Uganda National Council for Science and Technology

THE REPUBLIC OF UGANDA

REPORT ON THE HIGH-LEVEL SCIENCE TECHNOLOGY AND INNOVATION FORUM

KAMPALA, 26TH MAY, 2016

Theme:

STI for Industrialisation, Competitiveness and Employment Creation

UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Report on the High-Level Science Technology and Innovation Forum, Kampala, 26th May, 2016

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List of Acronyms

ACE	African Centre for Excellence
AGT	AgroGenetic Technologies Limited
AT	Appropriate Technologies
CAES	College of Agricutural and Environmental Sciences
CONAS	College of Natural Sciences
COVAB	College of Veterinary Medicine, Animal Resources and Biosecurity
EAC	East African Community
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IICS	Integrated Intelligent Computer Systems
IUIU	Islamic Univeristy in Uganda
KIU	Kampala International University
MFPED	Ministry of Finance, Planning and Economic Development
MUST	Mbarara University of Science and Technology
NARO	National Agricultural Research Organisation
NCHE	National Council for Higher Education
NRM	National Resistance Movement
PFST	Presidential Forum on Science and Technology
PIBID	Presidential Initiative on Banana Industrial Development
PIRT	Presidential Investors' Round Table
PISAT	Presidential Initiative to support Appropriate Technologies
STI	Science, Technology and Innovation
UBBC	Uganda Biotechnology and Biosafety Consortium
UBIC	Uganda Biosciences Information Centre
UBOS	Uganda Bureau of Statistics
UGX	Uganda Shillings
UIRI	Uganda Industrial Research Institute
UMA	Uganda Manufacterers' Association
UNAS	Uganda National Academy of Sciences
UNBS	Uganda National Bureau of Standards
UNCST	Uganda National Council for Science and Technology
URSB	Uganda Registration Services Bureau
UVRI	Uganda Virus Research Institute

Foreword

It is well-documented that no country has developed without mainstreaming science, technology and innovation in their economy across the sectors. Developing countries that have industrialized by absorbing technology and modernizing their economies are outperforming those that have not. Science Technology and Innovation improves the value added in existing sectors; help the economy expand into new industries and challenge entrepreneurs to engage in technology upgrading and catch-up with international competitors.

The government of Uganda through UNCST has over the years facilitated the development of STI and its integration into the national development process through among many other mechanisms, Government Support to Scientists. This support has triggered significant research and innovative tangible outputs. Despite several efforts at policymaking and strategic levels, Uganda's STI sector still faces many challenges; including but not limited to inadequate infrastructure, financing, low levels of innovation and poor adoption of existing appropriate technologies. One of the reasons for the poor adoption of existing technologies is the little synergy between the private sector on one hand and the academia and research on the other. In view of this, the government is seeking to put in place strategies to enhance synergies between the private sector and academia.

As the UNCST continues to position itself to further the deployment of STI as tools that will foster competitiveness, industrialization, and job creation and contribute to the realization of Vision 2040, there is need to reflect on the achievements that the institution and the nation at large has registered through the Government Support to Scientists funding mechanism.

In a bid to critically assess achievements as a basis for the next steps in ensuring that STI impacts on the economy of Uganda, UNCST organized a High-Level Forum, which brought together scientists, researchers, policymakers, development partners, academia and the private sector. The overall aim of the Forum was to take stock of the achievements attained under the Government Support to Scientists and re-engineer strategies to consolidate the role of STI and partnership with the private sector as a critical tool for socioeconomic transformation.

The High-Level STI Forum which took place on Thursday 26th May 2016 at the Kampala Serena Hotel provided an excellent opportunity for frank dialogue among stakeholders on how to enhance synergies among different STI actors and for deliberating on the way forward for STI in Uganda.

There is no doubt the Forum provided an exciting opportunity to re-affirm the role of STI as strategic tools for unlocking Uganda's innovative potential and taking it to new frontiers. We commend the President of the Republic of Uganda who was represented by Hon. John Nasasira, Hon. David Bahati the Minister of State for Finance, Planning and Economic Development (Planning) who is also responsible for STI in Uganda, Hon. Jessica Alupo, Minister of Education, Science, Technology and Sports, and all the stakeholders and partners who participated in the High-level STI Forum, 2016.

Dr. Theresa Sengooba, Board Chairperson, UNCST

Remarks by the Executive Secretary

The High-level Science, Technology and Innovation Forum, the first of its kind, was organised to take stock of the achievements attained through the Government Support to Scientists funding mechanism and to strategize on how to build on these and other ongoing initiatives to enhance competitiveness, industrialization and create employment for all Ugandans.

At this forum the leadership of this country yet again demonstrated Government's commitment to advance the science and technology agenda in Uganda as a vehicle for achieving middle income status for all Ugandans by 2020. It is therefore no surprise that UNCST and the Scientific Community recognised the efforts made by HE the President of the Republic of Uganda for his efforts in championing S&T- led development in Uganda.

On behalf of UNCST I would like to appreciate the leadership of this country for the unwavering support for STI in Uganda. I thank all who participated in this important meeting for your insightful contributions and impressive exhibition of your scientific and technological innovations.

I am optimistic that Government will take our recommendations to have a fully-fledged Ministry for Science and Technology as well as a permanent forum for discussing STI development matters into consideration.

Thanks again and we look forward to working together in subsequent fora of this kind.

This report provides highlights of what transpired at this important meeting. I wish you good reading!!

Dr. Peter Ndemere, Executive Secretary UNCST.

Acknowledgements

Uganda National Council for Science and Technology (UNCST) is grateful to all participants for honouring the invitation to the High-Level Science, Technology, and Innovation (STI) Forum.

Special appreciation goes to His Excellency President Yoweri Kaguta Museveni, his representative at the forum - Hon. John Nasasira, Minister for Information and Communication Technologies (ICT); Hon. David Bahati, Minister for Finance, Planning and Economic Development (Planning); Hon. Jessica Alupo, Minister of Education, Science, Technology and Sports, Members of the Science and Technology Committee of Parliament, representatives of development partners, researchers, innovators, exhibitors and all distinguished STI stakeholders for their patronage and willingness to share with us their views.

UNCST appreciates the Governing Board (4th Council) for their guidance and support. Special gratitude is extended to Dr. Maxwell Otim-Onapa for spearheading the preparations together with the UNCST STI Forum coordination team comprising of Dr. Peter Ndemere, Mr. Bashir Kagere, Mr. Edward Tujunirwe, Ms. Mylia Rubanzana, Mr. Ronald Jaggwe, Ms. Deborah Kasule, Mr. Karl Sentongo, Ms. Loi Namugenyi, Ms. Ester Zansanze, Mr. Anthony Okimat, Mr. Collins Tumusiime, Mr. John B. Etoori and Mr. Geoffrey Sempiri.

