D personnel by occupation, sex, sector of employment, and formal education. The data shows an increase in R&D personnel during the period 2005 to 2009 with the most prominent increase being among the researchers. The 2009 R&D personnel totaling to 4002 were distributed such that Researchers were 42 percent, Technicians, 30 percent and support staff, 28 percent.

Section 4 presents statistics on research and development spending. The data shows that expenditures on R&D increased from Uganda Shillings 34 billion in 2005 to 124 billion in 2009. Over this period, the Government of Uganda was the main funder of R&D activities with a percentage contribution of 48 percent of the total research funding in 2009.

Section 5 discusses Uganda’s Technology Achievement Index (TAI), which gives a broad measure of a country’s technological readiness to participate in the global knowledge-based economy. Currently, Uganda’s TAI position is 0.18 which places it in the same category as most developing countries that are technologically marginalized.
INTRODUCTION

The Government of Uganda recognizes Science, Technology and Innovation (STI) as key inputs into the national development process. Its promotion and development has been prioritized within the National STI policy (2009) and the National Development Plan (NDP) 2009/2010-2014/2015. Successful implementation of these policies and programs entails systematic production and utilization of quality S&T statistics.

The Uganda National Council for Science and Technology (UNCST) is a semi-autonomous institution established in 1990 by an Act of Parliament (Cap 209 of the Laws of Uganda). The UNCST mandated to facilitate and coordinate the development and implementation of policies and strategies for integrating Science, Technology and Innovation into the national development process.

Essentially, the collection, management and dissemination of science statistics are principal statutory functions of the UNCST. The therefore UNCST has the national responsibility for collecting, publishing and disseminating science statistics for Uganda. In this regard UNCST collects S&T/ R&D data on government, business enterprise, higher education, and private nonprofit sectors and regularly publishes statistical information in national STI reports.

This publication compiles key data on various S&T indicators within the national system of innovation. It places emphasis on the statistics that are required for the measurement of Uganda’s progression in technological development. These include: scientific and technical education and training; human resources in research and development; expenditure on science and technology activities; and the Technology Achievement Index. Data on these indicators are presented and discussed in the respective sections of this Abstract.
This section focuses on S&T human resource capacity through education and training by Uganda institutions for the period 2007-2008.

Human capital development in science and technology is a prerequisite for attaining a knowledge-based economy. Uganda’s S&T personnel have increased over the past years through S&T training, migration, technology transfer and technical cooperation.

Universities dominate student enrolments at tertiary level with most of these enrolments being at Bachelors level. Notably, enrolments in Social Sciences are the majority while Science and Engineering (S&E) enrolments are still dismal. Gender disparities are still very pronounced at all levels of tertiary education as shown in figure 2.1.

**Figure 2.1: Gender disaggregated Shares by Science degree level 2007 and 2008**

University infrastructure and faculty remain critical challenges to the achievement of quality university education to the extent that Makerere University is the only globally ranked Ugandan university. Statistics pertaining to this section are presented in Appendix A (Tables 1-4).
HUMAN RESOURCES IN RESEARCH AND DEVELOPMENT

This section presents head count statistics on key human resources in research and development by occupation, sex, sector of employment and formal education. Human resources in R&D are categorized as researchers, technicians and other supporting staff (see glossary).

There was an increase in the number of R&D personnel during the period 2005 to 2009 with prominent gains among researchers (Figure 3.1). The 2009 R&D personnel totaling to 4002 were distributed as follows; Researchers (42%), Technicians (30%) and support staff (28%).

Figure 3.1: R&D personnel by occupation

In 2009, most of the researchers were in the Government sector (47%) and the High Education sector (37%). Approximately 30 percent of these researchers were PhD degrees holders, while 27 percent held Masters degrees and 42 percent Bachelors degree.

With regard to researchers by fields of science and technology, Medical Sciences and Social Sciences and Humanities account for the largest share at 39.5% and 38.4% respectively, with Engineering and Technology registering the least share of less than two percent (1.7%).

The details on human resources in R&D for 2008 and 2009 are presented in the Appendix B (Tables 1 - 8b).
Overall R&D expenditure increased 2.6 times over the last five years from Uganda Shillings 34 billion in 2005 to 124 billion in 2009. Over the period under review Government of Uganda was the main funder of R&D activities. Its percentage contribution in 2009 was 48 percent of total research funding (Figure 4.1).

**Figure 4.1: Total Expenditure on R&D by source of funds**

![Pie chart showing R&D funding by source. Government funds dominate at 48%, followed by Higher Education at 18%, Private non-profit at 10%, Funds from abroad at 26%, and Business Enterprise at 8%. Source: UNCST, 2010]

In 2009, R&D expenditure by sector of performance portrays a fairly skewed pattern. The Government sector contributed the largest share in research financing at 64% followed by the Higher Education sector at about 18%. Expenditure in the Private non-profit sector and the Business Enterprise sector remained low at 10% and 8% respectively (see Figure 4.2).
Furthermore, as indicated in Figure 4.1 above the funds that performed R&D in 2009 mainly came from the Government sector (48%) and the donor community, that is, funds from abroad (26%), with limited funding coming from the Ugandan Business sector.

Details on expenditure on R&D are indicated in Appendix C (Tables 1 - 7).
Technology achievement of a county refers to the level of its technological readiness to participate in the global knowledge-based economy. This can be described through a combination of appropriate indicators. Some of these indicators (read input indicators) may describe existing level of a country’s technological ability to perform while others (read output indicators) may give strong evidence that the ability is dynamic and productive. An appropriate combination of the two provides a fairly realistic measure of the technological achievement of a country.

The (TAI) is thus a composite index which aggregates national technological capabilities and performance in terms of (i) creation/diffusion of new technologies, (ii) diffusion of new technologies, (iii) diffusion of old technologies and (iv) development of human skills. It is a simple and relatively useful index for assessing the technological capability of a country. The sub-indicators used in the computation of TAI are considered to practically cover all related aspects of technology achievement. As such it is a very useful index for countries to assess their relative technology-based readiness in comparison with their competitors for participation in the global knowledge-based economy.

