UNCST

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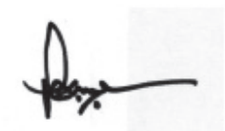
FOREWORD

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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LIST OF ACRONYMS

ARIPO	African Regional Intellectual Property Office
BERD	Business Enterprise R&D Expenditure
BFP	Budget Framework Paper
BOU	Bank of Uganda
DFID	Department of International Development
ERA	Electricity Regulatory Authority
FTE	Full Time Equivalents
GERD	Gross Domestic Expenditure on Research and Development
GOVERD	Government R&D expenditure
HC	Head Count
HERD	Higher Education R&D Expenditure
HRST	Human Resources in Science and Technology
HSI	Human Skills Index
IP	Intellectual Property
IPC	International Patent Classification
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification
ISP	International Service Provider
kWh	Kilowatt Hour
MDAs	Ministries, Departments and Agencies
MFPED	Ministry of Finance, Planning and Economic Development
MoES	Ministry of Education and Sports
MoICTs	Ministry of Information and Communication Technology
NCHE	National Council for Higher Education
NDP	National Development Plan
OECD	Organisation of Economic Cooperation and Development
PNPERD	Private Non-profit R&D Expenditure
R&D	Research and Development
S&T	Science and Technology
SITC	Standard International Trade Classification
STET	Scientific and Technical Education and Training
STI	Science, Technology and Innovation
STS	Science and Technology Services
TAI	Technology Achievement Index
TCI	Technology Creation Index

UBOS	Uganda Bureau of Statistics
UEDCL	Uganda Electricity Distribution Company Limited
UCC	Uganda Communications Commission
UNBS	Uganda National Bureau of Standards
UNCST	Uganda National Council for Science and Technology
UNESCO	United Nations Educational, Scientific and Cultural Organization
URSB	Uganda Registration Services Bureau
USPTO	United States Patent and Trademark Office
WIPO	World Intellectual Property Organization

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 andindicators 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, post-graduate 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.

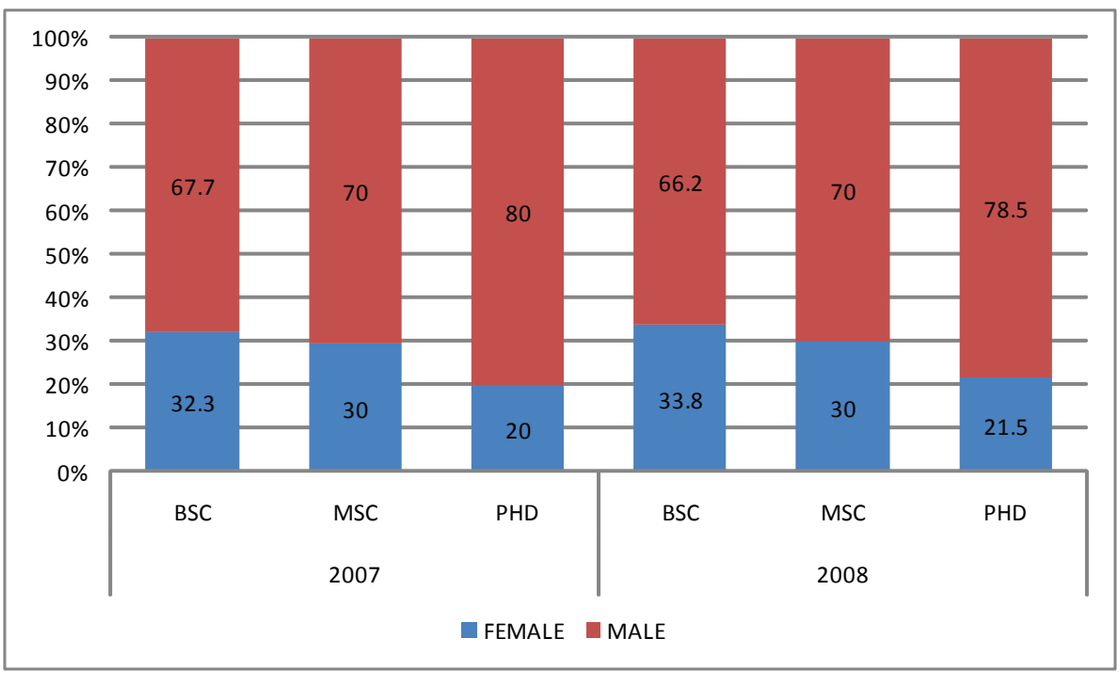
SCIENTIFIC AND TECHNICAL EDUCATION AND TRAINING

