

Does Research ICT Matter @ KALRO?

A Presentation to researchers at KALRO Headquarters,

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What is Our Agenda

- The Status of Research Productivity and Collaboration of KE Research Institutions
 - Is the research productivity of KARLO visible to the world?
 - “Discovery and promotion” of KE researchers
- Toward an Kenyan/African Open Science Platform
 - What has changed? Why does it matter?
- KENET Research ICT Services
 - Facilitating Research Collaboration and Access to Global Grid Infrastructures
 - Federated Identity, Certification Authority, Open Access Research Data Repository, Research computing
- KENET as the Research & Education Network of Kenya
 - KENET Community
 - KENET History & Governance
 - KENET Mission and Values
 - KENET as a catalyst for transformation of research and education in KE
- Conclusions – How do you want KENET to support your research agenda?
- Research services survey

Disclaimer

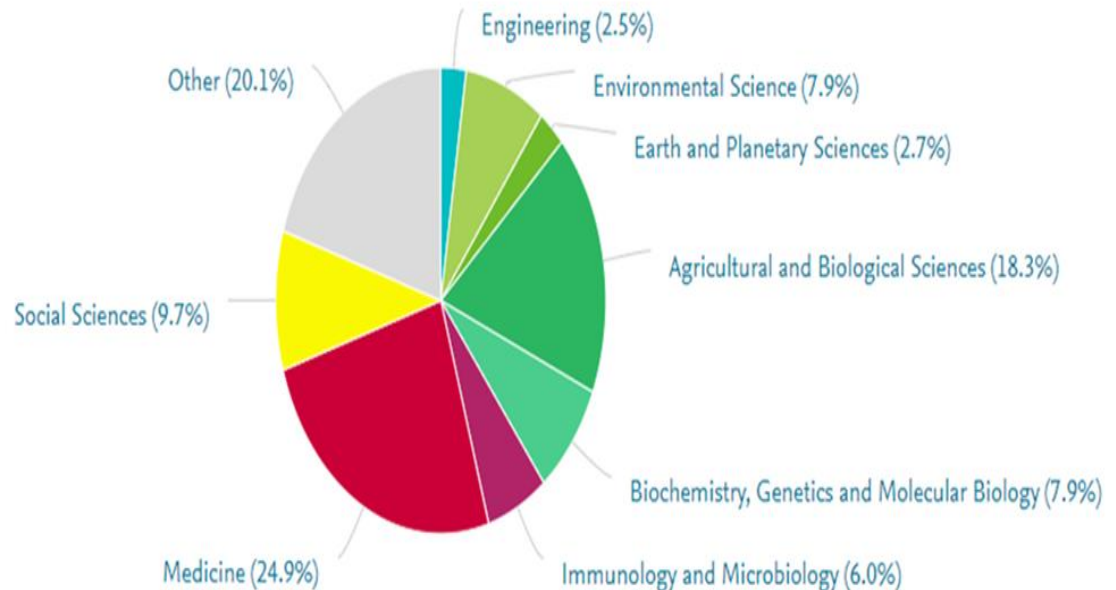
- **We do not know what advanced research ICT services** are available to you today as researchers or research institutions.
 - *We shall administer a researchers' survey today and a comprehensive e-readiness survey in next 12 months*
- **We do not know the Research ICT services or Big Data initiatives** that you are pursuing
 - *For example, the CGIAR Big Data platform*
- **We do not know why there is low uptake of advanced Research ICT services available through KENET by KE researchers** in all fields!
 - *Common Research ICT services are widely available to scientists in Europe and North America and South Africa*
- **We do not know what is required to increase the Research productivity** of KE universities and research institutes by 10x or even 100x
 - *is relatively low measured using research analytics tools like Elsevier.*
- **KENET's mandate is to "discover" researchers and promote research collaboration using common research ICT services**
 - *One of the outcomes would be increased research productivity and science-driven social-economic development*

Status of Research Productivity Collaboration and of Kenyan Research Institutions 2012 – 2017

Source: Elsevier SciVal research intelligence tool

Leading disciplines in Kenya 2012-2017

Medicine is the leading discipline in Kenya based on publication counts; and has a Field-weighted Citation Impact of 126% more than world average. The citation impact of Engineering is 13% below world average



Subject Area	Publications	Citations	Authors	FWCI
Medicine	6,137	77,398	6,532	2.26
Agricultural and Biological Sciences	4,524	31,601	4,996	1.27
Earth and Planetary Sciences	659	4,262	746	1.12
Engineering	613	2,008	832	0.87