The TAI focuses on assessing the technological performance of a country based on its capability in creating and using technology but NOT on the overall size of its technological development. It is for this reason that, for example, Finland a smaller country finds itself up the TAI rankings than the USA, UK and Germany. The Index has four dimensions and each dimension is specified by two sub-indicators. The four dimensions and the corresponding sub-indicators are summarized Table 5.1 below:
### Table 5.1 TAI dimensions and sub-indicators

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Sub-indicators</th>
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<tbody>
<tr>
<td>#1 Creation of technology</td>
<td>• <em>Patents granted to residents (per million people)</em>: stock of embedded knowledge. An indirect indicator of knowledge that has been developed and could be tapped for future use. It also reflects the current level of inventive activity</td>
</tr>
<tr>
<td></td>
<td>• <em>Royalties and license fees received (US$ per 1000 people)</em>: the indicator reflects the stock of successful past innovations that are still useful and hence have market value</td>
</tr>
<tr>
<td>#2 Diffusion of recent innovations</td>
<td>• <em>Internet hosts (per1000 people)</em>: Diffusion of internet is indispensable for participation in the global economic activities. It is one of the most dynamic and powerful tools to access the global information at relatively low cost</td>
</tr>
<tr>
<td></td>
<td>• <em>High-technology and medium-technology exports (as %age of total goods exports)</em>: the indicator is the best yardstick for measuring the annual average growth rates (AAGR) in high technology area of a country</td>
</tr>
<tr>
<td>#3 Diffusion of old technologies</td>
<td>• <em>Electricity consumption (kWh per capita)</em>: the indicator gives a reasonably accurate idea about the diffusion of electricity within a society. The indicator is important because of its use in new technologies and also for a multitude of other human activities</td>
</tr>
<tr>
<td></td>
<td>• <em>Telephone mainlines and cellular subscribers (per1000 people)</em>: this indicator shows the participation of the people in the communication revolution. Countries must adopt this old innovation to participate successfully in the present IT network era</td>
</tr>
<tr>
<td>#4 Human skills development</td>
<td>• <em>Mean years of schooling (aged 15 and above)</em>: the mean years of schooling is used as a proxy for cognitive skill.</td>
</tr>
<tr>
<td></td>
<td>• <em>Gross tertiary science enrolment ratio (%)</em>: this indicator assesses the skills of a nation in science, mathematics, engineering and construction at the tertiary level</td>
</tr>
</tbody>
</table>

The TAI is a composite measure of the country’s overall technological achievement in the field of Science and Technology. Currently Uganda’s TAI stands at 0.18 which places the country in the same category as most developing technologically marginalized nations. This section highlights the various components of the TAI (Table 5.2).
<table>
<thead>
<tr>
<th>Dimension</th>
<th>Indicator</th>
<th>Value</th>
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<tbody>
<tr>
<td>Creation of Technology</td>
<td>Patents granted to residents (per million people)</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Royalties and license fees received (US$ per 1000 people)</td>
<td>93.6</td>
</tr>
<tr>
<td>Diffusion of recent innovations</td>
<td>Internet hosts (per 1000 people)</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>High-technology and medium-technology exports (as % of total goods exports)</td>
<td>4.9</td>
</tr>
<tr>
<td>Diffusion of old innovations</td>
<td>Telephones (mainline and cellular, per 1000 people)</td>
<td>294.71</td>
</tr>
<tr>
<td></td>
<td>Electricity consumption (kWh per capita)</td>
<td>69.8</td>
</tr>
<tr>
<td>Human Skills</td>
<td>Mean years of schooling (aged 15 and above)</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>Gross tertiary science, enrolment ratio (%)</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
APPENDICES
Appendix A: Scientific and Technical Education and Training

Table 1: Level of university enrolments, 2007-2008

<table>
<thead>
<tr>
<th>Degree Award</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD</td>
<td>91</td>
<td>151</td>
</tr>
<tr>
<td>Masters</td>
<td>5155</td>
<td>5410</td>
</tr>
<tr>
<td>Bachelors</td>
<td>78310</td>
<td>67616</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>83556</strong></td>
<td><strong>73177</strong></td>
</tr>
</tbody>
</table>

Source: UNCST, 2009

*Excluding Universities – Kyambogo, African Bible College and St. Lawrence, Mutesa I Royal University*

Table 2: Total enrolments by field of science, 2007-2008

<table>
<thead>
<tr>
<th>Discipline</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Sciences</td>
<td>62857</td>
<td>53725</td>
</tr>
<tr>
<td>Humanities</td>
<td>3304</td>
<td>3086</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>1678 (2)</td>
<td>1990 (2.7)</td>
</tr>
<tr>
<td>Medical Science</td>
<td>3489</td>
<td>3971</td>
</tr>
<tr>
<td>Natural and Physical Sciences</td>
<td>8781</td>
<td>7832</td>
</tr>
<tr>
<td>Engineering</td>
<td>3447</td>
<td>2573</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>83556</strong></td>
<td><strong>73177</strong></td>
</tr>
</tbody>
</table>

Source: UNCST, 2009
Table 3: Total enrolment by field of science and sex, 2007-2008

<table>
<thead>
<tr>
<th>Discipline</th>
<th>2007 Male</th>
<th>2007 Female</th>
<th>2008 Male</th>
<th>2008 Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Sciences</td>
<td>32962</td>
<td>29939</td>
<td>29362</td>
<td>24399</td>
</tr>
<tr>
<td>Humanities</td>
<td>1789</td>
<td>1555</td>
<td>1767</td>
<td>1318</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>1313</td>
<td>365</td>
<td>1505</td>
<td>485</td>
</tr>
<tr>
<td>Medical Science</td>
<td>2082</td>
<td>1407</td>
<td>2214</td>
<td>1757</td>
</tr>
<tr>
<td>Engineering</td>
<td>2733</td>
<td>714</td>
<td>2044</td>
<td>529</td>
</tr>
<tr>
<td>Natural and Physical Sciences</td>
<td>5673</td>
<td>3108</td>
<td>5120</td>
<td>2713</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>46552</strong></td>
<td><strong>37088</strong></td>
<td><strong>41,976</strong></td>
<td><strong>31,201</strong></td>
</tr>
</tbody>
</table>

Source: UNCST Database 2009

Table 4: Number of graduates by field of science and qualification, 2007-2008

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Science</td>
<td>6</td>
<td>5</td>
<td>710</td>
<td>965</td>
<td>14247</td>
<td>15940</td>
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<tr>
<td>Humanities</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>41</td>
<td>881</td>
<td>789</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>5</td>
<td>2</td>
<td>17</td>
<td>7</td>
<td>339</td>
<td>230</td>
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<tr>
<td>Medical Sciences</td>
<td>8</td>
<td>0</td>
<td>96</td>
<td>45</td>
<td>331</td>
<td>171</td>
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<tr>
<td>Engineering</td>
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<td>1</td>
<td>14</td>
<td>8</td>
<td>783</td>
<td>432</td>
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<tr>
<td>Natural Sciences</td>
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<td>2</td>
<td>118</td>
<td>71</td>
<td>1845</td>
<td>1182</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>30</strong></td>
<td><strong>10</strong></td>
<td><strong>979</strong></td>
<td><strong>1137</strong></td>
<td><strong>18426</strong></td>
<td><strong>18744</strong></td>
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</tbody>
</table>

