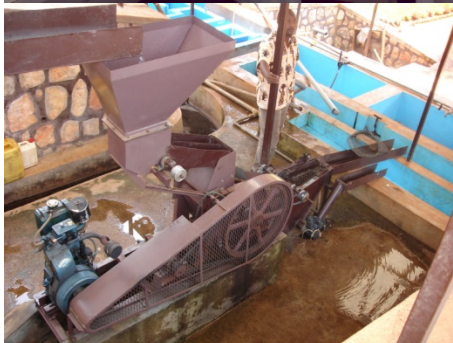


# Presentation on Science, Technology, and Innovation Policy- Rwanda

**STI policy Reviews Workshop**  
**Mombasa, 30 March – 3 April 2009**

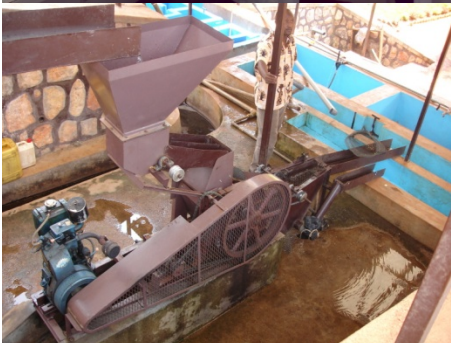


# Overview of Presentation

- Rwanda's Vision and Commitment
- Rwanda's National Science, Technology and Innovation Policy
- ICT Policy
- Overview of Science, Technology and Innovation Policy Areas
- Challenges
- Opportunities

# Rwanda's Vision

- The vision for Rwanda's future is enshrined in the Vision 2020 for Rwanda which looks towards the achievement of "a modern and Prosperous Nation, strong and united, worthy and proud of its fundamental principals"
- Science and Technology has a key role to play in the realisation, of this vision; and the target is to strengthen and integrate STI into the country's strategies and policies in order to achieve national socio-economic development.





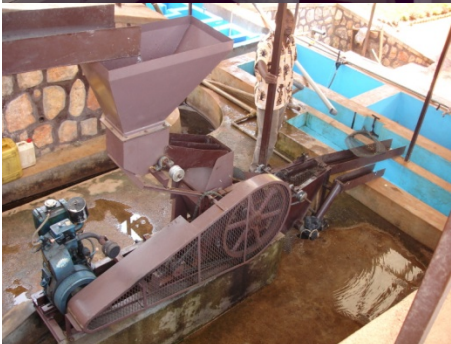
## Background to the Development of the National Science, Technology and Innovation Policy in Rwanda (including Development Partner Support)

- World Bank: September 2004 - Advisor in Science and Technology Appointed;
- DFID / UNESCO: November 2004 - Concept paper CSIRO – Preparatory National Integrated Innovation Framework for Rwanda;
- DFID: May 2005 – National Science and Technology Conference in Butare – Sponsored by DFID
- July 2005: National Policy on Science, Technology and Innovation Approved by the Rwandan Cabinet
- March 2006: The Ministry of Science, Technology and Scientific Research was created by the President’s Office to take charge of the implementation of this policy
- World Bank: September 2006 – Aide Memoire “Developing a Needs Assessment and Action Plan for Science, Technology and Innovation Capacity Building”
- DFID: January 2007 – Initial Scoping Study for Support to the Government of Rwanda in the development of the Legal and Regulatory Framework

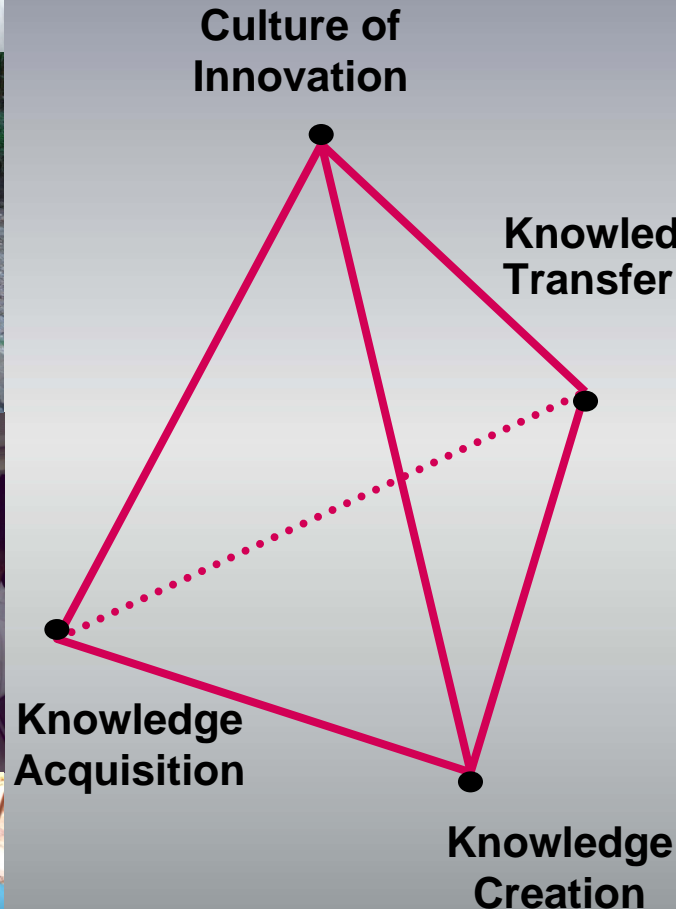
# Rwanda's National Science, Technology and Innovation Policy

## Specific Policy Objectives:

- ***Knowledge Acquisition and Deepening*** – to reinforce science and technology teaching and resources at all levels of education
- ***Knowledge Creation*** – Develop Research Capability in all priority sectors of the economy
- ***Knowledge Transfer*** – to reinforce Science and Technology Capability in all priority sectors of the economy
- ***Innovation Culture*** - To encourage Innovation at all levels to help stimulate economic growth



# Knowledge and Innovation Tetrahedron



- Often known as the knowledge triangle or innovation triangle, Can also be represented as the Knowledge and Innovation Tetrahedron
- This is the representation of the elements of the National STI Policy with:
- the four fundamental objectives, of
  - Knowledge Acquisition,
  - Knowledge Creation,
  - Knowledge Transfer and
  - Culture of Innovation to build on the solid foundation of these three