And finally the team that compiled this report comprising of Ms. Deborah Kasule, Mr. Bashir Kagere and Mr. Karl Sentongo is also appreciated.

1. Background

Uganda National Council for Science and Technology (UNCST) is a Uganda Government Agency, established by an Act of Parliament (Cap 209) under the Ministry of Finance, Planning and Economic Development. UNCST is mandated to facilitate and coordinate the development and implementation of policies and strategies for integrating science, technology and innovation (STI) into the national development process.

UNCST addresses the above mandate through a number of interventions inter alia: policy development and advising government on all matters of science and technology; supporting, guiding and coordinating research and innovation.

Conscious that Science, Technology and Innovation are strategic tools that can unlock the potential of Ugandan researchers and innovators and spur a shift from relatively lower end economic activities into high value added activities, the UNCST has over the years undertaken a number of transformative initiatives to ensure that STI contributes to the socioeconomic transformation of Uganda. These initiatives are anchored on the national innovation ecosystem, comprising of other actors, institutions and linkages, which include the academia/researchers, government/public and private sector. These partnerships have helped the STI stakeholders appreciate the dynamics of STI within the context of economic and market development and its role as a critical fulcrum around which the strategic transformation of Uganda can be leveraged.

UNCST facilitates the development of STI and its integration into the national development process through or among other means - Government Support to Scientists. This support has triggered significant research and innovation activities that have yielded exciting outputs over the years.

The UNCST therefore, found it imperative to hold this Forum in order to review key aspects of STI performance and deliberate the way forward especially in regard to research, technology development and innovation. The Forum was held under the theme: Science, Technology and Innovation for Industrialisation, Competitiveness and Job Creation.

2. The High-level Science, Technology and Innovation Forum Conceptual Framework

As UNCST continues to position herself to further deploy STI as a tool that fosters industrialization, competitiveness and job creation, and to contribute to the realization of Vision 2040, it is important to take stock of and reflect on the achievements that the institution has registered by supporting innovation through the Government Support to Scientists funding mechanism.

In a bid to assess the achievements of the funding mechanism as one of the means of ensuring that STI impacts on the economy of Uganda, UNCST organized a one day High-level Forum involved policy makers, development partners, beneficiaries of the Government Support to Scientists, researchers, academia, private sector and the media.

2.1 Aims and Objectives of the Forum

The overall aim of the Forum was to take stock of the achievements attained under the Government Support to Scientists and re-engineer strategies to consolidate the role of STI as a critical tool for socioeconomic transformation.

Specific objectives of the Forum

i. To provide a platform for researchers and innovators to showcase their outputs/products

ii. To provide an opportunity for policy makers, researchers, academia and the private sector to appreciate the impact Government Support to Scientists has made in the STI sector

iii. To harness further government and private sector funding support to STI in Uganda

iv. To recognize and honor excellence in STI in Uganda

v. To award the 2016 National Science, Technology and Innovation Grants

3. Participation

The high-level forum brought together over 150 participants drawn from different sectors of government, the diplomatic community, academia, private sector and the media.

The event was presided over by Hon. John Nasasira, Minister of Information and Communications Technology (ICT) who represented His Excellency General Yoweri Kaguta Museveni, President of the Republic of Uganda. Participants also included: Hon. Jessica Alupo, Minister of Education, Science, Technology and Sports; Hon. David Bahati, Minister of State for Finance, Planning and Economic Development (Planning), Hon. Hamson D. Obua (MP Ajuri County) and Hon. Robert Kafeero Sekitoleko (MP Nakifuma County) former Chairman and Vice Chairman respectively, of the S&T Committee of the 9th Parliament; heads of ministries, agencies and departments, and vice chancellors.

Hon. John Nasasira Minister for ICT, Hon Jessica Alupo Minister for Education, Science, Technology and Sports, and Hon David Bahati Minister of Finance for Planning at the Forum

4. Activities of the Forum

The one-day event comprised of an opening plenary; presentations of experiences by scientists; a panel discussion on the role of private sector in moving STI forward; an exhibition and STI Award Ceremony.

4.1 Opening Ceremony

The high level STI forum was officially opened by Hon. John Nasasira who represented His Excellency the President of the Republic of Uganda. Hon. Nasasira conveyed the President's regrets for being unable to preside over the Forum and reiterated his commitment to strengthening the STI sector through investment in research for national development; building human capital and infrastructure; and promoting private sector involvement in STI. He noted that the NRM Government has entrenched STI in the national development framework as evidenced by the National STI Policy (2009), Science Education Policy, and the National Development Plans I and II among others.

The President was happy to note that the researchers Government had invested in, had made significant

progress with most advancing beyond product development to commercialization and that they were even employing Ugandans. He advised the private sector to engage scientists and invest in research and innovation, in order to enhance competitiveness of their firms.

In his remarks Hon. David Bahati noted that the NRM government has established a conducive environment for fostering partnerships among the academia and industry, including the Public Private Partnership Policy. He indicated that UGX 200bn had been earmarked for specific STI programmes in the financial year 2016/17 of which UGX 40bn was for salary enhancement. He proposed that the High-level Forum be upgraded to a Presidential Forum on Science, Technology and Innovation (PFST) like is the case with the Presidential Investors' Round Table (PIRT). He further proposed that His Excellency the President of the Republic of Uganda chairs the Forum which should be coordinated by UNCST.

Hon. Jessica Alupo reiterated the NRM government's commitment to supporting science and technology at all levels of the education system.

Top Left to Right: Hon. Nasasira, Hon. Bahati and Hon Alupo give remarks at the Forum

Other remarks were given by Dr. Theresa Sengooba (Chairperson of UNCST Governing Council) and Dr. Peter Ndemere, the Executive Secretary UNCST.

In their remarks they highlighted the need for a substantive Ministry for Science, Technology and Innovation, full implementation of the STI policies, the need to intensify efforts to add value to Uganda's local products and reduction of dependency on imported products, increased funding for research and innovation (from 0.4% to 1% of GDP) and enactment of a law to guide the judicious application of biotechnology in Uganda. This is in light of the fact that products of biotechnology are already possibly on the Ugandan market. Dr. Maxwell Otim-Onapa, Deputy Executive Secretary UNCST moderated the opening session of the forum.

Left to Right: Dr. Peter Ndemere, Executive Secretary, UNCST and Dr. Theresa Sengooba, Board Chair UNCST give remarks at the Forum

4.2 STI Excellence Award/Recognition

The highlight of the event was the recognition and awarding of H.E. General Yoweri Kaguta Museveni a very well-known champion of STI whose tireless efforts have helped put STI at the forefront of Uganda's development agenda.

The scientific fraternity under the leadership of UNCST recognized His Excellency President Museveni for his leadership in the advancement of STI in Uganda. This is in view of the fact that the President has personally supported STI in Uganda through a number of initiatives; including the Presidential Support to Scientists funding mechanism. The Award was received by Hon. Nasasira, on behalf of the President.