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



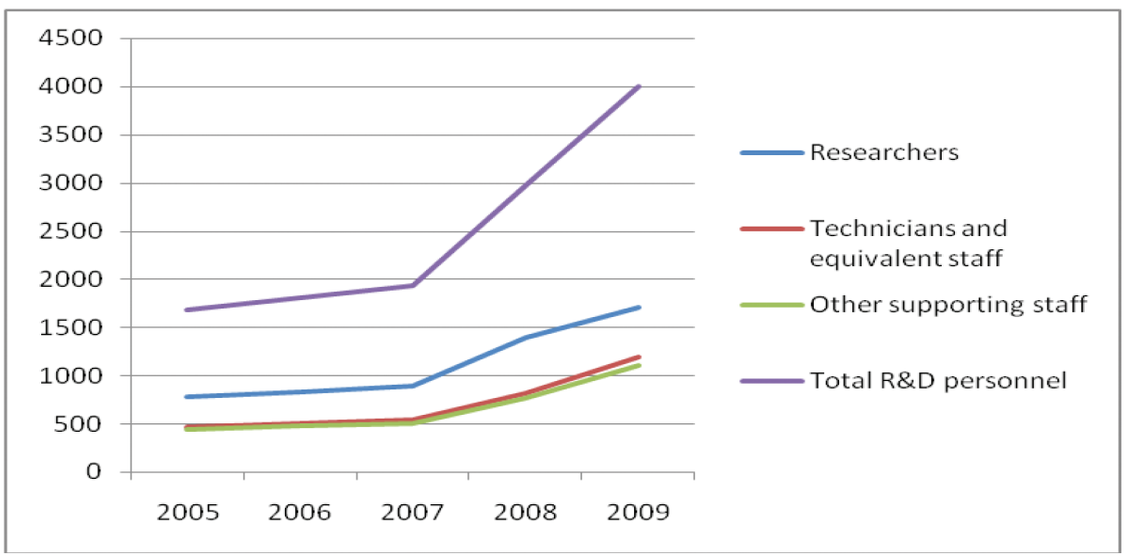
University infrastructure and faculty remain critical challenges to the achievement of quality university education to the extent that Makerere University is the only globally ranked Ugandan university. Statistics pertaining to this section are presented in Appendix A (Tables 1- 4).

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.