# Human Capacity Building in Knowledge Acquisition, and Deepening



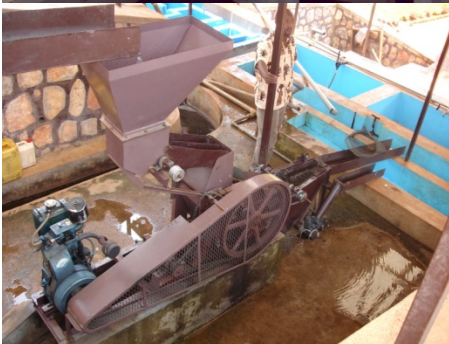
- The principal areas for knowledge acquisition start at Primary level and move up through Secondary to Vocational, Technical, and Higher Institutions of learning.
- At primary level a project is ongoing to equip all 2,200 primary schools in Rwanda with a science corner. This will display fundamental information about science with particular relevance to the world around the school including the cycle of life, fundamentals of energy, the environment, and a computer with internet connection.
- The “One Laptop Per Child” project has been initiated in primary schools; to be established in 50 % of the schools by 2012.
- The proposed interventions at secondary level will include the provision of a high quality science and technology education, in schools equipped to also undertake practical lessons.
  - Introduction of 10, broadband connected computers per secondary school
- At higher level (NUR, KIST, KHI, KIE, ISAE,UP) priority is focused on theoretical and practical training for medical practitioners, technologists in various fields, agriculturalists, scientists, engineers, doctors etc.

## Ongoing Project - One Laptop Per Child





## Knowledge Creation: Infrastructure and Human Capacity Building in Research



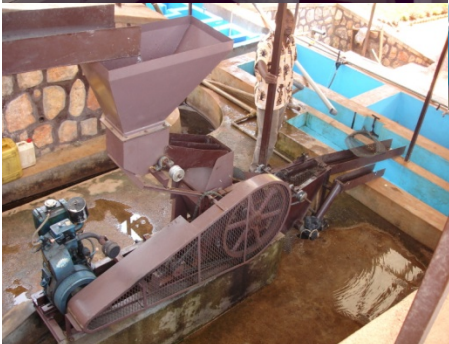
- Masters and PHD training for lecturers in universities and for staff of Research Institutes,
- The establishment of an S&T trust fund,
- Research Fellowships from partner institutions,
- Industrial Attachments in all major projects,
- Specific Research in Commodities with potential for Economic Growth,
- The establishment and reinforcement of high quality laboratories, including all health districts and a state of the art reference laboratory,
- To establish S&T Centres of Excellence in HLIs,
- Science and Technology Conferences
- Reinforce the capacity of Industries to conduct research by establishing R&D Units.



## Rwandan Research Institutes and Agencies Focus Areas

- **IRST** - research and generation of suitable technologies in energy, environment, health, society and economic fields
- **ISAR** - development of appropriate technologies to transform agriculture from subsistence to commercial
- **RADA** - implement the national agriculture policy, supply farmers with appropriate technologies to increase production, reinforce the farmers' technical capacity
- **RARDA** - growth of animal production through development of appropriate technologies, providing advisory, outreach and extension services to stakeholders in the animal resources sector
- **RHODA** - develop necessary legislation to govern activities for the increased production of horticultural products, implement national horticultural strategy
- **REMA** – implement the national environmental policy, environmental protection and regulation
- **RITA** – to be a centre of innovation and national point of reference for ICTs

# National Reference Laboratory CD4 DNA Analysis: genes to cells to proteins



# Partnership Between GoR and African Development Bank ISAE BUSOGO CAMPUS



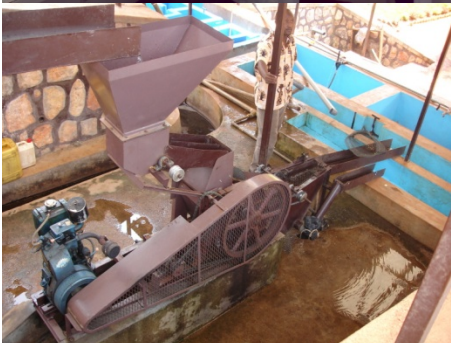
Micro Biology Laboratory

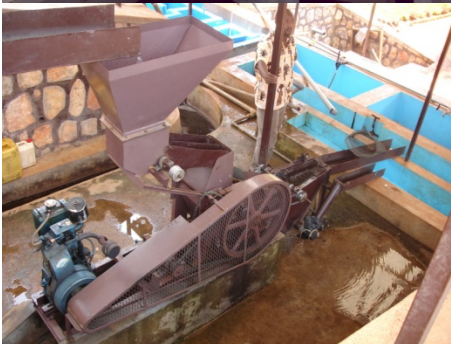


Animal Health



Students in Library





## Knowledge Transfer: STI Capacity for Economic Growth, Poverty Reduction and Meeting MDGs

- Using STI Capacity Building in Rwanda as a Tool for Improving the Lives of the Rural Poor, Reducing Poverty, and Achieving the MDGs, also as a tool for generating wealth and diversifying the economy:
  - Agriculture Productivity -Research and Extension
  - Geothermal Energy / Geosciences
  - Food Processing and Food Technology
  - Clean Drinking Water and Sanitation
  - Biofuels
  - Vocational and Technical Education and Training
  - ICT
  - Crops / commodities developed or under development include:
    - Coffee, Silk
    - Horticulture (flowers, vegetables, fruits)
    - Aquaculture, Herbs and Essential Oils

# Knowledge Transfer Biogas Installation at ETO Gitarama



# Knowledge Transfer

## Dam Construction – using readily available equipment and providing local employment



**Knowledge Transfer**  
**Adding Value to Natural Resources – Coffee Washing Station at Maraba**





**Knowledge Transfer**  
**Appropriate Technology – Fuel Efficient Cook stoves**



# Science and Technology Policy Areas

## Agriculture & Animal Husbandry

- Scientific techniques shall be used to improve land yield and productivity which is key to optimising the use of Rwanda's limited land resource;
- Scientific techniques shall be applied for the promotion and development of specific commodities with a view to transformation of agriculture and animal husbandry with particular emphasis on the promotion of exports

## Biotechnology

- The development of biotechnology shall be supported to increase productivity both in terms of crop yield and animal husbandry and to assist with the achievement of the Millennium Development Goals

## Health

- A scientific approach to health issues shall be promoted, focussing heavily on infectious disease vaccines and clinical treatments



# Science and Technology Policy Areas



## Environment

- Scientific techniques shall be applied for the sustainable management of natural resources including biodiversity, water and soil conservation, marshlands improvement and issues related to climate change