Hon John Nasasira receives the Outstanding Leadership Award on behalf of the President H.E. General Yoweri Kaguta Museveni.

4.3 Keynote Address and paper presentation by beneficiaries of Government Support to Scientists funding

4.3.1 A keynote address focusing on the role of STI in fostering industrialization, competitiveness and employment creation in Uganda was presented by Assoc. Prof. William Bazirake, a member of the UNCST Governing Council and beneficiary of Government Support to Scientists funding. The keynote highlighted progress made in integrating STI into the national development under the stewardship of UNCST. Assoc. Prof. Bazirake further emphasized the need for increased investment in research and development as well as the need to improve the packaging industry in the country.

He observed that the sector had made slow but steady progress over the last 25 years, and had in the last decade seen the establishment of an appropriate framework for governance of STI in Uganda notably: Information and Communication (ICT) Policy (2003); National Biotechnology and Biosafety Policy (2008), National Industry Policy (2008) and National Science, Technology and Innovation Policy (2009), among others.

These efforts he noted have yielded significant results. As an example he recalled that UNCST supported a working group on ICTs which produced the National ICT sector strategy, and laid the foundation for establishment of the Ministry for Information and Communication Technology, and liberalization of the ICT sector. This, he noted also saw the assigning of a sector status to science and technology and making it a priority within the national development frameworks (National Development Plans 2010-2015 and 2015-2020) and Vision 2040. Government of Uganda has through UNCST established a research oversight system that is of international repute, ensuring that individuals and communities in Uganda are neither harmed by research nor their rights, interest and values compromised when volunteering to be research participants. This system includes human research protection system, comprising of 20 accredited research ethics committees

(RECs), and a robust training programme in research ethics that has trained over 1500 individuals since 2009. This coherent research oversight mechanism Assoc. Prof. Bazirake noted, has made Uganda an internationally recognized research hub, registering advances in research in the fields of HIV/AIDS, cancer, malaria, TB, hemorrhagic fevers (mainly Ebola), socio behavioral, ecological, agricultural and other areas of study.

He further observed that many other successes have been registered in the areas of transfer of technology, popularisation of science and funding multisectoral research and innovation. Some of the outstanding innovations he cited that UNCST has sponsored include but are not limited to the following:

1. Banana Tissue Culture business - Agro-Genetic Technologies Limited
2. ARTAVOL - malaria prevention herbal drink
3. FREVASEMA - Fresh Vacuum Sealed Matooke
4. MAKAPads - sanitary pads made from waste paper and papyrus
5. Nabweru and Buwama Community TeleCentres
6. Pamoja CleanTech AB – gasification project in Muduuma Mpigi
7. Milk booster- production of animal feeds from urea blocks and sugar cane molasses
8. New Undergraduate Science and Engineering Programmes at various public and private universities in Uganda
9. Automated Cargo Route and Vehicle Management
10. Monthly Intellectual Property Clinics- a tool to raise awareness of intellectual property protection and Technology Transfer

4.3.2 Presentations

In a bid to add more perspective to the Forum, beneficiaries of the Government Support to Scientists presented papers focused on research and innovation as follows:

a) From Concept To The Market Place: What Does It Take?
b) Business Incubation as a Critical Link in the Innovation Cycle.
c) ICT Innovation For Improved Health Care Service Delivery.
d) Turning The Innovation Wheel Fully: A Practical Approach.
e) Appropriate Technology Innovations as a Tool for Unlocking Uganda's Industrialization Potential.

The above papers were presented by: Dr. Patrick Ogwang (Mbarara University of Science and Technology – MUST); Prof. Florence Muranga (Presidential initiative on Banana Industrial Development - PIBID project); Dr. Silver Kiyimba (Integrated Intelligent Computer Systems –IICS); Prof. William Kyamuhangire – (Banana Juice Project); and Prof. Moses Kizza Musaazi (Presidential Initiative to Support Appropriate Technologies - PISAT).

Innovation was described as the development and application of a new idea, device or process that meets new requirements, unarticulated needs or existing market demand." Innovations solve problems that people have identified. A new idea or concept that addresses an actual market need must also be developed (produced), applied (released) and proven to meet the need (market acceptance). Generating ideas for innovation is a deliberate that process requires understanding of the subject matter; thinking, a conducive environment and a long term vision (5-10 years). Innovation further requires an understanding of the present and future market trends.

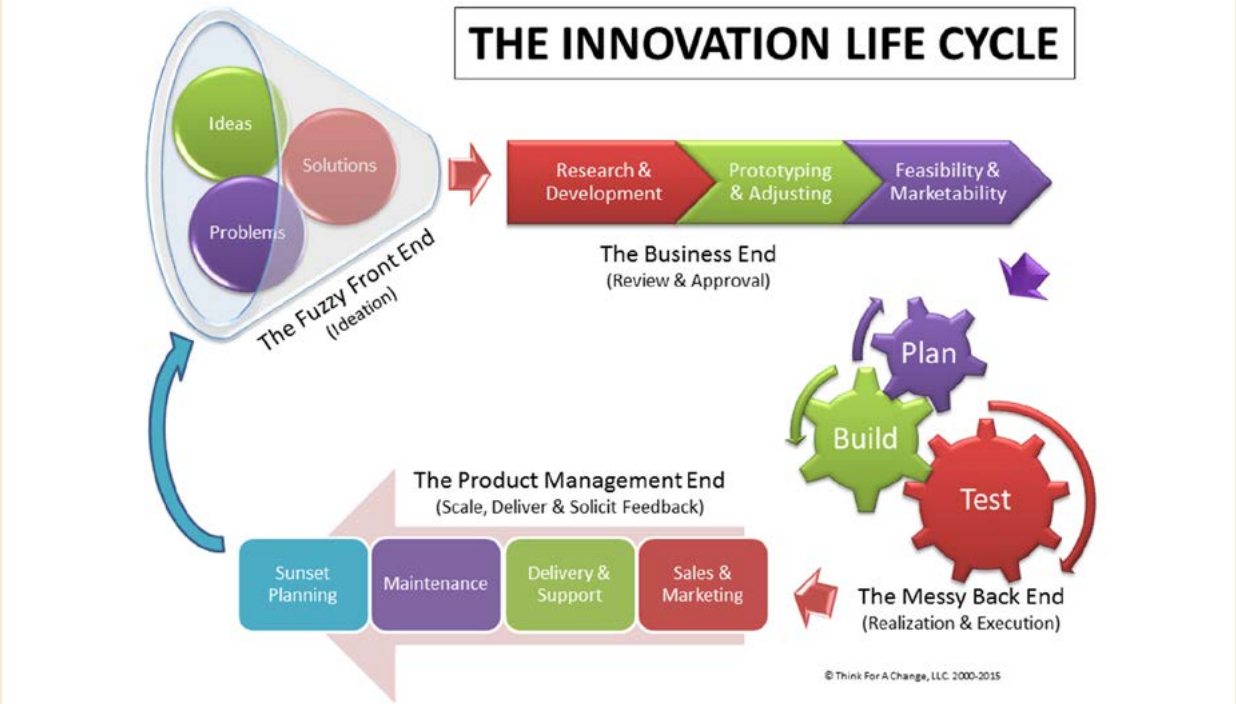


Fig.1: An illustration of the Innovation Cycle.