Source: UNCST, 2009
## Appendix B: Human Resources in Research and Development

### Table 1  R&D personnel by occupation - Headcounts (HC)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total R&amp;D personnel (A+B+C)</th>
<th>Occupation</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Researchers (A)</td>
<td>Technicians and equivalent staff (B)</td>
<td>Other supporting staff (C)</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>4002</td>
<td>1703</td>
<td>1194</td>
<td>1105</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>2973</td>
<td>1387</td>
<td>823</td>
<td>763</td>
<td></td>
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<tr>
<td>2007</td>
<td>1937</td>
<td>891</td>
<td>542</td>
<td>504</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>1807</td>
<td>831</td>
<td>506</td>
<td>470</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>1686</td>
<td>776</td>
<td>472</td>
<td>438</td>
<td></td>
</tr>
</tbody>
</table>

Source: UNCST, 2010

### Table 2  R&D personnel by sex

<table>
<thead>
<tr>
<th>Year</th>
<th>Total R&amp;D personnel (A+B+C)</th>
<th>Total Researchers (A+B)</th>
<th>Total Researchers by sex</th>
<th>Total Researchers by sex by unknown/no data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Female (A)</td>
<td>Male (B)</td>
<td>Unknown/No data (C)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>4002</td>
<td>1369</td>
<td>2633</td>
<td>1703</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>688</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1015</td>
</tr>
<tr>
<td>2008</td>
<td>2973</td>
<td>1028</td>
<td>1945</td>
<td>1387</td>
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<td>838</td>
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<td>2007</td>
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<td>365</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>526</td>
</tr>
<tr>
<td>2006</td>
<td>1807</td>
<td>488</td>
<td>849</td>
<td>831</td>
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<td></td>
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<td>519</td>
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<tr>
<td>2005</td>
<td>1686</td>
<td>455</td>
<td>793</td>
<td>438</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>776</td>
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<td>291</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>485</td>
</tr>
</tbody>
</table>

n = quantity nil

Source: UNCST, 2010
### Table 3a  R&D personnel by sector of employment and occupation, 2008

<table>
<thead>
<tr>
<th>Reference year 2008</th>
<th>Total R&amp;D personnel (A+B+C)</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Researchers (A)</td>
</tr>
<tr>
<td>Total (i. + ii. + iii. + iv.)</td>
<td>2973</td>
<td>1387</td>
</tr>
<tr>
<td>i. Business enterprise</td>
<td>243</td>
<td>87</td>
</tr>
<tr>
<td>ii. Government</td>
<td>1381</td>
<td>742</td>
</tr>
<tr>
<td>iii. Higher education</td>
<td>1051</td>
<td>456</td>
</tr>
<tr>
<td>iv. Private non-profit</td>
<td>298</td>
<td>102</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010

### Table 3b  R&D personnel by sector of employment and occupation, 2009

<table>
<thead>
<tr>
<th>Reference year 2009</th>
<th>Total R&amp;D personnel (A+B+C)</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Researchers (A)</td>
</tr>
<tr>
<td>Total (i. + ii. + iii. + iv.)</td>
<td>4002</td>
<td>1703</td>
</tr>
<tr>
<td>i. Business enterprise</td>
<td>280</td>
<td>100</td>
</tr>
<tr>
<td>ii. Government</td>
<td>1621</td>
<td>808</td>
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<tr>
<td>iii. Higher education</td>
<td>1585</td>
<td>631</td>
</tr>
<tr>
<td>iv. Private non-profit</td>
<td>516</td>
<td>164</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
### Table 4a  R&D personnel by sector of employment and sex, 2008

<table>
<thead>
<tr>
<th>Sector</th>
<th>Reference year 2008</th>
<th>Total R&amp;D personnel</th>
<th>Researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total (A+B)</td>
<td>Female (A)</td>
</tr>
<tr>
<td>Total (i. + ii. + iii. + iv.)</td>
<td></td>
<td>2973</td>
<td>1029</td>
</tr>
<tr>
<td>i. Business enterprise</td>
<td></td>
<td>243</td>
<td>107</td>
</tr>
<tr>
<td>ii. Government</td>
<td></td>
<td>1381</td>
<td>461</td>
</tr>
<tr>
<td>iii. Higher education</td>
<td></td>
<td>1051</td>
<td>367</td>
</tr>
<tr>
<td>iv. Private non-profit</td>
<td></td>
<td>298</td>
<td>94</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010

### Table 4b  R&D personnel by sector of employment and sex, 2009

<table>
<thead>
<tr>
<th>Sector</th>
<th>Reference year 2009</th>
<th>Total R&amp;D personnel</th>
<th>Researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total (A+B)</td>
<td>Female (A)</td>
</tr>
<tr>
<td>Total (i. + ii. + iii. + iv.)</td>
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<td>4002</td>
<td>1370</td>
</tr>
<tr>
<td>i. Business enterprise</td>
<td></td>
<td>280</td>
<td>124</td>
</tr>
<tr>
<td>ii. Government</td>
<td></td>
<td>1621</td>
<td>539</td>
</tr>
<tr>
<td>iii. Higher education</td>
<td></td>
<td>1585</td>
<td>537</td>
</tr>
<tr>
<td>iv. Private non-profit</td>
<td></td>
<td>516</td>
<td>170</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
### Table 5a Researchers by formal qualification and sector of employment, 2008

<table>
<thead>
<tr>
<th>Reference year 2008</th>
<th>Total researchers (A+B+C+D)</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Business enterprise (A)</td>
</tr>
<tr>
<td>Total (i + ii + iii +iv)</td>
<td>1387</td>
<td>87</td>
</tr>
<tr>
<td>i. ISCED 6</td>
<td>429</td>
<td>6</td>
</tr>
<tr>
<td>ii. ISCED 5A</td>
<td>293</td>
<td>16</td>
</tr>
<tr>
<td>iii. ISCED 5B</td>
<td>660</td>
<td>65</td>
</tr>
<tr>
<td>iv. All other qualifications</td>
<td>5</td>
<td>n</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010