Research Productivity of Kenya compared with selected Benchmark Countries – 2012-2017

source: Elsevier Scival, World Bank

Country	Research Productivity (2012 - 2017)	Population in Millions (2016)	GDP per capita (USD) (2016)
Brazil	411,120	207.70	8,649.95
South Africa	118,811	55.91	5,273.59
Egypt	97,762	95.69	3,514.49
Nigeria	37,831	186.00	2,177.99
Kenya	15,065	48.46	1,455.36
Tanzania	7,860	55.52	879.19
Ethiopia	11,682	102.40	706.76
Uganda	8,297	41.49	615.31

Top 10 Collaborating Countries With Kenya 2012-2017

(Source: Elsevier SciVal)

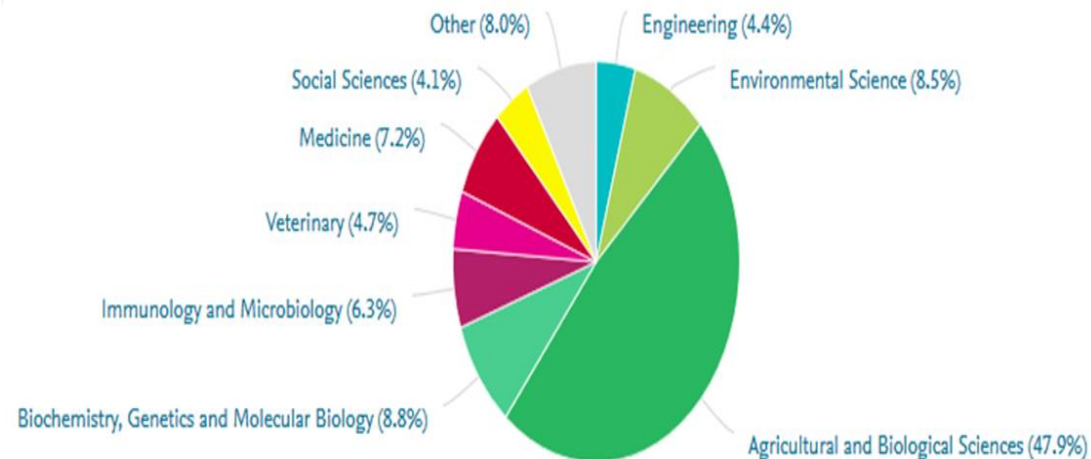
Country	Number of Publications	Number of Kenyan co-authors with collaborating country	Number of collaborating country co-authors with Kenya
United States	4,997	4,999	11,874
United Kingdom	2,925	2,942	4,787
South Africa	1,591	1,763	1,977
Germany	1,195	1,297	1,939
Netherlands	973	1,103	1,213
Canada	936	1,174	1,443
Uganda	865	1,200	1,059
Tanzania	757	1,285	1,000
Australia	753	845	1,325



KALRO Research productivity and collaboration

Summary of Scholarly Output and Publication areas of KALRO – 2012-2017

Metric	Score
Scholarly output	240
Authors	1302
Field Weighted Citation Impact	1.04
Citation Count	1900
Citations per Publication	8.1
h5-index (5 year h index)	21