Ideas usually arise from gaps in the market or product range and may take the form of: new technology that increases efficiency of a process to take a shorter time or require less materials, etc. or one that improves the usability or quality of the final product, such as the tablets, laptops or even a completely new product. New challenges such as the banana bacterial wilt disease in agriculture, or global warming among many others present opportunities for innovation. Changing preferences by society such as interest in organic products, environmental friendly products, among others, stimulate innovation.

In regard to what it takes to progress from concept to marketing of innovations, one of the innovators opined what it may entail getting an innovation to the market in Uganda, on the basis of their experience in the area of natural health products. He went on to note that it all starts with rigorous laboratory and clinical studies aimed at detecting and quantifying the active compounds in various naturally occurring plants or even animals. This requires equipment – which is often very expensive; several clinical studies to prove safety and effectiveness; funding as well as publishing one's research, and patenting the innovation.

The choice of material is dictated by; availability and ease of propagation of the raw materials; availability of basic scientific data, acting as leads; and the organoleptic (taste, smell) presentation of the material or final product on the market. Product development then involves transformation of the product into the pharmaceutical product. In the areas of natural health products this requires among others things such as: equipment for identification; extraction of active ingredients; production of pharmaceutical dosage forms; development of standards for the product; and human resource capacity building.

He also advised that marketing is another key consideration and entails demand for the given production; mapping potential users as well as public education – given that the product is usually new; exploring external markets. In this regard, innovators may also consider patenting of their outputs although he noted that intellectual property protection is quite costly and involves a lengthy process consequently, innovators often fail to pursue IP protection because of the costs of maintaining rights to a patent. Licensing is another option innovators in Uganda may consider, and in such a case the rights would be vested in the host institution. However, in most cases host institutions lack IP policies and capacity to handle research output-related business.

The journey from concept to market is not without challenges. The initial capital investment needs are too high for the ordinary scientist/innovator; scientists don't have the time and skills to market their products; and in Uganda like many other developing countries, there is low private sector investment in research product development.

The researcher observed that at the moment innovators, especially those in the natural health products can only operate at small scale targeting the local markets because of the high costs of production of bulk shipments of these products as well as the intricacies of obtaining international certification for export overseas.

Appropriate Technology (AT) was defined as that technology that suits the social and economic conditions of the geographic area in which it is applied; is environmentally sound, and promotes self-sufficiency among those using it. In Uganda an Appropriate Technology Innovation (ATI) is therefore one which meets the above criteria and additionally creates employment for the population.

In contrast to conventional industrialization, appropriate technology innovations create jobs by empowering the people. This implies that people are not moved to industries but industries are created around the people wherever they are (Fig. 2).

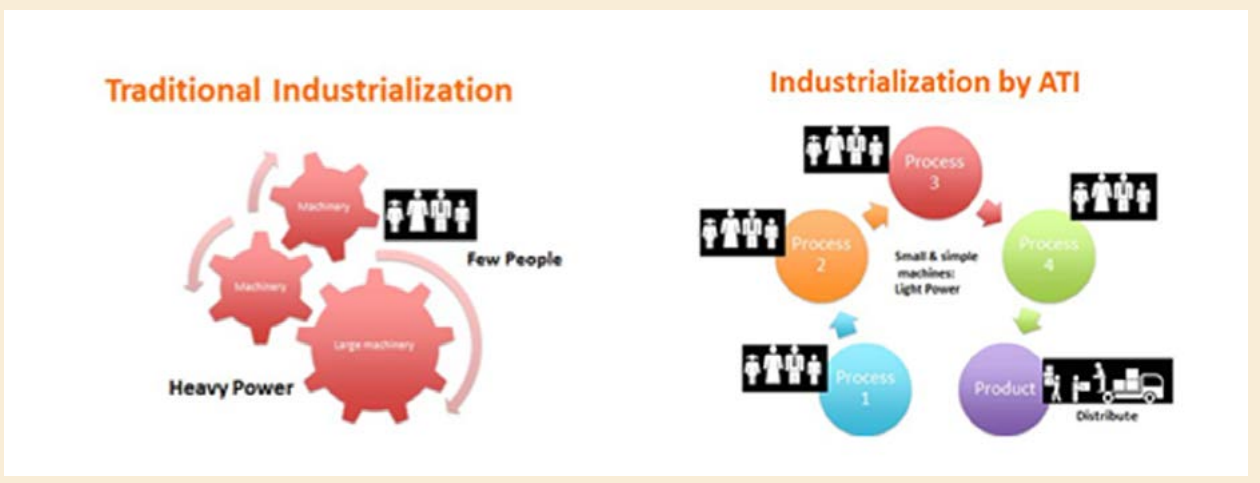


Fig.2: Conceptual illustration of Traditional Industrialisation and Industrialisation by Appropriate Technology (AT).

The appropriate technology model if adopted would ensure that Ugandan industries: are widely spread throughout Uganda; have products that are highly demanded by the population; create jobs around the people, empowering them within their social conditions; and protect the environment in the course of their operations.

4.4 Science Technology and Innovation Exhibition

The UNCST, partner research institutions and beneficiaries of Government Support to Scientists showcased their products, technologies and services in a parallel event. It was gratifying to observe that some of the researchers had progressed from a single product to a whole range of commercial products, while others had since established commercial enterprises.

The exhibition show-cased some high potential scientific work such as the Neonatal Incubator and many other innovative products such as: biodegradable sanitary towels and diapers made from papyrus, Herbal antimalarial beverage as well as tablets, pellets; previously perishable banana modified to extend shelf-life, assorted products from the banana plant and fruit e.g. banana wool, vinegar, wine; ICT applications for monitoring productivity of human resources and service delivery; biotechnology products; alternative renewable energy sources, etc. all made in Uganda by Ugandan researchers.