### Table 5b Researchers by formal qualification and sector of employment, 2009

<table>
<thead>
<tr>
<th>Reference year 2009</th>
<th>Total researchers (A+B+C+D)</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Business enterprise (A)</td>
</tr>
<tr>
<td>Total (i + ii + iii +iv)</td>
<td>1703</td>
<td>100</td>
</tr>
<tr>
<td>i. ISCED 6</td>
<td>519</td>
<td>7</td>
</tr>
<tr>
<td>ii. ISCED 5A</td>
<td>460</td>
<td>23</td>
</tr>
<tr>
<td>iii. ISCED 5B</td>
<td>719</td>
<td>70</td>
</tr>
<tr>
<td>iv. All other qualifications</td>
<td>5</td>
<td>n</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
## Table 6a  Researchers by formal qualification and sex, 2008

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Reference year 2008</th>
<th>Total researchers (A+B)</th>
<th>Gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Female (A)</td>
<td>Male (B)</td>
</tr>
<tr>
<td></td>
<td>Total (i + ii + iii + iv)</td>
<td>1387</td>
<td>550</td>
<td>837</td>
</tr>
<tr>
<td>i. ISCED 6</td>
<td></td>
<td>429</td>
<td>154</td>
<td>275</td>
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<tr>
<td>ii. ISCED 5A</td>
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<td>293</td>
<td>123</td>
<td>170</td>
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<tr>
<td>iii. ISCED 5B</td>
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<td>660</td>
<td>271</td>
<td>389</td>
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<td>iv. All other qualifications</td>
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<td>3</td>
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</tbody>
</table>

Source: UNCST, 2010

## Table 6b  Researchers by formal qualification and sex, 2009

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Reference year 2009</th>
<th>Total researchers (A+B)</th>
<th>Gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Female (A)</td>
<td>Male (B)</td>
</tr>
<tr>
<td></td>
<td>Total (i + ii + iii + iv)</td>
<td>1703</td>
<td>688</td>
<td>1015</td>
</tr>
<tr>
<td>i. ISCED 6</td>
<td></td>
<td>519</td>
<td>180</td>
<td>339</td>
</tr>
<tr>
<td>ii. ISCED 5A</td>
<td></td>
<td>460</td>
<td>205</td>
<td>255</td>
</tr>
<tr>
<td>iii. ISCED 5B</td>
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<td>301</td>
<td>418</td>
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<tr>
<td>iv. All other qualifications</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td></td>
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</tbody>
</table>

Source: UNCST, 2010
### Table 7a  Researchers by fields of science and sector of employment, 2008

<table>
<thead>
<tr>
<th>Reference year 2008</th>
<th>Total researchers (A+B+C+D)</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Business enterprise (A)</td>
</tr>
<tr>
<td>i. Natural sciences</td>
<td>77</td>
<td>6</td>
</tr>
<tr>
<td>ii. Engineering and technology</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>iii. Medical sciences</td>
<td>532</td>
<td>9</td>
</tr>
<tr>
<td>iv. Agricultural sciences</td>
<td>219</td>
<td>n</td>
</tr>
<tr>
<td>v. Social sciences and Humanities</td>
<td>533</td>
<td>67</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010

### Table 7b  Researchers by fields of science and sector of employment, 2009

<table>
<thead>
<tr>
<th>Reference year 2009</th>
<th>Total researchers (A+B+C+D)</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>Business enterprise (A)</td>
</tr>
<tr>
<td>i. Natural sciences</td>
<td>125</td>
<td>6</td>
</tr>
<tr>
<td>ii. Engineering and technology</td>
<td>28</td>
<td>5</td>
</tr>
<tr>
<td>iii. Medical sciences</td>
<td>673</td>
<td>15</td>
</tr>
<tr>
<td>iv. Agricultural sciences</td>
<td>223</td>
<td>1</td>
</tr>
<tr>
<td>v. Social sciences and Humanities</td>
<td>654</td>
<td>73</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
Table 8a  Researchers by fields of science and sex, 2008

<table>
<thead>
<tr>
<th>Reference year</th>
<th>Total researchers (A+B)</th>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 i. Natural sciences</td>
<td>77</td>
<td>38</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>2008 ii. Engineering and technology</td>
<td>26</td>
<td>6</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>2008 iii. Medical sciences</td>
<td>532</td>
<td>183</td>
<td>349</td>
<td></td>
</tr>
<tr>
<td>2008 iv. Agricultural sciences</td>
<td>219</td>
<td>66</td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>2008 v. Social sciences and Humanities</td>
<td>533</td>
<td>257</td>
<td>276</td>
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</tr>
</tbody>
</table>

Source: UNCST, 2010

Table 8b  Researchers by fields of science and sex, 2009

<table>
<thead>
<tr>
<th>Reference year</th>
<th>Total researchers (A+B)</th>
<th>Sector</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 i. Natural sciences</td>
<td>125</td>
<td>67</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>2009 ii. Engineering and technology</td>
<td>28</td>
<td>21</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>2009 iii. Medical sciences</td>
<td>673</td>
<td>434</td>
<td>239</td>
<td></td>
</tr>
<tr>
<td>2009 iv. Agricultural sciences</td>
<td>223</td>
<td>154</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>2009 v. Social sciences and Humanities</td>
<td>654</td>
<td>339</td>
<td>315</td>
<td></td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
## Appendix C: Expenditure on Research and Development

### Table 1  Total expenditure on R&D, (Ushs. ‘000s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total expenditure in R&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>123,889,061</td>
</tr>
<tr>
<td>2008</td>
<td>79,939,412</td>
</tr>
<tr>
<td>2007</td>
<td>82,249,000</td>
</tr>
<tr>
<td>2006</td>
<td>54,688,635</td>
</tr>
<tr>
<td>2005</td>
<td>34,531,052</td>
</tr>
</tbody>
</table>