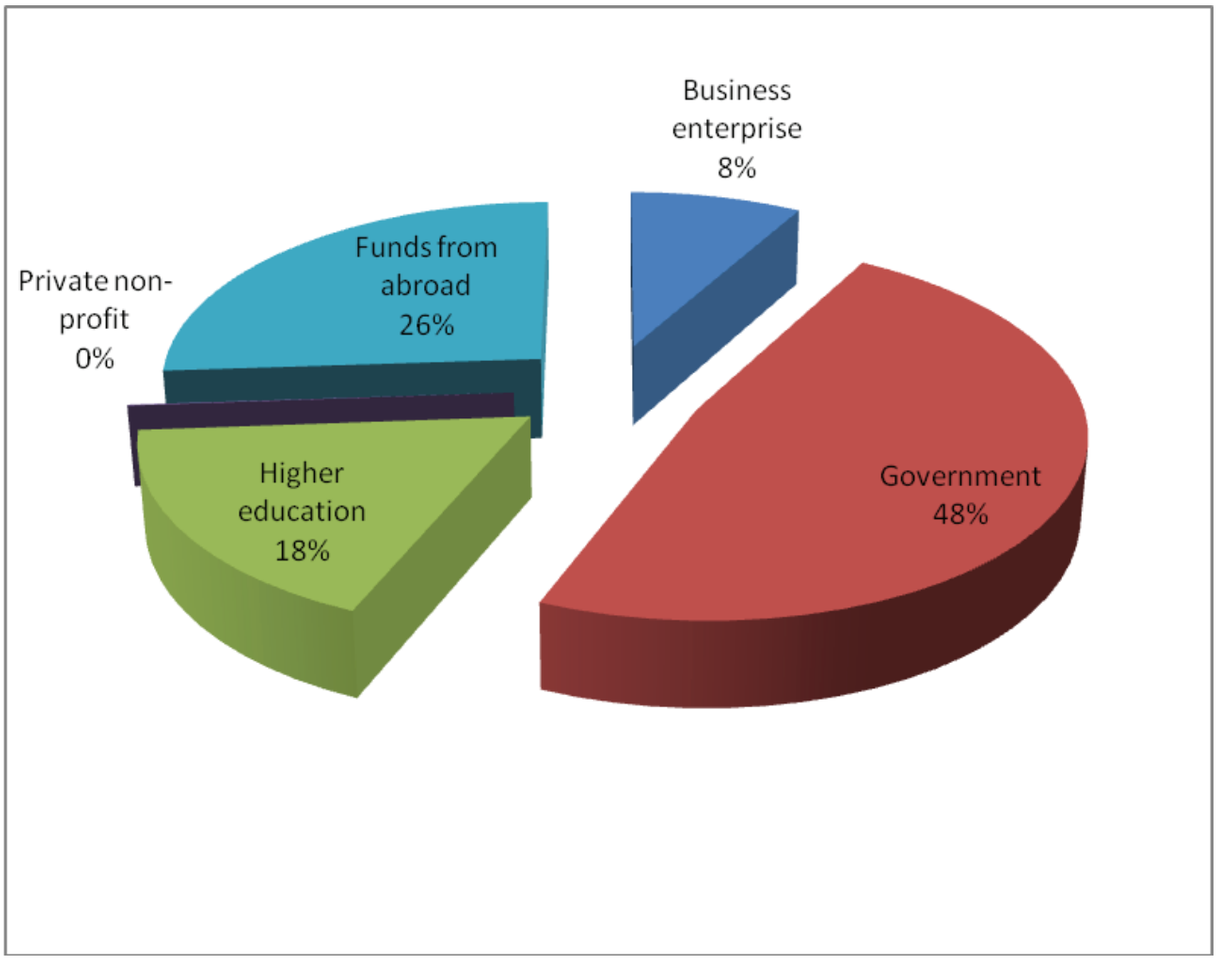
With regard to researchers by fields of science and technology, Medical Sciences and Social Sciences and Humanities account for the largest share at 39.5% and 38.4% respectively, with Engineering and Technology registering the least share of less than two percent (1.7%).

The details on human resources in R&D for 2008 and 2009 are presented in the Appendix B (Tables 1 - 8b).

EXPENDITURE ON RESEARCH AND DEVELOPMENT

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).

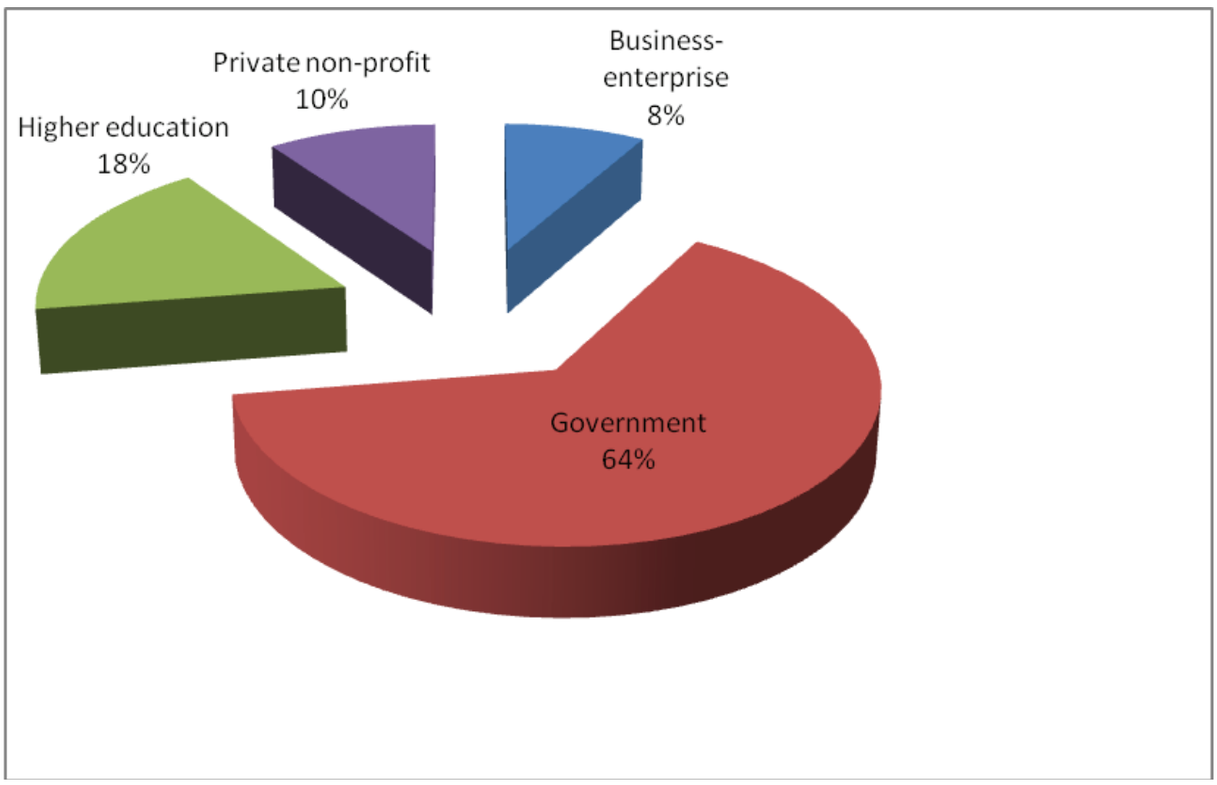
Figure 4.1: Total Expenditure on R&D by source of funds