Table 1: Summary of Products that were exhibited at the Forum:	
Products	
Banana cluster	
Rev. Dr. Florence Isabirye Muranga: Banana Industrial Development Project (PIBID	• Biscuits, porridge, banana wool, matooke-based confectionaries
Prof. George William Byarugaba Bazirake: Fresh Vacuum Sealed Matooke Project	• Fresh Vacuum Sealed Matooke, Juices, vinegar, biogas, wines, jewelry and household items e.g. doormats, lamp shades
Mr. Erostus Nsubuga : Agro-Genetic Technologies Limited	• Tissue culture planting materials
Health care products and services	
Dr. Patrick Ogwang: Household Malaria Prevention – Artemisia Annua Project	• Artavol anti-malarial beverage and assorted healthcare products
Dr.Miph Musoke: Oluwoko Malaria Control Project	• Posters, experiments and publications of Malaria studies
Mr. Chris Nsamba: Neonatal Intensive Care Unit Incubator	• Neonatal Incubator
Appropriate technologies	
Dr. Moses Musaazi: Appropriate Technologies	• Makapads and diapers made out of papyrus
Dr. Fred Kabi: Milk Booster Project	• Milk boosting animal feed
ICT Innovations	
Dr. Silver Kiyimba : Integrated Intelligent Computer Systems (IICS) Technologies Project	• ICT solutions for management of health systems and processes
Mr. Herbert Lwanga: Log'el Project – ICT Systems Project	• ICT security systems, Software Development, Mobile App Development, Comprehensive web hosting and branding services
Renewable energy	
Mr. Ismail Kavuma: Appropriate Energy Technologies Uganda Limited	• Cheap clean charcoal briquettes made out of agricultural waste, cook stoves (Sigiris), Production of biogas, briquette-making machines and training manuals
Biotechnology	
Mr. Erostus Nsubuga : Agro-Genetic Technologies Limited	• Tissue culture banana planting material, information education and communication materials on agricultural biotechnology

Banana Cluster

Innovation in the banana cluster is mainly driven by the following challenges: despite Uganda's being 2nd largest producer of the non-dessert banana and given that banana production provides the major occupation for the majority of the rural poor (75%), the country has no place in the vibrant world banana Market. This is because raw matooke is a low value commodity that suffers high post-harvest losses. Furthermore. the country is landlocked, making export of fresh banana uncompetitive because of the costs of airfreight. At local level the innovations showcased address the challenge of transporting bulky raw bananas, and poor mechanical condition of available transport for bananas which results in ripening and loss of quality during transportation. Value addition research, though advanced, had remained with academic and research institutions and the costs of any industry in banana required high capital investment.

Figure 3: Infrastructure for Banana value addition - Top left and Centre: Bisquit line and Top Right: Banana Dryers at PIBID in Bushenyi. Bottom: Tooke Porridge, one of the products of PIBID.

Innovation in the banana cluster has seen some significant achievements. The PIBID programme (Fig.3) for example has 5 patents for products and processes as follows:

Description	Patent No.	Date issued
1. Extraction of low Amylose Matooke (Banana) starch from a triploid acuminate East Africa highland varieties 19 and its application for industrial use	UG/P/2004/00012	27/12/2004
2. Process for preparation of raw matooke (Banana) flour.	AP/P/2005/003308	25/04/2005
3. Processing for extracting banana wool and sponge	AP/P/2008/004542	03/05/2007
4. Preparation of pre-cooked instant banana flour	UG/P/04/00010	22/07/2010
5. Extrusion cooking process of matooke/non-cooking banana flour into extrudents which serve as raw materials for a highly soluble extruded banana flour	UG/P/2004/00011	27/12,2010

Technology transfer and incubator facilities as well as a medium scale enterprise have been established by the Fresh Vacuum Sealed Matooke project – Afribanana Agribiz Incubator/Afribanana Limited. They too have the FREVASEMA commercialized Patent (Fig. 4) and have been able to export over 100 metric tonnes of fresh vacuum sealed matooke to the USA annually and have the US Food and Drug Administration (FDA) certification. FREVASEMA is providing a market for over 200 farmers thereby providing income and creating employment for the rural poor.

Fig.4: Left to Right: Fresh vacuum-sealed bananas, and FREVA Wines produced by AfriBanana Limited.

Fig. 5: Left to Right: Banana Juice, Crafts, lamp shades, bags, table mats made out of the banana plant and Tissue culture banana seedlings produced by AfriBanana Limited.

Other products of the banana value chain include (Fig. 5): tissue culture planting materials, wines such as Freva wine, Red star wine, juices – Excelas juice, biscuits – Tooke, house furnishings such as doormats, lamp shades, and jewelry. The banana waste (peels) is used for biogas and production of vinegar.

Health care Products and Services

In the area of healthcare products some of the innovations exhibited include Makapads, affordable sanitary pads made from recycled paper with papyrus as the absorbent. The process of producing Makapads itself is innovative given that it is centred on the people. For example, people can work at home and only have to take the final product to the factory for packaging to ensure quality and delivery on schedule.

Hon Jessica Alupo, Hon John Nasasira, Dr Theresa Sengooba and Hon David Bahati listen to a presentation from Dr. Kizza Musaazi the innovator behing MakaPads.

As the next step, the plan is industrialisation of baby and adult diapers using MakaPads technology and production method (appropriate technology). The samples of diapers which were also exhibited at the High-level forum have been tested and found not to cause diaper rash or skin irritation because they are free of chemicals. They further don't bulge because of the natural absorbent used and are proudly the only biodegradable diapers in the world, rendering them of great export potential.

Another outstanding innovation in healthcare is the ***Artemisia annua*** anti-malarial beverage- Artavol (Fig.6) where medicinal plants have been converted into an antimalarial product with pharmaceutical characteristics. This project explored the outcome of the use of powder-lemon grass blend herbal beverage for malaria prevention and eradication at household and community levels. This innovation was conceived to address the widespread devastating effects of malaria using a readily available and marketable beverage – tea to

deliver the solution. The product of this innovation, Artavol is patented at ARIPO and currently produced and widely distributed through Pharmacies and Drug shops in Uganda. In 2014 the Ministry of Health in Uganda recognized this work and awarded the principal investigator for outstanding achievement in research for herbal prevention of malaria.