* Data in fiscal years (e.g. 2009 refers to 2009/2010)*

Source: UNCST, 2010

### Table 2  Total expenditure on R&D by sector of performance, (Ushs. ‘000s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total (A+B+C+D)</th>
<th>Business enterprise (A)</th>
<th>Government (B)</th>
<th>Higher education (C)</th>
<th>Private non-profit (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>123,889,061</td>
<td>10,200,000</td>
<td>79,726,290</td>
<td>21,757,191</td>
<td>12,205,580</td>
</tr>
<tr>
<td>2008</td>
<td>79,939,412</td>
<td>3,466,670</td>
<td>61,054,470</td>
<td>n</td>
<td>15,418,272</td>
</tr>
<tr>
<td>2007</td>
<td>82,249,000</td>
<td>6,200,000</td>
<td>55,516,787</td>
<td>n</td>
<td>20,532,213</td>
</tr>
<tr>
<td>2006</td>
<td>54,688,635</td>
<td>n</td>
<td>32,745,185</td>
<td>5,271,394</td>
<td>16,672,056</td>
</tr>
<tr>
<td>2005</td>
<td>34,531,052</td>
<td>573,610</td>
<td>27,594,944</td>
<td>6,362,498</td>
<td>n</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
### Table 3: Total expenditure on R&D by source of funds, (Ushs. '000s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total (A+B+C+D+E)</th>
<th>Sectors of performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Business enterprise (A)</td>
</tr>
<tr>
<td>2009</td>
<td>123,889,061</td>
<td>10,200,000</td>
</tr>
<tr>
<td>2008</td>
<td>79,939,412</td>
<td>3,466,670</td>
</tr>
<tr>
<td>2007</td>
<td>82,249,000</td>
<td>6,200,000</td>
</tr>
<tr>
<td>2006</td>
<td>54,688,635</td>
<td>n</td>
</tr>
<tr>
<td>2005</td>
<td>34,531,052</td>
<td>573,610</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010

### Table 4 Total expenditure on R&D by field of science, (Ushs. '000s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total (A+B+C+D+E)</th>
<th>Sectors of performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Natural sciences (A)</td>
</tr>
<tr>
<td>2009</td>
<td>123,889,061</td>
<td>402,525</td>
</tr>
<tr>
<td>2008</td>
<td>79,939,412</td>
<td>66,510</td>
</tr>
<tr>
<td>2007</td>
<td>82,249,000</td>
<td>109,000</td>
</tr>
<tr>
<td>2006</td>
<td>54,688,635</td>
<td>365,183</td>
</tr>
<tr>
<td>2005</td>
<td>34,531,052</td>
<td>n</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
### Table 5 Total expenditure on R&D by type of R&D activity, (Ushs. ‘000s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total (A+B+C)</th>
<th>Basic research (A)</th>
<th>Applied research (B)</th>
<th>Experimental development (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>123,889,061</td>
<td>42,709,856</td>
<td>72,949,205</td>
<td>8,230,000</td>
</tr>
<tr>
<td>2008</td>
<td>79,939,412</td>
<td>19,903,040</td>
<td>55,192,794</td>
<td>4,843,578</td>
</tr>
<tr>
<td>2007</td>
<td>82,249,000</td>
<td>14,963,799</td>
<td>65,480,201</td>
<td>1,805,000</td>
</tr>
<tr>
<td>2006</td>
<td>54,688,635</td>
<td>8,519,264</td>
<td>45,934,092</td>
<td>235,279</td>
</tr>
<tr>
<td>2005</td>
<td>34,531,052</td>
<td>4,089,192</td>
<td>30,441,860</td>
<td>n</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010

### Table 6 Total expenditure on science and technology services by source of funds, (Ushs. ‘000s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total expenditure on STS (A+B)</th>
<th>Government (A)</th>
<th>Funds from abroad (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>296,618,918</td>
<td>261,349,348</td>
<td>35,269,570</td>
</tr>
<tr>
<td>2008</td>
<td>230,006,806</td>
<td>213,546,986</td>
<td>16,459,820</td>
</tr>
<tr>
<td>2007</td>
<td>150,589,766</td>
<td>131,031,100</td>
<td>19,558,666</td>
</tr>
<tr>
<td>2006</td>
<td>113,580,902</td>
<td>93,900,590</td>
<td>19,680,012</td>
</tr>
<tr>
<td>2005</td>
<td>77,148,376</td>
<td>35,430,876</td>
<td>41,717,500</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
Table 7  Total expenditure on scientific and technical education and training by source of funds, (Ushs. '000s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total expenditure on STET (A+B)</th>
<th>Government (A)</th>
<th>Funds from abroad (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>58,361,796</td>
<td>50,977,797</td>
<td>7,384,000</td>
</tr>
<tr>
<td>2008</td>
<td>56,574,460</td>
<td>45,084,460</td>
<td>11,491,000</td>
</tr>
<tr>
<td>2007</td>
<td>25,058,036</td>
<td>16,329,204</td>
<td>11,728,832</td>
</tr>
<tr>
<td>2006</td>
<td>19,921,555</td>
<td>6,077,328</td>
<td>19,680,012</td>
</tr>
<tr>
<td>2005</td>
<td>26,232,701</td>
<td>16,179,500</td>
<td>41,717,500</td>
</tr>
</tbody>
</table>