## Water and Sanitation

- Science and technology interventions to achieve sustainable and integrated water resources development and management to enable access nationally to effective sanitation systems and clean drinking water



## Transport

- To develop local Rwandan capacity in the design and construction of transport infrastructure, including bridges, viaducts and culverts



# Science and Technology Policy Areas

## Energy

- To promote scientific and technological activities that will increase access to electricity and provide good quality, cost-effective service, including the development of capacity in all areas of energy research, development and implementation, with particular regard to renewable energy and the protection of the environment

## ICT

- A focus shall be applied to information technology, especially in the fields of intelligence systems and decision making

## Geo-information

- Advanced Geographical Information / Remote Sensing Systems (GIS/RS) shall be developed, covering the whole country, to enable spatial databases to be developed and maintained to maximise knowledge and understanding of the country



# Science and Technology Policy Areas



## Tourism

- Scientific and Technological processes shall be developed in support of the application of science to eco-environmental tourism with a view to supporting the development of the tourism sector in Rwanda



## Industry

- The application of Science and Technology shall be promoted in support of the growth of the Industrial sector with a focus on light industry within a diversified economy, competitive and oriented towards exports

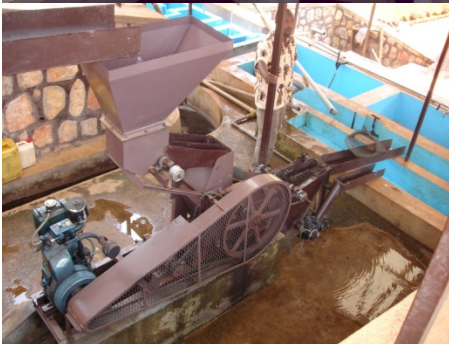


## Private Sector

- The Science and Technology policy objective for the private sector is to focus on technological and innovative advancements in support of the emergence of a healthy private sector that will lead economic growth in Rwanda

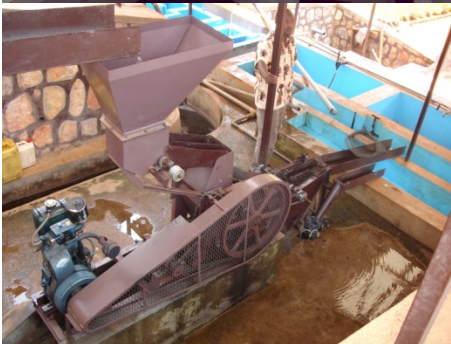
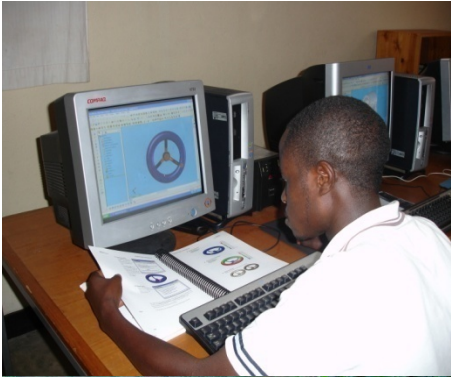


# International Cooperation and Partnerships in Science and Technology

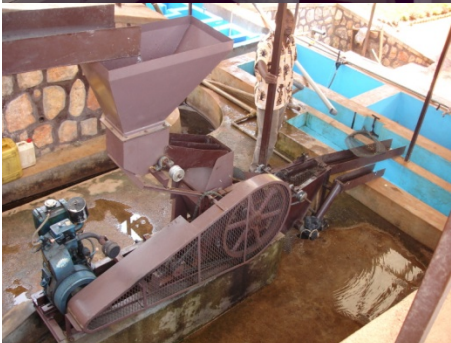


- In addition to its own resources, building scientific and technological capacity for a country like Rwanda needs international co-operation.
- The Government of Rwanda, starting with His Excellency President Paul Kagame, has aggressively engaged in progressing S&T partnerships with more technologically advanced nations and world technology leaders including major corporations.
- The overall effect has resulted in several corporations and countries accepting to establish collaboration with Rwanda. These collaborations have taken several different forms, at:
  - **Bilateral**
  - **Multilateral**
  - **Corporate Level**

# Visit of Professor Baltimore, President American Academy for Advancement Science, AAAS

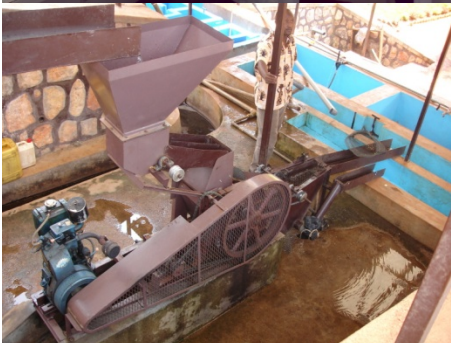


# Visit of Professor Nina Federoff, Science Advisor to US State Department & Science Advisor USAID

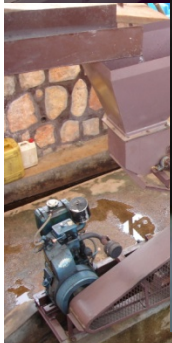




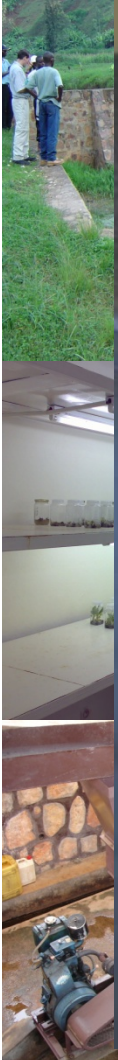
# Visit of Sir Gordon Conway, Chief Scientific Advisor for DFID UK