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).

Figure 4.2: Total Expenditure on R&D by sector of performance



Source: UNCST, 2010

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 INDEX (TAI)

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

Dimensions	Sub-indicators
#1 Creation of technology	• *Patents granted to residents (per million people)*: 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 • *Royalties and license fees received (US$ per 1000 people)*: the indicator reflects the stock of successful past innovations that are still useful and hence have market value
#2 Diffusion of recent innovations	• *Internet hosts (per1000 people)*: 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 • *High-technology and medium-technology exports (as %age of total goods exports)*: the indicator is the best yardstick for measuring the annual average growth rates (AAGR) in high technology area of a country
#3 Diffusion of old technologies	• *Electricity consumption (kWh per capita)*: 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 • *Telephone mainlines and cellular subscribers (per1000 people)*: 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
#4 Human skills development	• *Mean years of schooling (aged 15 and above)*: the mean years of schooling is used as a proxy for cognitive skill. • *Gross tertiary science enrolment ratio (%)*: this indicator assesses the skills of a nation in science, mathematics, engineering and construction at the tertiary level

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 5.2 Performance of Uganda on the Indicators of TAI, 2008

Dimension	Indicator	Value
Creation of Technology	Patents granted to residents (per million people)	0.00
	Royalties and license fees received (US$ per 1000 people)	93.6
Diffusion of recent innovations	Internet hosts (per 1000 people)	0.037
	High-technology and medium-technology exports (as % of total goods exports)	4.9
Diffusion of old innovations	Telephones (mainline and cellular, per 1000 people)	294.71
	Electricity consumption (kWh per capita)	69.8
Human Skills	Mean years of schooling (aged 15 and above)	3.5
	Gross tertiary science, enrolment ratio (%)	1.3

Source: UNCST, 2010

APPENDICES

Appendix A: Scientific and Technical Education and Training

Table 1: Level of university enrolments, 2007-2008

Degree Award	2007	2008
PhD	91	151
Masters	5155	5410
Bachelors	78310	67616
TOTAL	83556	73177

Source: UNCST, 2009

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

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

Discipline	2007	2008
Social Sciences	62857	53725
Humanities	3304	3086
Agricultural Sciences	1678 (2)	1990 (2.7)
Medical Science	3489	3971
Natural and Physical Sciences	8781	7832
Engineering	3447	2573
TOTAL	83556	73177

Source: UNCST, 2009

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

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

Source: UNCST Database 2009

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

	PhD		Masters		Bachelors	
	2007	2008	2007	2008	2007	2008
Social Science	6	5	710	965	14247	15940
Humanities	0	0	24	41	881	789
Agricultural Sciences	5	2	17	7	339	230
Medical Sciences	8	0	96	45	331	171
Engineering	3	1	14	8	783	432
Natural Sciences	8	2	118	71	1845	1182
TOTAL	**30**	**10**	**979**	**1137**	**18426**	**18744**