Source: UNCST, 2010
### Appendix D: S&T Metadata Sheet

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Definition and Standard Classifications</th>
<th>Scope and Coverage</th>
<th>Sources of data</th>
<th>Compilation Practices</th>
<th>Computation Method</th>
<th>Accessibility and availability of data</th>
<th>Accounting conventions</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GERD</td>
<td>Gross Domestic Expenditure on Research and Development (GERD) is the total intramural expenditure on R&amp;D performed on the national territory during a given period.</td>
<td>National level. Gross expenditure on R&amp;D covers: Business enterprise expenditure on R&amp;D (BERD), Higher Education expenditure on R&amp;D (HERD), Government expenditure on R&amp;D (GGERD) and Private Non-profit expenditure on R&amp;D (PNERD).</td>
<td>R&amp;D surveys, Institutions in government, Higher education institutions, Business enterprises and private non-profit institutions. Administrative records from - MFPED, Office of the Auditor General, UNBST.</td>
<td>Expenditures on R&amp;D performed by each statistical unit are identified. The sources of funds for these R&amp;D expenditures as reported by the performer are also identified. Data by sectors of performance and sources of funds is aggregated to derive the significant national totals. Other classifications and distributions are then compiled within the GERD framework. For administrative data on treasury records, estimates are made for the sector in question, reference period, or relevant R&amp;D variable, as deemed appropriate, based on budgetary appropriations to the sector if data is missing.</td>
<td>Summation of intramural expenditure on R&amp;D.</td>
<td>UNBST website <a href="http://www.unbst.gov.ug">www.unbst.gov.ug</a> National STI Status Report Report on National S&amp;T Expenditure in Uganda, S&amp;T Policy Briefs S&amp;T Indicators Publication</td>
<td>GERD is available to the government and the public before the end of the budgeting cycle of the next financial year in December, 6 months after the end of the fiscal year of the reference period. GERD is available on request.</td>
<td>The data is collected in basic units, Uganda Shillings. Expenditure data is not easily provided by both the public and private sectors due to lack of distinction between the routine S&amp;T surveys and sector audits by Government. While data from public agencies can be obtained through the Treasury Office of Accounts, R&amp;D data from the private sector is rather difficult to obtain.</td>
</tr>
<tr>
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</tr>
<tr>
<td>Indicators</td>
<td>Definition and Standard Classifications</td>
<td>Scope and Coverage</td>
<td>Sources of data</td>
<td>Compilation Practices</td>
<td>Computation Method</td>
<td>Accessibility and availability of data</td>
<td>Accounting conventions</td>
<td>Comments and limitations</td>
</tr>
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<td>---------------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
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</tr>
<tr>
<td>SFS expenditures</td>
<td>Science and Technology Services (SFS) expenditures are costs incurred on activities concerned with R&amp;D and its contribution to the generation, dissemination and application of scientific and technical knowledge</td>
<td>National level.</td>
<td>Administrative records from MIPFED, Office of the Auditor General, S&amp;T research registration databases, and the Uganda National Bureau of Standards (UNBS)</td>
<td>Data on SFS expenditures is obtained through surveys conducted by UNCST on institutions performing scientific and technological services. Expenditures on SFS performed by each statistical unit are identified. The sources of funds for these SFS expenditures as reported by the relevant performer are also identified. Data by sectors of performance and sources of funds is aggregated to derive the significant national totals. Other classifications and distributions are then compiled within the SFS expenditure framework. Validation of data Comparisons with relevant data sources are made to ensure accuracy of the data. This is done through peer reviews by sector experts, and international benchmarking.</td>
<td>Summation of expenditures on Science and Technology Services</td>
<td>UNCTST website <a href="http://www.uncst.go.ug/">www.uncst.go.ug</a>&lt;br&gt;National STI Status Report&lt;br&gt;Report on National S&amp;T Expenditure in Uganda,&lt;br&gt;S&amp;T Policy Briefs&lt;br&gt;S&amp;T Indicators Publication</td>
<td>STS expenditures are availed to the government and the public before the end of the budgeting cycle of the next financial year in December, 6 months after the end of the fiscal year of the reference period. STS expenditures is availed on request.</td>
<td>The data is collected in basic units, Uganda Shillings</td>
</tr>
<tr>
<td>Indicators</td>
<td>Definition and Standard Classifications</td>
<td>Scope and Coverage</td>
<td>Sources of data</td>
<td>Compilation Practices</td>
<td>Computation Method</td>
<td>Accessibility and availability of data</td>
<td>Accounting conventions</td>
<td>Comments and limitations</td>
</tr>
<tr>
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<td>------------------------</td>
</tr>
<tr>
<td>STET Expenditures</td>
<td>Scientific and Technological Education and training (STET) expenditures are costs incurred on all activities comprising specialized non-university higher education and training, higher education and training leading to a university degree, post-graduates and further training, and organized life-long training for scientists and engineers. These activities correspond broadly to the International System for Classification of Education levels 5, 6, and 7.</td>
<td>National level.</td>
<td>Surveys from S&amp;T training institutions, Administrative records from MFED, Office of the Auditor General, MoES, S&amp;T research registration database - UNCST.</td>
<td>Expenditures on STET are collected through surveys conducted by UNCST on training institutions performing scientific and technical education and training. Expenditures on STET are performed by each statistical unit and identified. The sources of funds for these STET expenditures as reported by the relevant performer are also identified. Data by sectors of performance and sources of funds is aggregated to derive the significant national totals. Other classifications and distributions are then compiled within this STET expenditure framework.</td>
<td>Summation of STET Expenditures</td>
<td>UNCST website <a href="http://www.uncst.go.ug">www.uncst.go.ug</a> National STI Status Report Report on National S&amp;T Expenditure in Uganda, S&amp;T Policy Briefs S&amp;T Indicators Publication</td>
<td>Periodicity of production: Annually (Fiscal years). Provisional data on STET expenditure are released 6 months after the end of the fiscal year of the reference period. STET expenditures are availed on request.</td>
<td>The data is collected in basic units, Uganda Shillings</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Indicators</th>
<th>Definition and Standard Classifications</th>
<th>Scope and Coverage</th>
<th>Sources of data</th>
<th>Compilation Practices</th>
<th>Computation Method</th>
<th>Accessibility and availability of data</th>
<th>Accounting conventions</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D Personnel</td>
<td>R&amp;D personnel are all persons employed directly on research and experimental development (R&amp;D), as well those providing direct services, such as R&amp;D managers, administrators, and clerical staff.</td>
<td>National level. Personnel in R&amp;D comprise all persons in the sectors of government, higher education, business, and private non-profit sectors working on research and development.</td>
<td>Personnel in R&amp;D are compiled based on the national aggregates, calculated as the sum of data by sector and/or field of science and technology. The R&amp;D personnel in each statistical unit are identified. The personnel data by sector of performance is aggregated to derive the national figures. Other classifications and distributions are then compiled within the R&amp;D personnel framework. Headcount (HC) and Fulltime equivalent (FTE) are applied in the compilation of R&amp;D personnel. HC covers the total number of persons engaged in R&amp;D activities while FTE comprises the time spent on R&amp;D activities by the personnel.</td>
<td>Summation of R&amp;D personnel by category</td>
<td>UNOST website, <a href="http://www.uncst.go.ug">www.uncst.go.ug</a> National STI Status Report Report on National S&amp;T Expenditure in Uganda, S&amp;T Policy Briefs S&amp;T Indicators Publication Personnel data are availed on request.</td>
<td>Periodicity of production: Annually (Fiscal year). Provisional data on R&amp;D personnel are released 6 months after the end of the fiscal year of the reference period.</td>
<td>The inherent operation of Uganda’s S&amp;T/R&amp;D system makes the compilation of the FTE difficult and challenging.</td>
<td></td>
</tr>
</tbody>
</table>
**Human Resources in Science and Technology**

- **Definition and Standard Classifications**: Human Resources in Science and Technology (HRST) are those that have either successfully completed education at the third level in an S&T field of study or not formally qualified as above, but employed in an S&T occupation where this above qualifications are normally required.