Mark Biasotti of SolidWorks Conducting training to students at ETO Gitarama



# President of the AfDB Dr Donald Kaberuka visiting ETO Gitarama



# Partnership Between GoR and African Development Bank ISAE BUSOGO CAMPUS



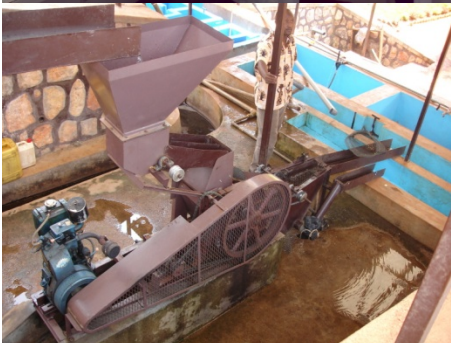
Micro Biology Laboratory



Animal Health



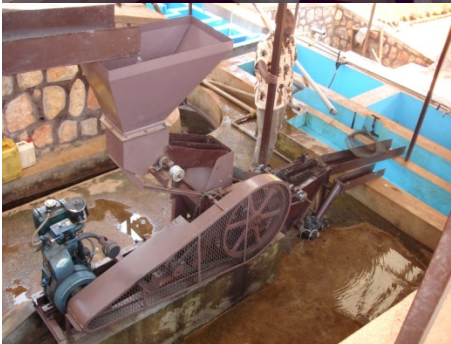
Students in Library



# Multilateral Partnership with the World Bank



- A partnership was established with the World Bank resulting in an Aide Memoire between the Government of Rwanda and the World Bank:
- *“Developing a Needs Assessment and Action Plan for Science, Technology and Innovation Capacity Building for Sustainable Development and Poverty Reduction in Rwanda.”*
- Resulted in baseline studies (Technical and Vocational Education, Agricultural Productivity and Extension, Industry Capabilities, Research Institutions etc.) and Programme Design, Needs Assessment and Action Plans relating to high priority areas identified in Rwanda’s Vision 2020 statement & NSTIP
- Methodology, policy conclusions, and detailed Action Plans were published in a book by the World Bank, January 2008 – *“Developing Practical Solutions to Practical Problems”*



## ICT Development in Rwanda

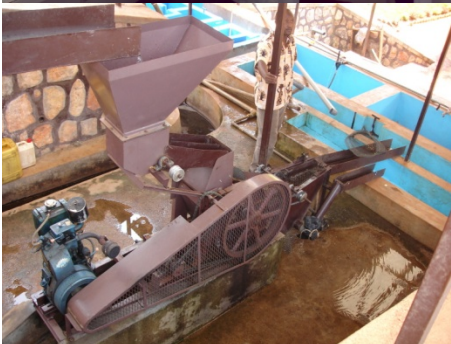
# VISION



Agricultural  
Based  
Economy  
2001

20 Years

Knowledge  
Based  
Economy  
2020



- To transform Rwanda's currently Agriculture based economy to a knowledge based economy by year 2020
- To use Science, Technology and ICT as a key enabler of this transformation
- The Rwanda ICT VISION-NICI Plan: a 5 years plan which started in 2001 and extends to 2020 in 4 phases;
- NICI 2 (2006-2010) comprises 168 projects from all sectors: social(education, Health, Public service etc...), economic(Finance ,Agriculture, Infrastructure),Private sector, civil society.



# Some of the expectations from ICT and how can it help Rwanda?

Access to:

- Voice
- Data
- Video

Transformation of the lives of the people of Rwanda through improved access to and functioning of facilities and institutions such as:

- Good Governance and Strengthening of Democratic Institutions
- Improved Government Communications
- Improved Delivery of Public Services
- Education
- Health Care
- Revenue Management Systems
- Financial Sector



# The NICI II Pillars



1. Education

2. Human Capacity Development

3. Infrastructure, Equipment and Content

4. Economic development

5. Social development

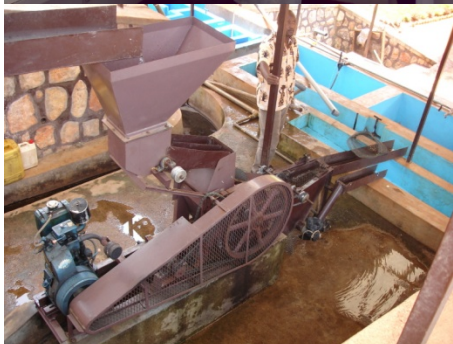
6. e-Government and e-Governance

7. Private Sector Development

8. Rural and Community Access

9. Legal, Regulatory and Institutional Provisions and Standards

10. National Security, Law and Order



## SUMMARY OF ONGOING PROGRESS AGAINST NICI II PILLARS

(1)

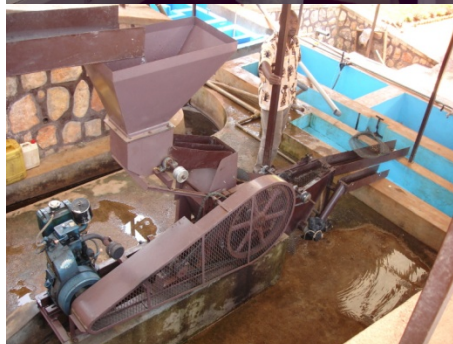
NICI II Pillar	Achieved	Targets 2008	2010 targets
Education	<ul style="list-style-type: none"> <li>- One laptop per child</li> <li>- National school-net project, 2700 computers distributed to 270 secondary schools</li> </ul>	<ul style="list-style-type: none"> <li>- 20,000 laptops was distributed</li> <li>- OLPC Content development ongoing</li> <li>- Addnl 1,300 computers for School-net</li> <li>- Dedicated team for School-net (MINEDUC)</li> </ul>	<ul style="list-style-type: none"> <li>- To transform the educational system using ICTs - improve accessibility, quality &amp; relevance to development needs</li> </ul>
Human Capacity Development	<ul style="list-style-type: none"> <li>- Training programmes for VoIP</li> <li>- Building public awareness of ICT facilities and uses</li> <li>- Ongoing technical support to 60 secondary schools (teachers and students)</li> <li>- Mentoring and internship programme</li> </ul>	<ul style="list-style-type: none"> <li>- <b>e-Rwanda Initiatives to enhance technical capacity of central &amp; Local Govmnt IT staff</b></li> <li>- <b>Increased number of interns, 10 to 20</b></li> <li>- <b>IDRC agreement 1-year s/w capacity building program, \$300,000 USD – 3 mentors from US teams at RITA, NUR and KIST</b></li> <li>- <b>Plans to establish ICT Centre of Excellence – joint venture GoR, Carnegie Mellon, ADB</b></li> </ul>	<ul style="list-style-type: none"> <li>- To improve the human resource development capacity of Rwanda to meet the changing demands of the economy</li> </ul>
Infrastructure , Equipment and Content	<ul style="list-style-type: none"> <li>- National backbone and WiBro project initiated</li> <li>- Karisimbi tower installed and operational – Pilot DVB-T transmission demonstrated</li> <li>- ARTEL – new infrastructure with increase in available bandwidth</li> </ul>	<ul style="list-style-type: none"> <li>- Detailed National Backbone design done,</li> <li>- Implementation of backbone from late 2008 stated</li> <li>- Develop proposals for linking to planned submarine cables</li> <li>- Karisimbi - improve radio &amp; TV coverage, pursue Air Traffic Control possibilities</li> </ul>	<ul style="list-style-type: none"> <li>-To improve the information and communications infrastructure of Rwanda</li> <li>-Implementation of CNS/ATM project</li> <li>-Finalise the implementation of national backbone</li> </ul>