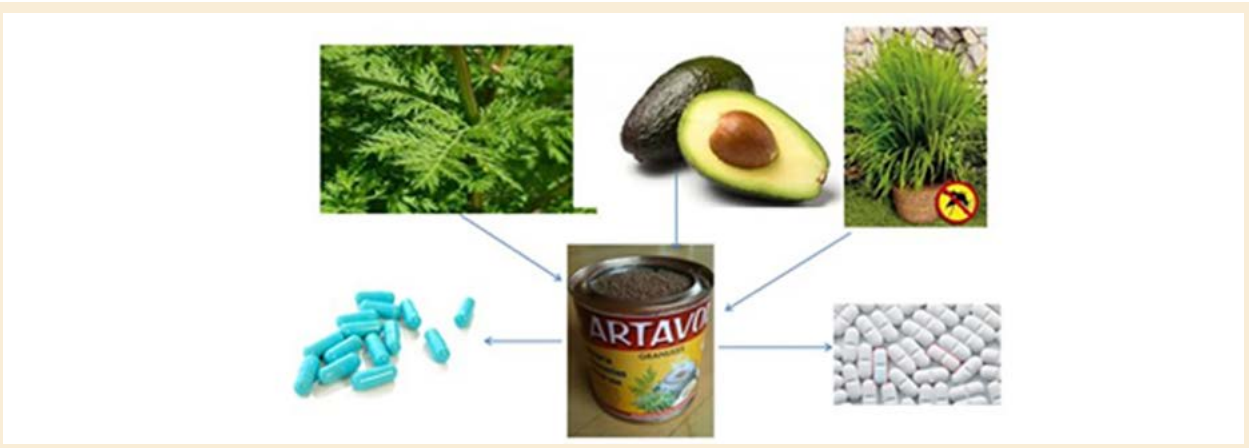


Fig.6: The Ingredients of Artavol

ARTAVOL production currently stands at 6000 tins per month. Distribution is mainly through pharmacies, exhibitions and during school visits to raise awareness about the product. Artavol is distributed by pharmacies in Fort Portal, Jinja, Kampala, Lira Mbale, Mbarara, Soroti, Tororo, and Wakiso districts in Uganda. Unfortunately the local population is not yet fully aware of this product's potential. At international level the researcher has airlifted 100 tins to Ghana and received orders from Niger, Mozambique, and Senegal. However, the freight costs are still prohibitive. Moreover, this large scale shipping would require licensing the product in those countries as a medicine for malaria control.

Among the significant outcomes of this innovative endeavor is the new discovery that regular consumption of Artemisia among HIV/AIDS patients increases their CD4 count.

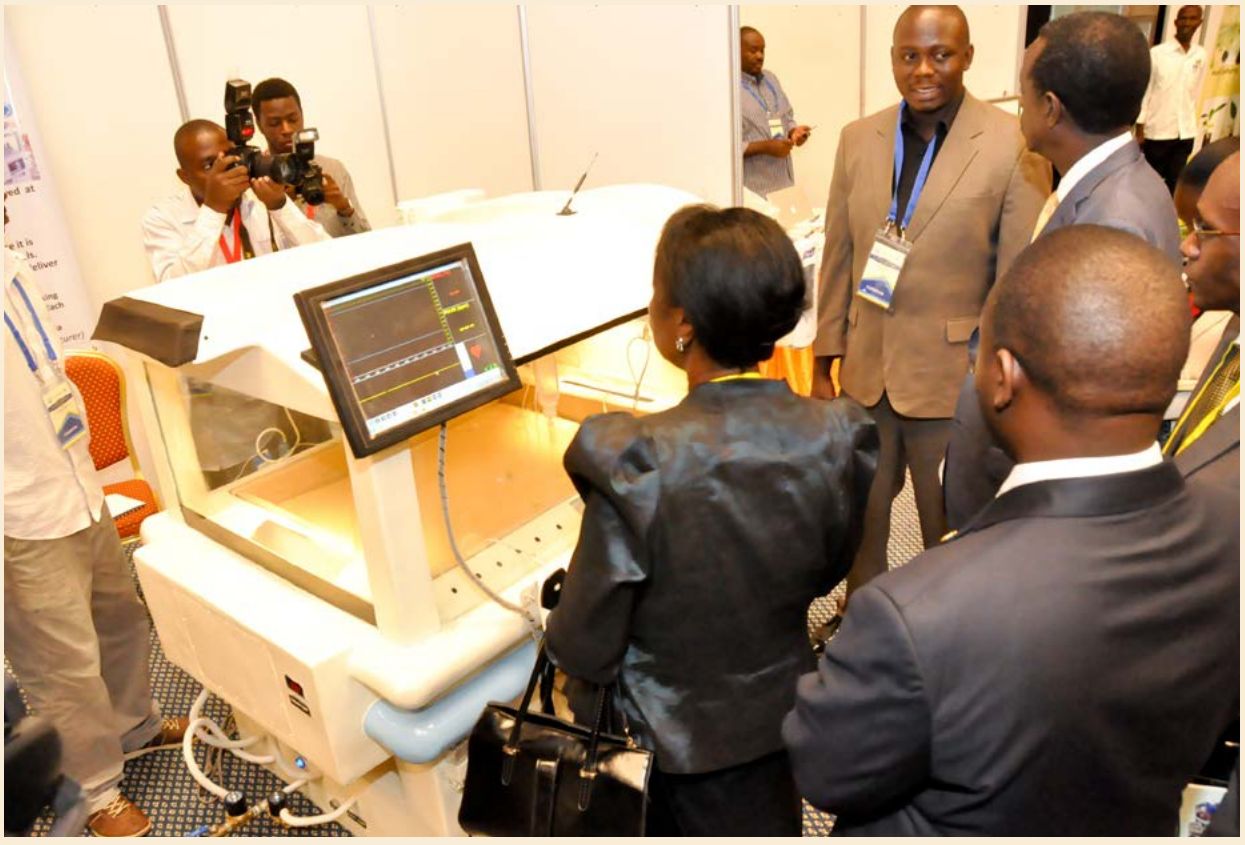
Fig. 7: Left: Artavol anti-malaria beverage. Right: Production equipment – extreme right is a locally fabricated version of the stainless steel equipment used for this pharmaceutical product.

In order to address the high costs of equipment, Artavol Programme has a collaborative arrangement with Makerere University College of Engineering Design Art and Technology alumni to fabricate equipment.

In terms of sustainability the ARTAVOL concept has evolved into a Center for Science-driven Traditional Medicine and Drug Development at Mbarara University of Science & Technology (PHARMBIOTRAC-MUST). This is sponsored by the Government of Uganda and World Bank under the auspices of the African Center of Excellence for Southern and Eastern Africa (ACE II). The objective of this initiative is to train and build a critical mass of graduate scientists specializing in traditional medicine and pharmaceutical biotechnology and to link traditional medicine research outputs to Industry in the region. It is envisaged that at the end of 5 years 30 PhDs from the various disciplines specializing in traditional medicine will be trained; new drugs will be discovered and developed; 60 Master students adding scientific and economic value to Traditional Medicine; 500 Herbal Medicine producers trained through short courses to improve quality, safety

and efficacy of their herbal products and 5000 traditional medicine practitioners trained to improve primary healthcare service in the region.

Another outstanding innovation at the High-level forum in this category was the Neonatal Intensive care unit – a neonatal incubator by one Chris Nsamba. This is a manually built machine with safety features and software to monitor a new-borne's condition. Key features of the incubator include: capability to generate oxygen from the environment (unlike the others that use an oxygen cylinder); a pulse graph for the heart; monitors for breathing which are fitted with an alarm; control panel for temperature, humidity, mosquito-repellent; automatic humidifier and sanitizer and a wireless computer device that that transmits information to a health worker, so that they don't have to sit attend to the machine all the time.



Chris Nsamba the brain behind the Neonatal Incubator innovation explains how it works to the Chief Guest and Management of UNCST.