Source: UNCST, 2009

Appendix B: Human Resources in Research and Development

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

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

Source: UNCST, 2010

Table 2 R&D personnel by sex

Year	Total R&D personnel				Researchers		
	Total (A+B+C)	Female (A)	Male (B)	Unknown/ No data (C)	Total (D+E)	Female (D)	Male (E)
2009	4002	1369	2633	n	1703	688	1015
2008	2973	1028	1945	n	1387	549	838
2007	1937	715	1222	n	891	365	526
2006	1807	488	849	470	831	312	519
2005	1686	455	793	438	776	291	485

n = quantity nil

Source: UNCST, 2010

Table 3a R&D personnel by sector of employment and occupation, 2008

Reference year 2008		Total R&D personnel (A+B+C)	Occupation		
			Researchers (A)	Technicians and equivalent staff (B)	Other supporting staff (C)
Sector	Total (i. + ii. + iii. + iv.)	2973	1387	823	763
	i. Business enterprise	243	87	56	100
	ii. Government	1381	742	281	358
	iii. Higher education	1051	456	385	210
	iv. Private non-profit	298	102	101	95

Source: UNCST, 2010

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

Reference year 2009		Total R&D personnel (A+B+C)	Occupation		
			Researchers (A)	Technicians and equivalent staff (B)	Other supporting staff (C)
Sector	Total (i. + ii. + iii. + iv.)	4002	1703	1194	1105
	i. Business enterprise	280	100	69	111
	ii. Government	1621	808	371	442
	iii. Higher education	1585	631	573	381
	iv. Private non-profit	516	164	181	171

Source: UNCST, 2010

Table 4a R&D personnel by sector of employment and sex, 2008

Reference year 2008		Total R&D personnel			Researchers		
		Total (A+B	Female (A)	Male (B)	Total (D+E)	Female (D)	Male (E)
Sector	Total (i. + ii. + iii. + iv.)	2973	1029	1944	1387	550	837
	i. Business enterprise	243	107	136	87	41	46
	ii. Government	1381	461	920	742	271	471
	iii. Higher education	1051	367	684	456	192	264
	iv. Private non-profit	298	94	204	102	46	56

Source: UNCST, 2010

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

Reference year 2009		Total R&D personnel			Researchers		
		Total (A+B)	Female (A)	Male (B)	Total (D+E)	Female (D)	Male (E)
Sector	Total (i. + ii. + iii. + iv.)	4002	1370	2632	1703	688	1015
	i. Business enterprise	280	124	156	100	49	51
	ii. Government	1621	539	1082	808	298	510
	iii. Higher education	1585	537	1048	631	268	363
	iv. Private non-profit	516	170	346	164	73	91

Source: UNCST, 2010

Table 5a Researchers by formal qualification and sector of employment, 2008

Reference year 2008		Total researchers (A+B+C+D)	Sector			
			Business enterprise (A)	Government (B)	Higher education (C)	Private non-profit (D)
Qualification	Total (i + ii + iii +iv)	1387	87	742	456	102
	i. ISCED 6	429	6	291	109	23
	ii. ISCED 5A	293	16	160	71	46
	iii. ISCED 5B	660	65	290	273	32
	iv. All other qualifications	5	n	1	3	1

Source: UNCST, 2010

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

Reference year 2009		Total researchers (A+B+C+D)	Sector			
			Business enterprise (A)	Government (B)	Higher education (C)	Private non-profit (D)
Qualification	Total (i + ii + iii +iv)	1703	100	808	631	164
	i. ISCED 6	519	7	309	160	43
	ii. ISCED 5A	460	23	196	163	78
	iii. ISCED 5B	719	70	302	305	42
	iv. All other qualifications	5	n	1	3	1

Source: UNCST, 2010

Table 6a Researchers by formal qualification and sex, 2008

Reference year 2008		Total researchers (A+B)	Gender	
			Female (A)	Male (B)
Qualification	Total (i + ii + iii +iv)	1387	550	837
	i. ISCED 6	429	154	275
	ii. ISCED 5A	293	123	170
	iii. ISCED 5B	660	271	389
	iv. All other qualifications	5	2	3

Source: UNCST, 2010

Table 6b Researchers by formal qualification and sex, 2009

Reference year 2009		Total researchers (A+B)	Gender	
			Female (A)	Male (B)
Qualification	Total (i + ii + iii +iv)	1703	688	1015
	i. ISCED 6	519	180	339
	ii. ISCED 5A	460	205	255
	iii. ISCED 5B	719	301	418
	iv. All other qualifications	5	2	3