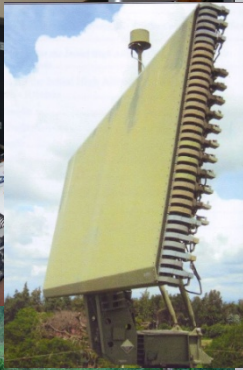
## SOME OF ONGOING PROGRESS AGAINST NICI II PILLARS (2)

NICI II Pillar	Progress 2007	Targets 2008	2010 targets
Economic development	<b>ICT Park established</b>	- Continued growth of ICT Park tenant community, development of strategic, business & architectural plans	- To utilise ICTs to support economic growth in Rwanda
Social development	- eRwanda project declared effective in June 2007 - 9 Video conferencing terminals installed	- Enhancing ICT Infrastructure in Ministries and District Offices - Increase video conferencing from 9 to 50 nodes	- To promote social & cultural interaction
e-Government & e-Governance	- On-line publication of high level cabinet decisions, judicial procedures & relevant laws - e-gov centralized gov'mnt communications,	- To continue to enhance efficient delivery of key public services & the decentralised government process, including Local Government Communication System	- To improve the efficiency of the Civil and Public services
Private Sector Development	- 12 telecentres have been completed & operational in 12 districts - Gasabo 3D offering 2D & 3D conversion	- Rural Private Sector Development Support – Incl. establishment of telecentres to enable the gathering and distribution of information of all sorts & widespread dissemination - detailed “best practice” & market information	-To promote and encourage the deployment and utilization of ICTs within the economy and society

## SUMMARY OF ONGOING PROGRESS AGAINST NICI II PILLARS (3)



NICI II Pillar	Progress 2007	Targets 2008	2010 targets
Rural and Community Access	<ul style="list-style-type: none"> <li>- ARTEL – migrated 100 rural sites, through the new iDirect HUB.</li> <li>- A partnership between BRD, MTN and RITA (and the line ministry) established to increase access to phones by rural communities was setup                             <ul style="list-style-type: none"> <li>– <b>53,355 low cost phones recently delivered to 15 districts in rural areas</b></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- New ARTEL - provincial offices and service centers to improve rural service delivery</li> <li>- eRwanda - training to strengthen rural technical support,</li> <li>- Develop strategy for community healthcare support systems incl. rural telemedicine</li> <li>- Continue rollout of affordable phones project</li> </ul>	<ul style="list-style-type: none"> <li>- To facilitate the process of national reconciliation and re-integration by promoting social and cultural interaction within society.</li> </ul>
Legal, Regulatory & Institutional Provisions & Standards	<ul style="list-style-type: none"> <li>- Liberalisation of telecommunications industry</li> <li>- Tax exemption /relief on ICT related equipment</li> <li>- Conducive labour law for skilled professionals</li> </ul>	<ul style="list-style-type: none"> <li>- Continue to enhance the necessary enabling environment to encourage innovation and entrepreneurship in the ICT sector</li> </ul>	<ul style="list-style-type: none"> <li>- Develop legal, institutional, regulatory framework and structures required for supporting the deployment and utilization of ICTs.</li> </ul>
National Security, Law and Order	<ul style="list-style-type: none"> <li>- National ID implementing task force appointed August 2007</li> <li>- Biometric data capture pilot (pictures, fingerprint &amp; signatures) conducted in Gishali sector</li> <li>- Small network security unit set up in RITA</li> </ul>	<ul style="list-style-type: none"> <li>- Capturing of biometric information production and distribution of NID and Driving Licensing cards – target conclusion end August 2008</li> <li>- RITA Staff training ongoing to develop capability in network security needs.</li> </ul>	<ul style="list-style-type: none"> <li>- To facilitate the process of national reconciliation and re-integration, supporting the deployment and utilization of ICTs</li> </ul>



300 Nautical Miles  
(500km) Radius  
Controlled Air Space



**Mt Karisimbi**

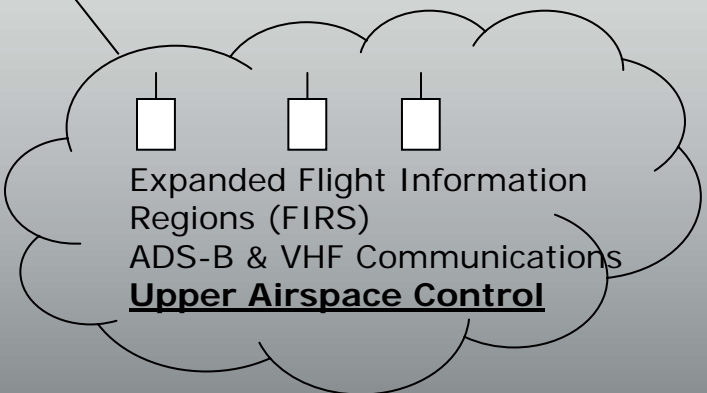
ADS-B  
VHF/UHF/HF  
Communications  
**Upper Airspace Control**



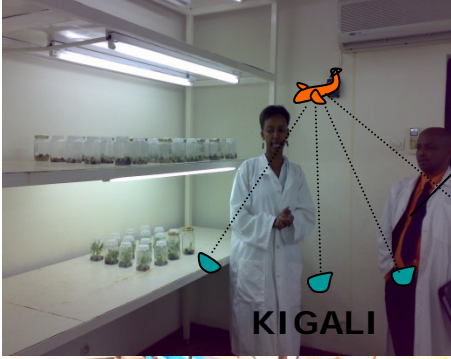
**Long Range Radar**  
**Upper Airspace Control**