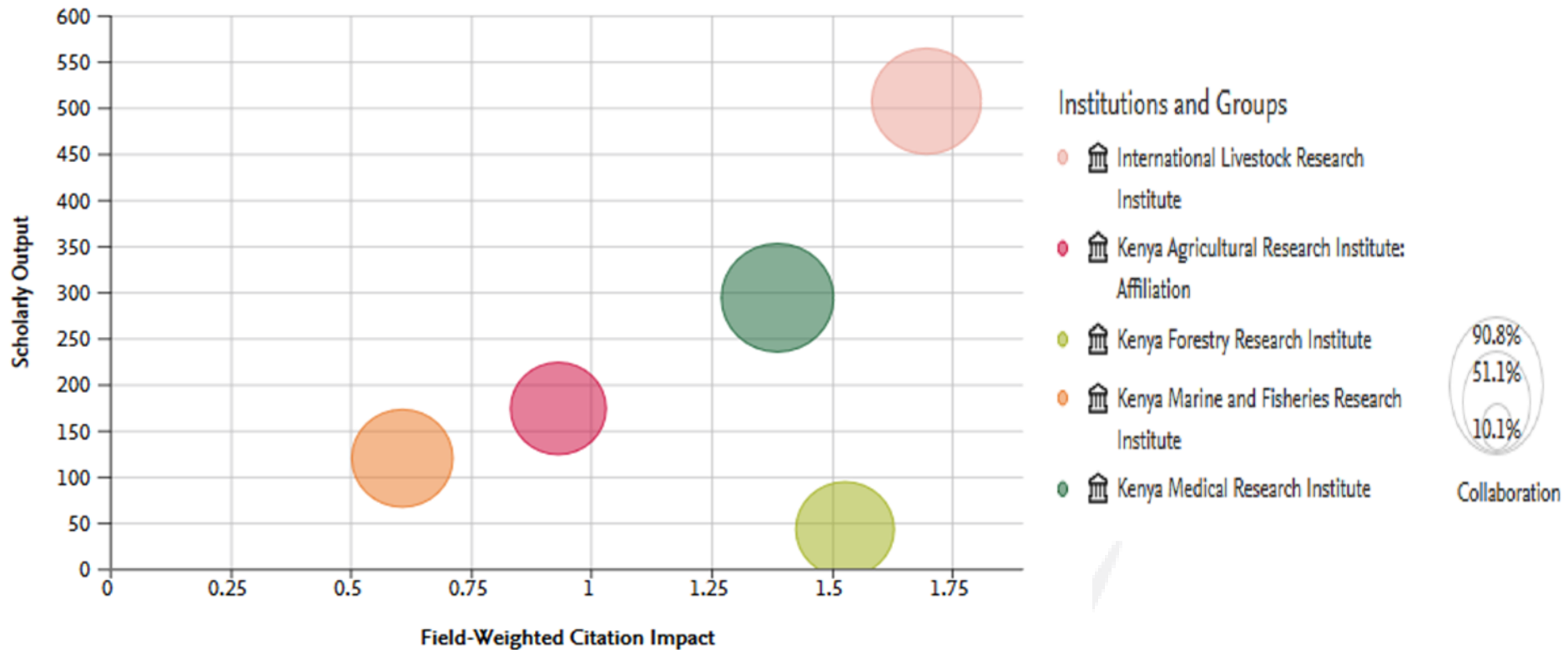


“Discovering” researchers

Top 10 authors @ KALRO 2012-2017

Name	Publications	Most recent publication	Citations	Citations per Publication	Field-Weighted Citation Impact	h-index
1. Muthoni, Jane	8	2015	17	2.1	0.28	4
2. Wanyera, Ruth	7	2015	128	18.3	1.92	12
3. Kabira, Jackson N.	6	2015	9	1.5	0.16	5
4. Gicheru, Patrick T.	5	2014	25	5	0.85	10
5. Kinyua, Zakary M.	5	2014	69	13.8	1.85	6
6. Kuria, S. G.	5	2014	6	1.2	0.2	4
7. Njau, Peter N.	5	2015	64	12.8	1.64	12
8. Amata, Ruth L.	4	2014	1	0.3	0	4
9. Esilaba, Anthony O.	4	2016	16	4	0.37	5
10. Gikaara, Daniel M.	4	2015	0	0	0	2

Benchmarking of KE research institutes



Benchmarking in terms of scholarly output for 5 KE research institutes (2012-2017)

Name	Scholarly Output	Field-Weighted Citation Impact	Collaboration (%)
International Livestock Research Institute	982	1.9	88.2
Kenya Agricultural Research Institute: Affiliation	234	1.05	70.5
Kenya Forestry Research Institute	50	1.52	74
Kenya Marine and Fisheries Research Institute	166	0.72	72.9
Kenya Medical Research Institute	2005	2	89.7

Does Research ICT for research productivity?

- Research / Science is now data intensive and collaborative
- Research collaboration requires what are called **e-infrastructures** (in Europe) or **Cyberinfrastructures** (North America)
 - Research institutes in South Africa, Europe, or North America have 10 Gb/s or 100 Gb/s higher connections to Global research & education networks
 - Researchers require high-speed data transfers and petabytes of storage (e.g., researchers in climate change areas)
 - Researchers require federated identity for collaboration and digital certificates (or passports)
 - High-performance computing necessary for data-intensive research
 - Learning algorithms or analysis of large data sets
- Basic High speed Internet and secure WiFi (e.g., eduroam).

Q & A on Research Productivity Reports ?