Source: UNCST, 2010

Table 7a Researchers by fields of science and sector of employment, 2008

Reference year 2008		Total researchers (A+B+C+D)	Sector			
			Business enterprise (A)	Government (B)	Higher education (C)	Private non-profit (D)
Fields of science	Total (i + ii + iii +iv + v)	1387	87	742	456	102
	i. Natural sciences	77	6	27	39	5
	ii. Engineering and technology	26	5	6	13	2
	iii. Medical sciences	532	9	309	165	49
	iv. Agricultural sciences	219	n	216	3	0
	v. Social sciences and Humanities	533	67	184	236	46

Source: UNCST, 2010

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

Reference year 2009		Total researchers (A+B+C+D)	Sector			
			Business enterprise (A)	Government (B)	Higher education (C)	Private non-profit (D)
Fields of science	Total (i + ii + iii +iv + v)	1703	100	808	631	164
	i. Natural sciences	125	6	38	70	11
	ii. Engineering and technology	28	5	7	14	2
	iii. Medical sciences	673	15	349	229	80
	iv. Agricultural sciences	223	1	216	6	0
	v. Social sciences and Humanities	654	73	198	312	71

Source: UNCST, 2010

Table 8a Researchers by fields of science and sex, 2008

Reference year 2008		Total researchers (A+B)	Gender	
			Female (A)	Male (B)
Fields of science	Total (i + ii + iii +iv + v)	1387	550	837
	i. Natural sciences	77	38	39
	ii. Engineering and technology	26	6	20
	iii. Medical sciences	532	183	349
	iv. Agricultural sciences	219	66	153
	v. Social sciences and Humanities	533	257	276

Source: UNCST, 2010

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

Reference year 2009		Total researchers (A+B)	Sector	
			Female (A)	Male (B)
Fields of science	Total (i + ii + iii +iv + v)	1703	688	1015
	i. Natural sciences	125	58	67
	ii. Engineering and technology	28	7	21
	iii. Medical sciences	673	239	434
	iv. Agricultural sciences	223	69	154
	v. Social sciences and Humanities	654	315	339

Source: UNCST, 2010

Appendix C: Expenditure on Research and Development

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

Year[a]	Total expenditure in R&D
2009	123,889,061
2008	79,939,412
2007	82,249,000
2006	54,688,635
2005	34,531,052

a 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)

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

Source: UNCST, 2010

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

Year	Total (A+B+C+D+E)	Sectors of performance				
		Business enterprise (A)	Government (B)	Higher education (C)	Private non-profit (D)	Funds from abroad (E)
2009	123,889,061	10,200,000	59,548,770	21,757,191	100,335	32,282,765
2008	79,939,412	3,466,670	41,838,750	n	66,590	34,567,402
2007	82,249,000	6,200,000	34,326,786	n	4,947	41,717,267
2006	54,688,635	n	27,396,264	n	4,375	27,287,996
2005	34,531,052	573,610	14,321,776	n	n	19,635,666

Source: UNCST, 2010

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

Year	Total (A+B+C+D+E)	Sectors of performance				
		Natural sciences (A)	Engineering & technology (B)	Medical & health sciences (C)	Agricultural sciences (D)	Social sciences & humanities (E)
2009	123,889,061	402,525	13,079,483	11,590,108	62,672,880	36,144,065
2008	79,939,412	66,510	7,869,578	15,810,112	42,819,780	13,373,432
2007	82,249,000	109,000	4,831,000	19,232,000	50,688,000	7,389,000
2006	54,688,635	365,183	3,265,279	13,294,594	25,673,796	12,089,783
2005	34,531,052	n	n	1,334,518	25,574,254	7,649,280

Source: UNCST, 2010

Table 5 Total expenditure on R&D by type of R&D activity, (Ushs. '000s)