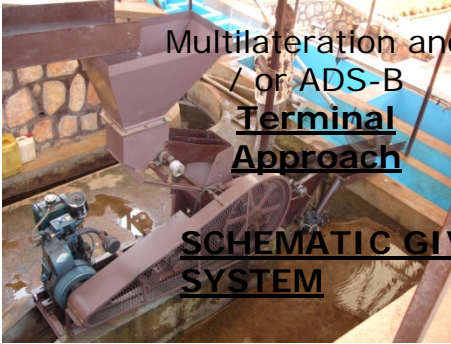
**Area Control Centre**  
-New (Show Piece) Building  
-Control & Operations (incl. associated personnel)  
-Sophisticated Control equipment  
-Automation System (automatic billing and safety functions)  
-Training/Simulation  
-Procedures / Policies



Expanded Flight Information Regions (FIRS)  
ADS-B & VHF Communications  
**Upper Airspace Control**



**KIGALI**



Multilateration and / or ADS-B  
**Terminal Approach**

**SCHEMATIC GIVING AN OVERVIEW OF PROPOSED CNS / ATC SYSTEM**

# Development of ICT Infrastructure in Rwanda (1)

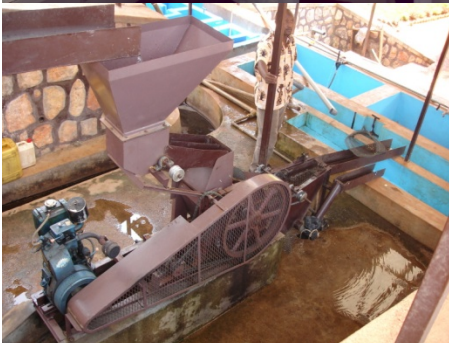
## National Connectivity

### *Background*

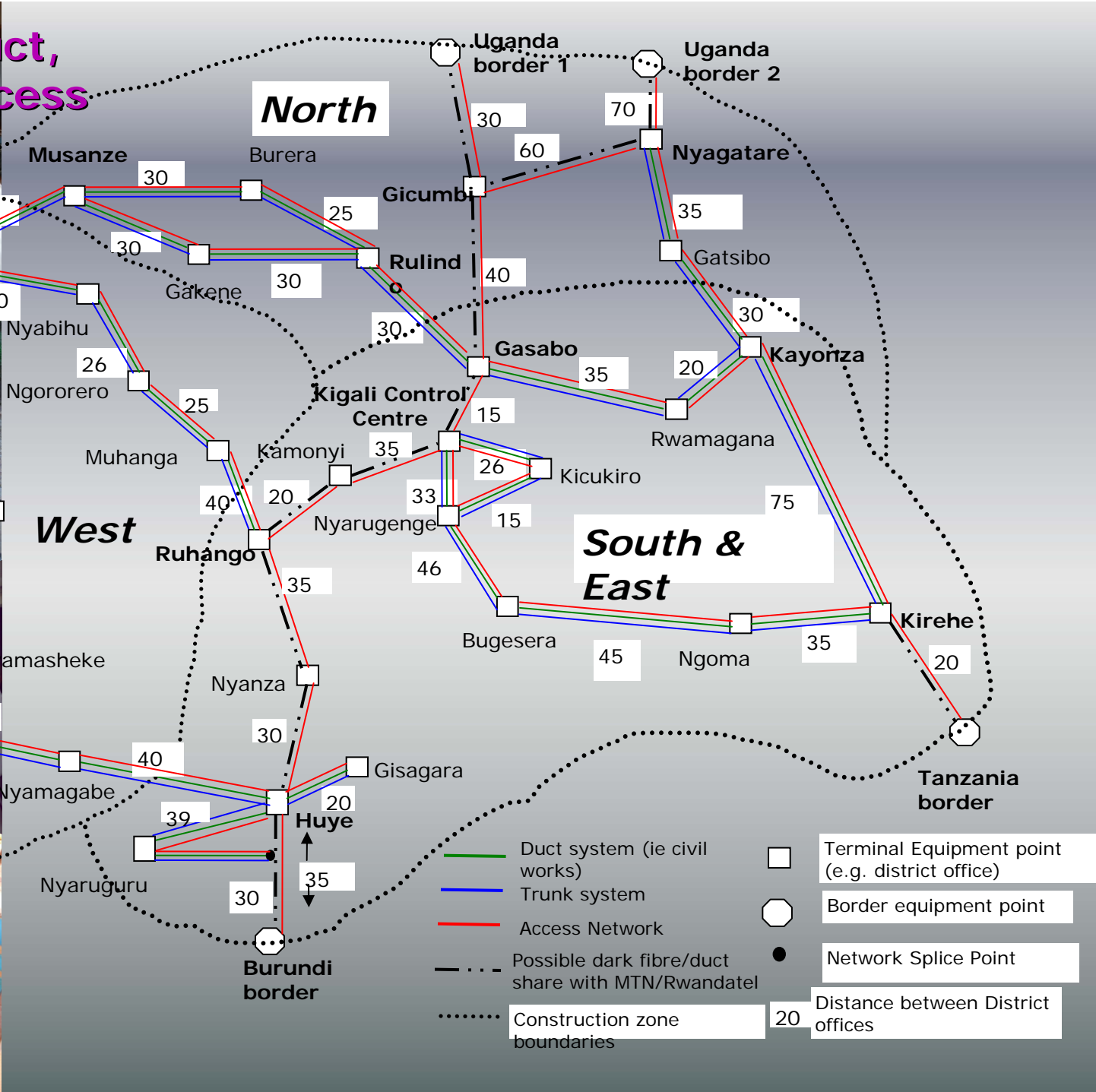
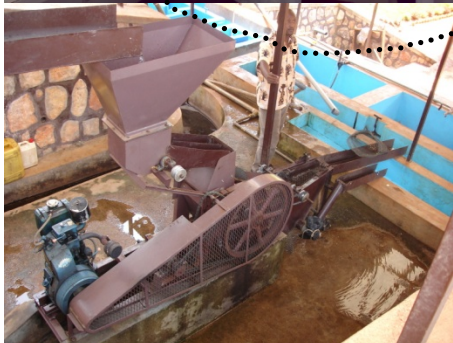
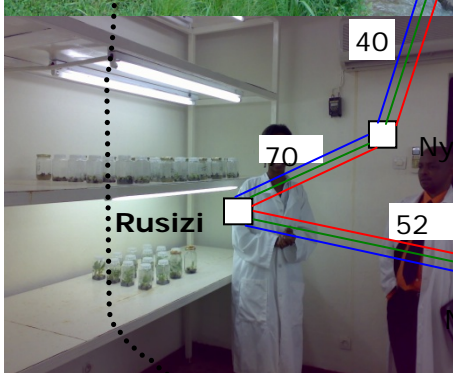
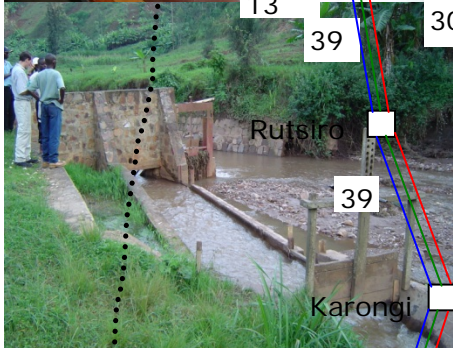
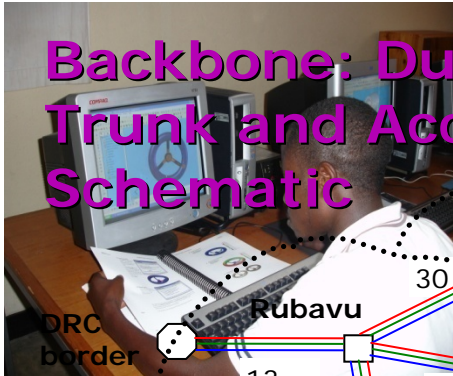
- One of the crucial strategies is to ensure that the telecommunications services, and the resulting benefits of economic, social and cultural development, are extended effectively and efficiently throughout the rural areas of Rwanda. These rural areas stand to benefit most from these services as alternative methods of passing information are more costly and difficult than in urban areas.