- **Sources of data**: Higher institutions of learning, Ministries, Departments and Agencies (MDAs), and private S&T/R&D institutions in the country.

- **Compilation Practices**: Data is extracted from the S&T research registration databank at the UNCST and analysed to derive the indicator.

- **Compilation Method**: HRST data on (stock and flow) in the relevant statistical units is aggregated at the centre; identified, obtained, and Other classifications and Ministries, Departments and Agencies (MDAs), and private S&T/R&D institutions in the country.

- **Scope and Coverage**: National level. Covers the number of people currently or potentially available to work at a certain level (The Qualification Dimension) and the number of people who are actually required in S&T activities at a certain level (The Occupational Dimension).

- **Provisional data on HRST** are released 6 months after the end of the fiscal year of the reference period.

**Human Resources in Science and Technology (HRST) are those that have either successfully completed education at the third level in an S&T field of study or not formally qualified as above, but employed in an S&T occupation where this above qualifications are normally required.**

**Technology Creation Index**

The Technology Creation Index (TCI) is used to capture the level of innovation in a society, and measures changes in the number of patents granted to residents per capita and the receipts of royalties and license fees from abroad per capita.

**Data validation**: UNCST collects data on patents, royalties and license fees which are checked, processed and compared with other relevant data sources. Comparisons are made between the most recent data deliveries and previous data deliveries.

**Calculating the technology creation index**: Patents and receipts of royalties and license fees are used to approximate the level of technology creation. Indices for the two indicators are calculated according to the general formulae.

### Table: Human Resources in Science and Technology

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Definition and Standard Classifications</th>
<th>Scope and Coverage</th>
<th>Sources of data</th>
<th>Compilation Practices</th>
<th>Compilation Method</th>
<th>Accessibility and availability of data</th>
<th>Accounting conventions</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRST</td>
<td>Human Resources in Science and Technology (HRST) are those that have either successfully completed education at the third level in an S&amp;T field of study or not formally qualified as above, but employed in an S&amp;T occupation where this above qualifications are normally required.</td>
<td>National level. Covers the number of people currently or potentially available to work at a certain level (The Qualification Dimension) and the number of people who are actually required in S&amp;T activities at a certain level (The Occupational Dimension).</td>
<td>Higher institutions of learning, Ministries, Departments and Agencies (MDAs), and private S&amp;T/R&amp;D institutions in the country.</td>
<td>Data is extracted from the S&amp;T research registration databank at the UNCST and analysed to derive the indicator.</td>
<td>HRST data on (stock and flow) in the relevant statistical units is aggregated at the centre; identified, obtained, and Other classifications and</td>
<td>UN CST website: <a href="http://www.uncst.go.ug">www.uncst.go.ug</a></td>
<td>Periodicity of production: Annually (Fiscal years).</td>
<td>There are inherent challenges in establishing the actual demand for S&amp;M personnel especially those in the private sector.</td>
</tr>
</tbody>
</table>

**Technology Creation Index**

- The TCI covers two indicators: The first is the number of patents granted per capita, to reflect the current level of invention activity. The second is receipt of royalty and license fees from abroad per capita, to reflect the stock of successful past innovations that are still useful and hence have market value.

- Data on patents granted to residents are available for the most recent years. Data relate to the TOI at the national level.

- Data is extracted from URSB/ARIPO/USPTO reference databases. Data on royalties and license fees - BOU reference database.

- Data validation: UNCST collects data on patents, royalties and license fees which are checked, processed and compared with other relevant data sources. Comparisons are made between the most recent data deliveries and previous data deliveries.

- Calculating the technology creation index: Patents and receipts of royalties and license fees are used to approximate the level of technology creation. Indices for the two indicators are calculated according to the general formulae.

- **Indicators**
  - Patent index = \[ \frac{av}{om_{v}} \] where, \( av \) = actual value, \( om_{v} \) = observed minimum value
  - Royalty and license fee index = \[ \frac{av - om_{v}}{om_{a}} \] where, \( av - om_{v} \) = observed maximum value

- The technology creation index is the simple average of the patent index and the royalty and license fee index.

- Periodicity of production: Annually (Calendar years).
<table>
<thead>
<tr>
<th>Indicators</th>
<th>Definition and Standard Classifications</th>
<th>Scope and Coverage</th>
<th>Sources of data</th>
<th>Compilation Practices</th>
<th>Computation Method</th>
<th>Accessibility and availability of data</th>
<th>Accounting conventions</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffusion of recent innovations index</td>
<td>This is a measure of changes in the number of Internet hosts per capita and the share of high- and medium-technology exports in total goods exports. Standard classifications: The groups classified as high-technology products are aggregated on the basis of the Standard International Trade Classification (SITC Rev. 3).</td>
<td>National level</td>
<td>Covers two indicators: the diffusion of the Internet, indispensable to participation, and the exports of high-technology and medium-technology products as a share of all exports.</td>
<td>UNCST</td>
<td>Reference data are extracted from ITU/UCC/UBOS databases. UNCST calculates the aggregates and derives the relevant index. Data validation: UNCST collects data on the Internet and technology exports which are checked, processed and compared with other relevant data sources. Calculating the diffusion of recent innovations index. Internet hosts and the share of high-technology and medium-technology exports in total goods exports are used to compute the diffusion of recent innovations. Indices for the two indicators are calculated according to the general formula.</td>
<td></td>
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</tr>
<tr>
<td>Diffusion of old innovations index</td>
<td>This is a measure of the changes in the number of active telephones (mainline and cellular) per capita and electricity consumption per capita.</td>
<td>National level</td>
<td>Covers two indicators: telephones and electricity, which are especially important because they are needed to use newer technologies and are also pervasive inputs to a multitude of human activities.</td>
<td>UCC, MICT, UEDC, ERA, UMEME</td>
<td>Basic and reference data are extracted from UCC/UEDC/ERA databases and analyzed by UNCST to derive the index. Data is obtained by UNCST through face to face interviews / telephone interviews or through self-administered mail or online web questionnaires from the respective institutions. All ICT data is validated by the Uganda Communications Commission. Calculating the diffusion of old innovations index. Telephones (mainline and cellular) and electricity consumption per capita are used to approximate the diffusion of old innovations. Indices for the two indicators are calculated according to the general formulas. The indices are calculated using the logarithm of the value.</td>
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</tbody>
</table>