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

Source: UNCST, 2010

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

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

Source: UNCST, 2010

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

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

Source: UNCST, 2010

Appendix D: S&T Metadata Sheet

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
GERD	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. Intramural expenditures are all expenditures on R&D performed within a statistical unit or sector of the economy during a specific period, whatever the source of funds. Standard Classifications: International Standard Industrial Classification of Economic Activities (ISIC) for the classification of activities International Standard Classification of Occupations. International Standard Classification of Education GERD is further classified by field of science (FOS) and sector of performance. GERD is also classified by source of funds by sector.	National level. Gross expenditure on R&D covers: Business enterprise expenditure on R&D (BERD), Higher Education expenditure on R&D (HERD), Government expenditure on R&D (GOVERD) and Private Non-profit expenditure on R&D (PNERD).	R&D surveys Institutions in government, Higher education institutions, Business enterprises and private non profit institutions. Administrative records from - MFPED; Office of the Auditor General ; and UNCST	Expenditures on R&D performed by each statistical unit are identified The sources of funds for these R&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&D variable, as deemed appropriate, based on budgetary appropriations to the sector, if data are missing. Data validation 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. Revision policy Data revisions are made based on the changes in the International STI Indicator systems.	Summation of intramural expenditure on R&D.	UNCST website www.uncst.go.ug National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication GERD 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. GERD is availed on request	Periodicity of production: Annually (Fiscal years) Provisional data on R&D expenditure are released 6 months after the end of the fiscal year of the reference period	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&T surveys and sector audits by Government. While data from public agencies can be obtained through the Treasury Office of Accounts, R&D data from the private sector is rather difficult to obtain.

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
STS expenditures	Science and Technology Services (STS) expenditures are costs incurred on activities concerned with R&D and its contribution to the generation, dissemination and application of scientific and technical knowledge	National level.	Administrative records from MFPED, Office of the Auditor General, S&T research registration databank, and the Uganda National Bureau of Standards (UNBS)	Data on STS expenditures is obtained through surveys conducted by UNCST on institutions performing scientific and technological services Expenditures on STS performed by each statistical unit are identified. The sources of funds for these STS 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 STS 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. Revision policy Data revisions are made based on the changes in the International STI Indicator systems.	Summation of expenditures on Science and Technology Services	UNCST website www.uncst.go.ug National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication 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.	Periodicity of production: Annually (Fiscal years). Provisional data on STS expenditure are released 6 months after the end of the fiscal year of the reference period	The data is collected in basic units, Uganda Shillings

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
STET Expenditures	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-graduate 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."	National level.	Surveys from S&T training institutions. Administrative records from MFPED, Office of the Auditor General, MoES, S&T research registration databank - UNCST.	Expenditures on STET are collected through surveys conducted by UNCST on training institutions performing scientific and technical education and training Expenditures on STET expenditures performed by each statistical unit are 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 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. Revision policy Data revisions are made based on the changes in the International STI Indicator systems.	Summation of STET Expenditures	UNCST website www.uncst.go.ug National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication STET 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. STET expenditures are availed on request.	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	The data is collected in basic units, Uganda Shillings

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
R&D Personnel	R&D personnel are all persons employed directly on research and experimental development (R&D), as well those providing direct services, such as R&D managers, administrators and clerical staff. Standard Classifications International Standard Industrial Classification of Economic Activities (ISIC) for the classification of activities International Standard Classification of Occupations. International Standard Classification of Education Classifications are further by Field of Science and Sector of Performance.	National level. Personnel in R&D comprise all persons in the sectors of government, higher education, business, and private non profit sectors working on research and development.	Research performers in the government, higher education, business, and private non profit sectors. The R&D personnel data is collected through a survey of all R&D institutions and government agencies. Personnel data are also obtained from the UNCST's S&T research registration databank.	Personnel in R&D are compiled basing on the national aggregates, calculated as the sum of data by sector and/or field of science and technology. The R&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&D personnel framework Headcount (HC) and Fulltime equivalent (FTE) are applied in the compilation of R&D personnel. HC covers the total numbers of persons engaged in R&D activities while FTE comprises the time spent on R&D activities by the personnel. Data validation Comparisons with relevant data sources are made to ensure accuracy of the data. Revision policy Data revisions are made based on the changes in the International STI Indicator systems.	Summation of R&D personnel by category	UNCST website www.uncst.go.ug National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication Personnel data are availed on request.	Periodicity of production: Annually (Fiscal years). Provisional data on R&D personnel are released 6 months after the end of the fiscal year of the reference period	The inherent operation of Uganda's S&T/ R&D system makes the compilation of the FTE difficult and challenging