### *Future Developments*

- National Fibre Backbone network – currently under implementation, Funding has been made available, initial feasibility studies already undertaken, and a major project about to be launched to develop a National Broadband Backbone Infrastructure in Rwanda. Central to this will be a physical fibre network linking all 30 District Offices in Rwanda.



# Backbone: Duct, Trunk and Access Schematic







## Development of ICT Infrastructure in Rwanda (2)

### Regional Connectivity

#### Background

- To provide a secure, high bandwidth connection to Rwanda regional access routes need to be available via Uganda, Kenya to the North and Burundi, Tanzania to the South

#### Current Status

- North out of Rwanda - The route from the planned Mombasa landing point, through Kenya, to the Uganda border is complete with routes from both Telkom Kenya and Kenya Data Network. From the Kenya border through Jinja to Kampala and onwards to Mbarara routes have been built by both CELTEL and MTN. The route from Mbarara to the Gatuna border is expected to be complete soon
- South out of Rwanda – The route through Burundi is being built with support through the World Bank RCIP programme. Routes are not available through Tanzania, may be planned with support from the World Bank or a separate arrangement



## Development of ICT Infrastructure in Rwanda (3)

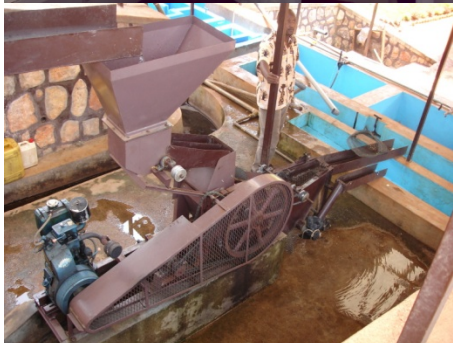
### International Connectivity

#### *Submarine Cable Options*

- EASSy – South Africa and all countries to Sudan - project involving consortium of regional and international telecom operators financed by international development banks
- Seacom – South Africa and all countries to Egypt (+spur to Asia) - privately financed cable project by investment companies major backing prominent private equity firm Blackstone Equity
- TEAMS (East African Marine System) – Mombasa to Gulf - project with backing of Kenya
- NEPAD Broadband Cable – Ring around Africa

#### Current status

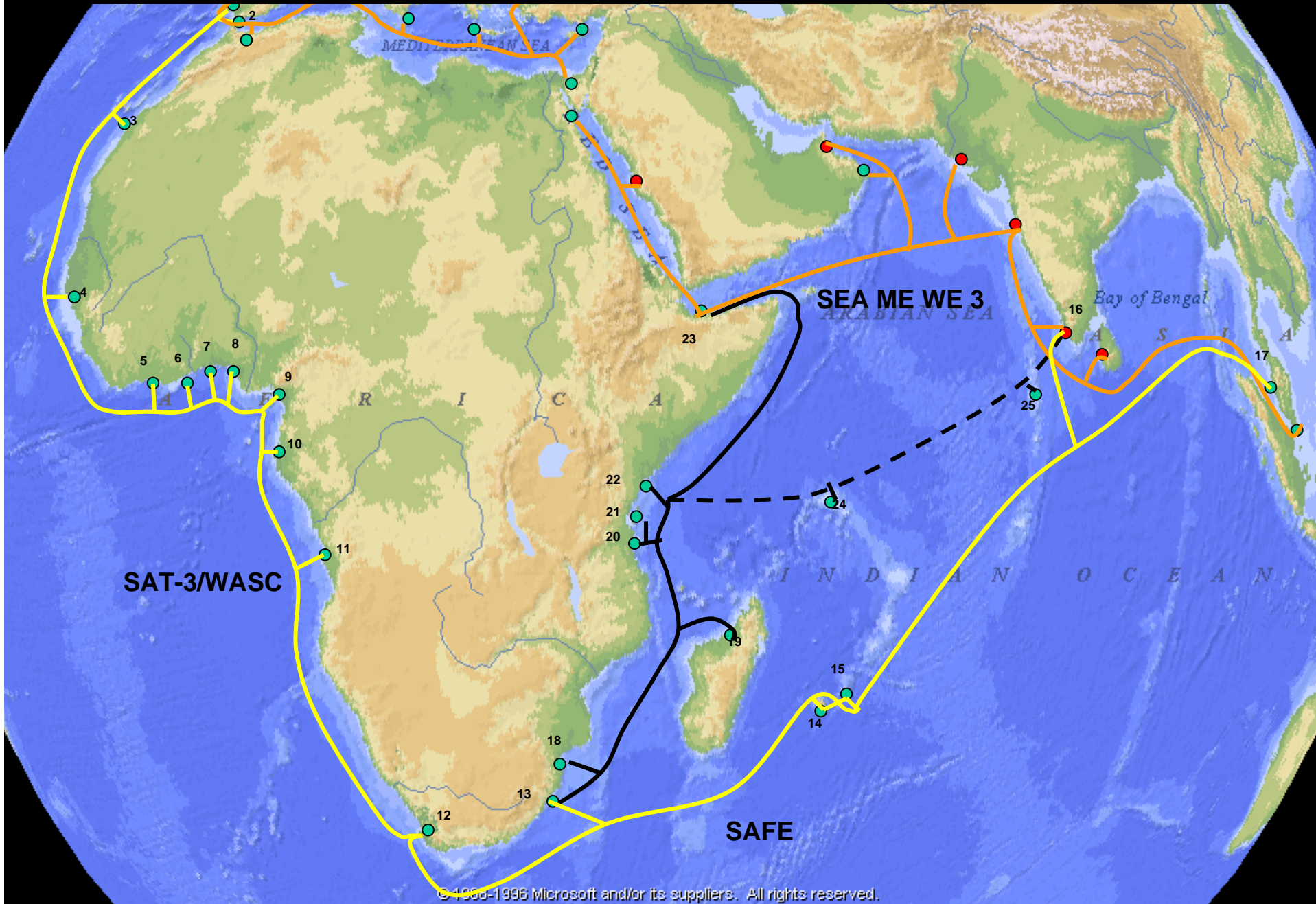
- EASSy, Seacom and Teams all have financing agreed - Continued support of Rwanda to all options offers significant strategic benefits in terms of redundancy, choice of services and competitive pricing.
- It is expected that construction will start first half of 2008 with completion 18 months to two years.