This is a remarkable innovation in a country that is ranked 13th out of 184 countries with the highest number of premature births costing the health sector millions of shillings. According to the innovator, the incubator has a lifespan of 50 years and is worth 27 million shillings (US$8,000), which is about half the price of externally manufactured incubators.

ICT applications for improved service delivery

The Integrated Intelligent Computer System (IICS) is a collection of customizable software components running from a centralised platform. It was designed to optimize, automate, and streamline some of the business processes in the health sector in order to overcome challenges such as: frequent stock-outs of essential medicines; expiry of medicines and medical supplies; over ordering or the reverse, for health supplies; poor management of patients' records and institutional assets; persistent absenteeism of health workers; health centres' late opening and early closing, among others.

Mr. Silver Kiyimba the scientist behind the IICS innovation presents to the Chief Guest.

This information and communication technology (ICT) innovation has since its inception been used to monitor drug supplies, usage and consumption right from suppliers to health facility stores patients. They have been used to support patients' records management including schedules, prescriptions and dispensing. They have further been deployed to monitor staff attendance.

Table 3: Significant outcomes of IICS intervention at Mulago National Referral hospital

Outcomes of IICS intervention	Initial	Now
Reduced Expiry of drugs	UGX 117 million per month	UGX 0.127 million per month
Reduced waiting times for supplies	from 3 hours	to 15 minutes
Reduced order queuing time	1 day	30 minutes
Reduced cost of stationery	UGX 720 million	UGX 430 million
Improved accountability for drugs	38%	80%
Example: Sodium Chloride 9%	**Before installation of System:** Average order volume per month = 2,000 cartons	**After installation of system:** Average order volume = 800 cartons
Introduced tracking of medicines from NMS to the patient		
Introduced tougher stock management regimes to reduce on drugs pilferage.		

Renewable Energy

Innovations under the renewable docket that were showcased included: energy saving equipment, production process for making cheap clean charcoal briquettes, affordable local cook stoves (Sigiris), technologies for production of biogas from leftover vegetables (utilizing domestic wasted foods), Cheap local briquette-making machines for training and business entrepreneurs.

Ms. Naigaga from Apropriate Rural Technologies Institute Uganda showcases renewable energy innovations available at their institution

4.5 Award of the National Science, Technology and Innovation Programme (NSTIP) Grants

The NSTIP is a competitive research funding initiative by the Government of Uganda, managed by UNCST. NSTIP supports scientific innovations across all domains of Science, Technology and Innovation (STI) in line with the national priorities indicated in Vision 2040 and the STI Policy 2009.

Table 4: **A Summary of projects that received grants for the year 2015-16 cycle:**

Project Title	Host Institution	Project Goal
1. Production and Evaluation of Anti- Tick Vaccine in Uganda	Makerere University, College of Veterinary Medicine, Animal Resources, and Biosecurity. **Contact** Principal Investigator: Margaret Saimo-Kahwa, PhD Tel: +256 772 592 736 email: msaimok@gmail. com	Dr Margaret Saimo-Kahwa and her team are proposing to provide an effective, affordable and easily accessible anti-tick vaccine that will lower the production costs, reduce the usage of acaricides, in livestock with reduced contamination risks to the environment and food chain, increase performance and household income thereby improving livelihoods.
2. Prototype Development, Feasibility Testing and Preclinical Validation of Mycobacterium Tuberculosis Thymidylate Kinase Based Rapid Serodiagnostic and Positive Culture-Detection Technologies for Tuberculosis	Makerere University, College of Health Sciences **Contact** Principal Investigator: Misaki Wayengera, PhD Tel: +256 782 450 610 email: wmisaki@chs. mak.ac.ug, wmisaki@yahoo.com	Dr Misaki Wayengera and his colleagues is working on developing a new improved TB diagnostic tool that can be performed by less skilled personnel, cheap and rapid enough to yield results while the patient waits. This would ultimately allow the health care workers to make a decision as to whether or not to treat while the patient waits and would also would reduce secondary contact, exposure and transmission
3. Using Exclusive- Based Sample Preparation (ESP) and Generic Reagents to Reduce HIV Viral Load Assay Cost	Joint Clinical Research Centre (JCRC) **Contact** Principal Investigator: Professor Peter Mugyenyi Tel:+256 414 201 146 email: pmugyenyi@jcrc. org.ug	Prof. Peter Mugyenyi together with his team are working to solve the problem of the expensive routine viral load monitoring among people living with HIV by developing and testing an affordable virus load test, which will result in improved access to diagnostic testing in Uganda, better patient care and health, prevention of HIV transmission, developing technical capacity, and reducing HIV test costs.
4. Commercialisation of the Bio- Multifunctional Platform for Agro-processing in Rural Areas: A Pilot Project in Kibaale District	Kyambogo University **Contact** Principal Investigator: Ssengonzi Bagenda, PhD Tel:+256 772473416 email:jjsengonzi@gmail. com	Dr. Ssengonzi Bagenda and collegues are working on establishing a bio-multifunctional platform which uses gasification technology that converts agricultural produce processing residues (waste) into gaseous fuel to run machinery, generate electricity and mechanical power. The commercialisation of this bio-multifunctional platform will encourage value addition to agricultural produce (Agro-processing) in areas not connected to the National Electricity grid.

Project Title	Host Institution	Project Goal
5. Stre@mline: Integrating patient safety and efficient health service delivery using Information Technology	Church of Uganda Kisiizi Hospital **Contact** Principal Investigator: Dr. Ian Spillman Tel: +256 781 169 475 email: khmedsup@ gmail.com	Dr. Ian Spillman and his team are working on developing Stre@mline which is an exciting, innovative, integrated patient-centred health management informatics system that will follow the patient journey through the health care process, providing valuable support for health workers, including a range of important patient safety features facilitating safe prescribing and reducing the risk of medical errors and adverse events e.g. alerting staff of patient allergies, supporting triage to avoid delay in treatment of seriously ill patients, identifying patients who pose an infection risk to others, prompting staff re good practice checklists etc. and offering learning opportunities for Staff and students.
6. Up scaling the Production and use of Ugandan Shea Butter (Vitellaria paradoxa) Oil in Food, Cosmetic and Pharmaceutical Applications	Makerere University, School of Forestry, Environment and Geographical Sciences **Contact** Principal Investigator: Professor John Bosco Lamoris Okullo Tel: +256 774 059 868 email:jbokullu@caes. mak. ac.ug | jbl.okullu@ gmail.com	The research team lead by Prof. John Bosco Lamoris Okullo is working to improve the efficiency of oil extraction and diversifying products from Ugandan shea butter oil for increased food processing applications. This will close the current gaps of inefficient post harvest handling and processing techniques that limit both quality and quantity of Ugandan shea butter that is produced for both local and international markets.

4.6 Panel Discussion

In order to concretize the proceedings of the day a panel discussion by prominent STI actors; including policy makers, researchers/innovators, academia and the private sector crowned the day. Discussions focused on strategies for the private sector involvement in fostering industrialization, competitiveness and employment creation and further leveraging STI.