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
Human Resources in Science and Technology	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 the above qualifications are normally required. Standard classifications International Classification of Education (ISCED) International Standard classification of Occupations (ISCO) HRST can be classified as either university level HRST (covering levels 6 and 7) or technician level HRST (covering level 5). ISCED	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).	Higher institutions of learning, Ministries, Departments and Agencies (MDAs), and private S&T/R&D institutions in the country. UNCST Data on stocks and flows - Ministry of Public Service, Ministry of Gender, Labour and Social Development, Ministry of Finance, Planning and Economic Development, Ministry of Education and Sports (MoES), and the National Council for Higher Education (NCHE).	Data is extracted from the S&T research registration databank at the UNCST and analysed to derive the indicator. HRST data on (stock and flow) in the relevant statistical units is identified, obtained, and aggregated at the centre; Other classifications and distributions are then compiled within this HRST framework	Summation of the Human Resources in Science and Technology 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 National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication HRST 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. Human resources data are availed on request.	Periodicity of production: Annually (Fiscal years). Provisional data on HRST are released 6 months after the end of the fiscal year of the reference period	There are inherent challenges in establishing the actual demand for S&E personnel especially those in the private sector.
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. Standard Classifications: Patents are classified according to the International Patent Classification (IPC).	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 TCI at the national level	Patent data - URSB/ARIPO/ USPTO reference database. Data on royalties and license fees - BOU reference database.	Data are extracted from URSB/ ARIPO databases. Reference data are obtained from USPTO reference database. Using these data, UNCST calculates the aggregates and derives the relevant index. 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. $Indicators\ index = \frac{av - omin.v}{omax.v - omin.v}$ where, av = actual value, omin.v = observed minimum value omax.v = observed maximum value The technology creation index is the simple average of the patent index and the royalty and license fee index	UNCST website www.uncst.go.ug National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication TCI 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.	Periodicity of production: Annually (Calendar years).	Innovation occurs throughout society, in formal and informal settings, although the current trend is towards increasing commercialization and formalization of the process of innovation.

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
Diffusion of recent innovations index	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).	National level 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.	UNCST UCC and UBOS reference databases	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 formulae. $Indicators\ index = \frac{av - omin.v}{omax.v - omin.v}$ where, av = actual value, omin.v = observed minimum value omax.v = observed maximum value The diffusion of recent innovations index is the simple average of the Internet host index and the High-technology and medium-technology export index.	UNCST website www.uncst.go.ug National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication Diffusion of recent innovations index 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.	Periodicity of production: Annually (Calendar years).	UNCST and other stakeholders make occasional news releases on new and emerging technologies.
Diffusion of old innovations index	This is a measure of the changes in the number of active telephones (mainline and cellular) per capita and electricity consumption per capita.	National level 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.	UCC, MoICT UEDCL ERA UMEME	Basic and reference data are extracted from UCC/ UEDCL/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 formulae. The indices are calculated using the logarithm of the value. $Indicators\ index = \frac{\log(av) - \log(omin.v)}{\log(omax.v) - \log(omin.v)}$ where, av = actual value, omin.v = observed minimum value omax.v = observed maximum value The diffusion of old innovations index is the simple average of telephones (mainline and cellular) index and electricity consumption per capita index.	UNCST website www.uncst.go.ug National STI Status Report Report on National S&T Expenditure in Uganda, S&T Policy Briefs S&T Indicators Publication Diffusion of old innovations index 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.	Periodicity of production: Annually (Calendar years).	It might be subjective to measure technology diffusion within the population as it has inherent pitfalls with regard to population size and distribution of the technologies into the population.

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
Human Skills Index	Human Skills Index (HSI) 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.	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 NCHE.	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 formulae. $Indicators\ index = \frac{av - omin.v}{omax.v - omin.v}$ where, av = actual value, omin.v = observed minimum value omax.v = 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 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	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.

Indicators	Definition and Standard Classifications	Scope and Coverage	Sources of data	Compilation Practices	Computation Method	Accessibility and availability of data	Accounting conventions	Comments and limitations
Technology Achievement Index	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 of: 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.	National level	Covers all data sources for TCI, Diffusion of recent innovations, Diffusion of old innovations, and HSI.	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. Revision Policy The TAI is compiled annually with revisions allowed for one preceding year.	TAI is the average of the TCI, diffusion of recent innovation index, diffusion of old innovation index, and the HSI. .	UNCST website www.uncst.go.ug 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	Periodicity of production: Annually	

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

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