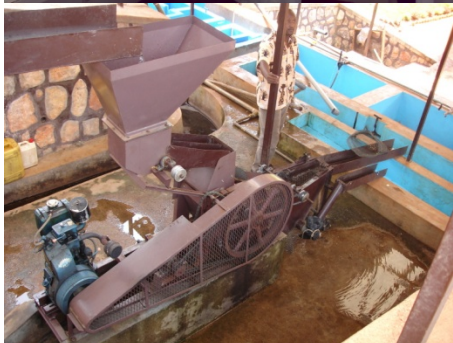


# Eastern Africa Submarine Cable System (EASSy)



# Global Connectivity





# Growth in Penetration of Voice and Data Services

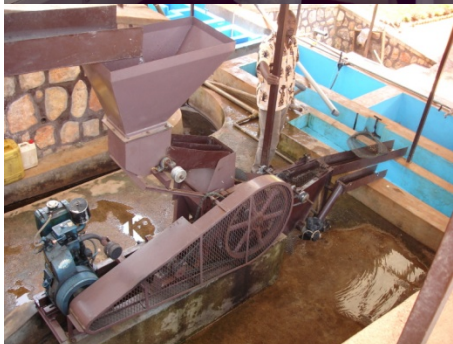
## Voice

- The penetration rate is now about 7% and by the end of the year 2008 this is expected to be within 12% to 15%.

## Data

- The current internet users are about 200, 000 and this is projected to be about 1,000, 000 by the end of the year. This increase is as a result of the adoption of broadband and the reduction in prices.

- The investment in Voice and data infrastructure is set to increase and voice penetration is targeted to be greater than 20% by end 2009, with a similar increase in data.



# KEY INVESTMENT MADE IN ICT 2008

## Telecom Operators

- **MTN – to invested about 32.2 M USD**
  - Split between network expansion and new services
- **Rwandatel – is investing about 87.6 M USD**
  - Including: GSM, GPRS, CDMA EVDO, NGN, WIMAX, ADSL and Fibre.

## Government of Rwanda

- **Is investing 40 M USD over 2 years**
  - Backbone broadband network infrastructure

## World Bank

- **Contract has been signed for 24 M USD grant –**
  - Part of Regional Communications Infrastructure Project (RCIP)



## Challenges

- **Scarcity of Human Resources** - to drive STI Implementation in different areas of scientific professions.
- **Weak base of Science Education and Training:**
  - Secondary school level: very few science teachers, no science laboratories, no science teaching /learning equipment/materials in most secondary schools
  - University level : lack of sufficient infrastructure, equipment, academic staff for training professionals in scientific fields. Private Universities opt for non-scientific faculties – less costly

## Challenges (cont'd)

- ***Insufficient Funding for:***
  - R & D at Research Institutions and Universities
  - Training a critical mass of specialised scientists (Masters, PhD, Post- Doctoral programmes)
- The ***Country Status Survey***, The ***Implementation Strategy*** and The ***Regulatory Framework*** for STI are yet to be carried out/finalised.
- ***Very low participation of women in scientific fields***  
***(students, researchers, academicians, technician, decision makers):*** at University; in Research Institutions; and in employment positions both in the public and in the private sectors.





# Opportunities

- Strong Political Will
- Strong commitment to Country's Vision 2020, MDGS and EDPRS – everyone's agenda
- Rwanda - a new country in the making, ready for Innovation and for learning from the experiences of other countries.





## The words of Rwanda's President, His Excellency Paul Kagame

(Speech to Royal Society UK September 2006)

***“The application of science and technology is fundamental, and indeed indispensable, to the social and economic transformation of our countries. Productive capacities in modern economies are not based merely on capital, land and labour. They are also dependent on scientific knowledge and sustained technological advances”***



(Address to: AU Summit Addis Ababa January 2007)

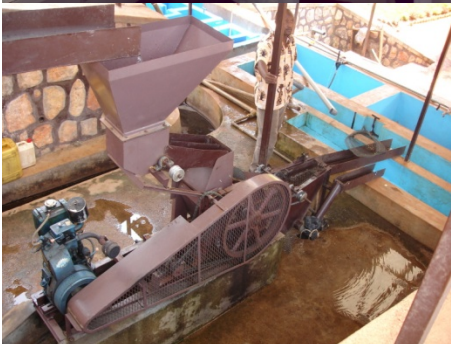
***“It is about applying science and technology holistically – in all levels of education and training .....in commercializing ideas, in developing business and quickening the pace of wealth-creation and employment-generation, in enabling government to provide better services.”***



(Speech at the International Research Conference on Biodiversity Conservation and Sustainable Natural Resource Management which was held in Kigali July 2008)

***“It is fitting that this important meeting is taking place in Rwanda not only because we wholeheartedly embrace sustainable development, but also because of the fact that our country lies in one of the world's internationally designated “Biological Hotspots”. This refers to ecological areas that are biologically rich but also highly endangered. Our geographical location in the heart of the Albertine Rift means that Rwanda is endowed with exceptional biodiversity, characterised by a wide range of indigenous animal and plant species.”***





THANK YOU