Ideal technology diffusion within the population is inherently paradoxical with regard to population size and distribution of the technologies into the population.
<table>
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<tr>
<th>Indicators</th>
<th>Definition and Standard Classifications</th>
<th>Scope and Coverage</th>
<th>Sources of data</th>
<th>Compilation Practices</th>
<th>Computation Method</th>
<th>Accessibility and availability of data</th>
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</tr>
</thead>
</table>
| Human Skills Index  | Human Skills Index (HSI) is a measure of the changes in mean years of schooling in the population aged 20 and above and the gross tertiary science enrolment ratio. | National level Covers two indicators i.e. Mean years of schooling which give a good indication of the overall level of basic educational skills in the population, notwithstanding the fact that education quality varies from country to country. Enrolment in tertiary education in science, mathematics and engineering. This measure gives an idea of the current effort in developing advanced skills in science and mathematics. | Universities MoES NOHE. | Data is extracted from the appropriate databases and analyzed to derive the index. Data validation UNCST collects both aggregated and disaggregated data which are checked, processed and compared with other relevant data sources. | Calculating the human skills index. Mean years of schooling and the gross tertiary science enrolment ratio are used to compute the human skills index. Indices for the two indicators are calculated according to the general formula:\[
\text{Index} = \frac{a - o_{\min}}{o_{\max} - o_{\min}}
\]

where, 
- \(a\) = actual value,
- \(o_{\min}\) = observed minimum value,
- \(o_{\max}\) = observed maximum value.

The human skills index is the simple average of the Mean years of schooling index and the gross tertiary science enrolment ratio.

National aggregates are calculated as the sum of country data where data is available by sector or other variable. | UNCST website [www.uncst.go.ug](http://www.uncst.go.ug) National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication | Periodicity of production: Annually (Calendar years). Provisional data on human skills index are released 6 months after the end of the fiscal year of the reference period. | Information on vocational training is not readily available. |
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<tr>
<td>Technology Achievement Index</td>
<td>The Technology Achievement Index (TAI) is a composite index of technological achievement that measures the level of technological progress and thus the capacity of a country to participate in the network age. A composite index helps a country situate itself relative to others, especially those farther ahead. The index captures technological achievements of a country in four dimensions: 1. creating new technology; 2. diffusing recent innovations; 3. diffusing existing technologies that are still basic inputs to the industrial and the network age; and 4. Building a human skill base for technological creation and adoption.</td>
<td>National level</td>
<td>Covers all data sources for TCI, Diffusion of recent innovations, Diffusion of old innovations, and HIS.</td>
<td>Aggregated data is extracted from the relevant institutions and appropriate databases and analyzed to derive the composite index. Data validation UNCST collects data on the TAI which are checked, processed and compared with other relevant data sources. Comparisons are made between the most recent data deliveries and previous data deliveries.</td>
<td>TAI is the average of the TCI, diffusion of recent innovation index, diffusion of old innovation index, and the HIS.</td>
<td>NC</td>
<td>Periodicity of production: Annually</td>
<td></td>
</tr>
</tbody>
</table>

National STI Status Report
Report on National S&T Expenditure in Uganda,
S&T Policy Briefs
S&T Indicators Publication
HIS is availed to the government and the public before the end of the budgeting cycle of the next financial year in December, 6 months after the end of the fiscal year of the reference period.
# Appendix E: S&T Sector Indicators

## 1. S&T Impact Indicators

1.1 Ugandan ranking in technology achievement index  
1.2 Technology creation index  
1.3 Diffusion of old innovations index  
1.4 Diffusion of new innovations index  
1.5 Human skills index  
1.6 Ugandan ranking in the transformation to a digital economy  
1.7 Technology balance of payments  
1.8 Attitudes on S&T by scientists, legislators and the public

## 2. Scientific and Technological Activities (STA)

(a) Research and Development (R&D)  
2.1 National R&D personnel by occupation  
2.2 National R&D personnel by sex  
2.3 National R&D personnel by sector of employment  
2.4 National researchers by formal qualification  
2.5 National researchers by sector of employment  
2.6 National researchers by sex  
2.7 National researchers by fields of science  
2.8 National R&D expenditures by sector of performance  
2.9 National R&D expenditures by source of funds  
2.10 National R&D expenditures by field of science  
2.11 National R&D expenditures by type of R&D activity  
2.12 Number of R&D personnel per million population  
2.13 Percent of national R&D expenditures to GDP  
2.14 Public sector expenditures for R&D  
2.15 Percent of public sector expenditures to national R&D expenditures  
2.16 Private sector expenditure for R&D  
2.17 Percent of private sector R&D expenditures to national R&D expenditure  
2.18 Number of internationally accredited laboratories  
2.19 Number of registered scientists and engineers  
2.20 Number of scientists and engineers per million population  

(b) Scientific and Technical Education and Training (STET)  
2.21 Number of S&T human resources by gender, sector, employment and by field of S&T
| 2.22 Number of student enrolment in Science, Mathematics and Engineering |
| 2.23 Number of graduates in Science, Mathematics and Engineering |
| 2.24 Number of Ugandan PhDs in science and engineering |
| 2.25 Employment of S&T professionals |
| 2.26 Number of publications of Ugandan scientists and engineers included in the International Science Citation Index |
| 2.27 Number of world-class S&T universities |
| (c) Scientific and Technological Services (STS) |
| 2.28 Patent applications received for inventions, utility models and industrial design |
| 2.29 Distribution of patents granted to local inventors by type |
| 2.30 Distribution of trademarks granted to local registrants by mark |
| 2.31 Number of months an application for patent is approved |
| 2.32 Patent applications arising from UNCST-supported projects |
| 2.33 Number of science centres, libraries, archives, museums, botanical and zoological gardens established/ maintained |
| 2.34 Number and kind of S&T standards developed and implemented |

| 3. Scientific and Technological Innovations |
| 3.1 Number of technologies commercialized |
| 3.2 Products and process innovations introduced in the market or in the production process |

| 4. BFP Output Indicators |
| 4.1 No. of products from the private sector |
| 4.2 No. of quality laboratories and other R&D facilities in research institutions |
| 4.3 Level of operationalization of the national science and technology fund |
| 4.4 No. of STI outreach programmes designed and implemented |
| 4.5 Percent increase in commercialization of R&D products |
| 4.6 No. of technology platforms involving academia/research institutions and private sector/industry |

| 5. NDP Indicators |
| 5.1 No. of S&T training centres established and operationalized |
| 5.2 No. of science parks and technology incubation centres operationalized |