The Panel discussion was moderated by Dr. Julius Ecuru (UNCST). Panelists included: Mr. Erostus Nsubuga (AgroGenetic Technologies – AGT Limited), Dr. Dick Kamugasha (Uganda Industrial Research Institute – UIRI), Dr. Andrew Kiggundu (National Agricultural Research Laboratories – NARO), Mr. Allan Senyondwa (Uganda Manufacturers' Association – UMA). Highlights of the presentation and panel are summarized in the matters arising and recommendations from the meeting.

Left to Right: Dr. Julius Ecuru (UNCST) moderates while Dr. Andrew Kiggundu (NARO-NARL, Mr. Erostus Nsubuga (AGT Limited), Dr. Dick Kamugasha (UIRI) and Mr. Allan Senyondwa (UMA) participate as panelists in the discussion.

4.7 Closing ceremony

The closing ceremony was presided over by Prof. John Opuda Asibo, Executive Director of the National Council for Higher Education (NCHE) who represented the Minister of Education, Science, Technology and Sports. Prof. Opuda commended scientists for their commitment to S&T development as evidenced by their commitment of time and ideas during the forum.

Chris Nsamba (left) the best exhibitor receives award from Prof. Opuda Asibo (NCHE).

He reiterated Government of Uganda's commitment to provide a conducive environment for nurturing the science and technology-led development that is envisioned in the country's national development planning. He highlighted the role higher education institutions play in spearheading innovation and the need to harness these as the raw material for taking Uganda to middle income status by 2020. He called on UNCST, the Science Fraternity and private sector to hold such, on a regular basis.

He awarded certificates to all exhibitors at the Forum and Mr. Charles Nsamba of the Neonatal Incubator innovation who was the best exhibitor. He then officially closed the High-level STI Forum.

5. Outcomes and Recommendations of the Forum

5.1 Outcomes /observations

- The products, technologies and services showcased at the Forum were of very high caliber.
- Uganda has a high potential to advance to a knowledge economy because of the very young population and natural resource endowment.
- The most successful companies/ businesses in the East African region (e.g. Safaricom, Mobile Money), are products of research and innovation in ICT. Uganda like other countries has very high potential for advancing knowledge –based economies.
- The STI sector is in transition. The government of Uganda is in the process of positioning the STI sector coordination within the most appropriate Ministry.
- The Government of Uganda through the Ministry of Finance, Planning and Economic Development (MFPED) is repositioning for more private sector engagement in all aspects of economic development including STI support therefore institutionalizing such a forum is timely.
- The integration of STI in Uganda's national development framework is a testimony of government's commitment to advancing the economy through STI among other means.
- The government of Uganda has earmarked 200 Billion Uganda Shillings to support value addition, research and innovation in the financial year 2016/17, of which 40 billion is for salary enhancement.
- Participants were concerned that most innovators in Uganda are lone-rangers. While this helps them avoid bureaucracy and deliver faster at usually less costs, it unfortunately results in higher failure rates and more sporadic innovation.
- Culture was observed as a major constraint to progress from research to commercialization among Ugandans.
- Marketing is the missing link in the research value chain.

5.2 Recommendations

- Uganda should have research priorities in place to guide research and innovation activity as well as investment in the two across all sectors
- Researchers should be helped to protect their knowledge
- Government should enact a policy to promote and guide Incubation. Incubation is key for progressing up the value chain
- Financing and monitoring of STI should be streamlined under UNCST for better coordination and optimal resource use
- There is a need for deliberate efforts to link research and innovation to private sector and industry. The high-level Forum is one such mechanism which should be institutionalized and jointly funded by both public and private sector institutions
- The multi-disciplinary research teams are a prerequisite for sustainable innovation and knowledge-based economic development
- Researchers and innovators should pay keen attention to quality assurance, especially when dealing with communities and the informal sector in STI development
- Uganda should focus more on innovations rather than invention given that the former is most likely to yield results in the shorter term
- The higher education system should encourage critical thinking to foster innovation among the youth
- In summary, partnerships, team building and coordination are key for advancing STI development in partnership with the private sector
- A Presidential Roundtable on STI should be established for regular engagement of STI stakeholders on pertinent issues with HE the President
- Proceedings of the Forum should be documented and sent to HE the President through Hon. Nasasira
- Full implementation of STI related policies, e.g enactment of the Biotechnology and Biosafety law
- Increase funding of research and innovation (from the current 0.4% to 1% of GDP)
- Establishment of the Ministry of Science, Technology and Innovation in order to effectively coordinate STI for sustainable national development.

Annex 1: Programme

TIME	EVENT	RESPONSIBLE PERSON
8:00-9:00	Arrival and Registration	UNCST Secretariat
	SESSION 1	
9:30–10:00	Arrival of H.E. The President Tour of the STI exhibition Singing of the National Anthem and the EA Anthem	UNCST Secretariat
10:00–10:10	***Welcome Remarks*** Executive Secretary UNCST	Dr. Peter Ndemere
10:10-10:20	Chairperson UNCST Governing Council	Dr. Theresa Ssengooba
10:20-11:00	Keynote Address	Prof. George William Byarugaba Bazirake
11:00-11:10	Minister of State for Planning and Economic Development (Planning)	Hon. David Bahati
11:10-12:00	Presentation of the 2015/16 National Science, Technology and Innovation Grants Group Photo with H.E. The President Presentation of the STI Excellence Award to H.E. The President	Chairperson UNCST Governing Council
12:00-12:30	Address by H.E. The President	
	SESSION 2	SESSION CHAIR
12:30– 12:50	***Presentation 1*** From Concept To The Market Place: What Does It Take?	Dr. Patrick Ogwang
12:50–14:00	LUNCH	UNCST Secretariat
14:00-14:20	***Presentation 2*** Business Incubation As a Critical Link In The Innovation Cycle	Prof. Rev. Florence Muranga
14:20-14:40	***Presentation 3*** ICT Innovation For Improved Health Care Service Delivery	Dr. Silver Kiyimba
14:40-15:00	***Presentation 4*** Turning The Innovation Wheel Fully: A Practical Approach	Prof. William Kyamuhangire
15:00–15:20	***Presentation 5*** Appropriate Technology Innovations As a Tool For Unlocking Uganda's Industrialization Potential	Prof. Moses Musaazi
15:20– 17:00	Panel Discussion	
	Science, Technology and Innovation: Looking Ahead.	Dr. Julius Ecuru
17:00– 17:10	Recap of the day	Dr. Maxwell Otim-Onapa
17:10– 17:30	Closing Remarks	Minister of Education, Science, Technology and Sports

Annex 2: List of Participants

	NAME	INSTITUTION	TELEPHONE/EMAIL CONTACT
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Annex 3: Photo Gallery


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