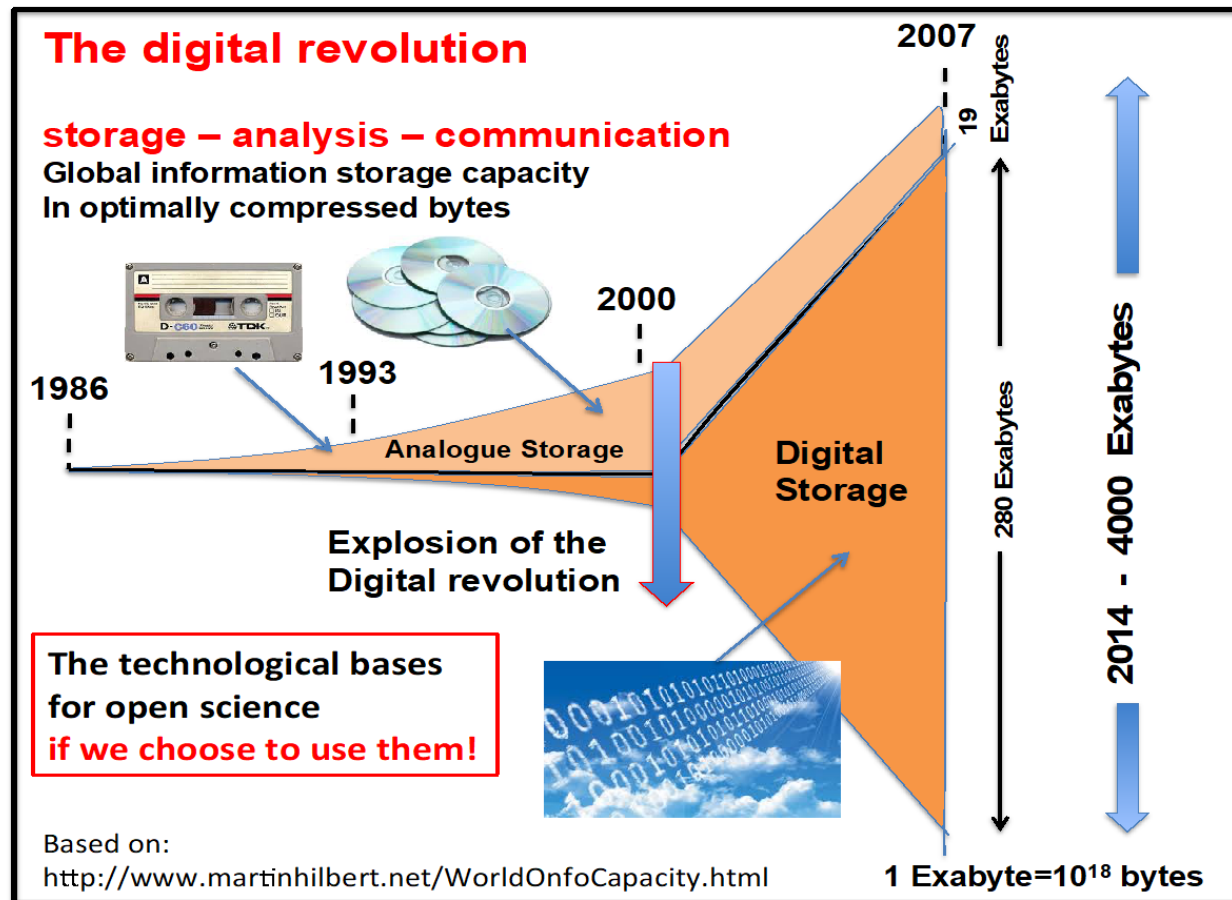
- Are you surprised?
- What will you do?

Transition to Open Science Platforms

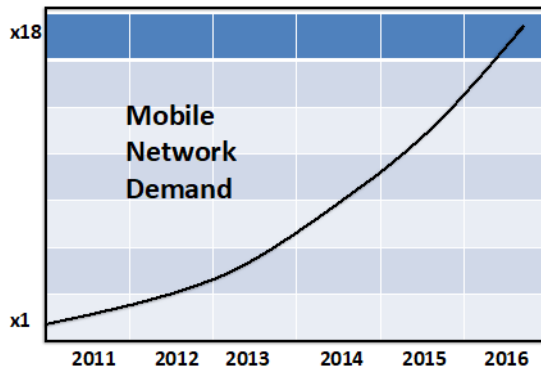
KENET is following the Horizon 2020 SciGaia Open Science Platform

<http://www.sci-gaia.eu/osp/>

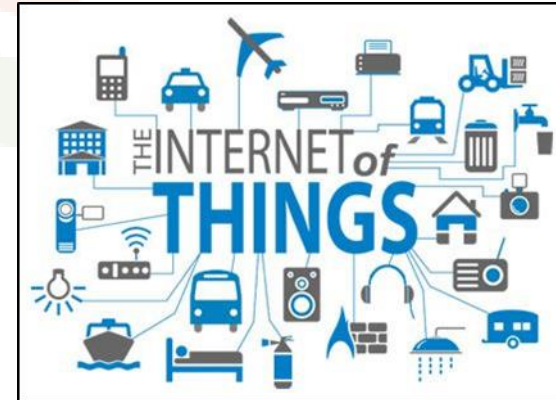
The Digital Explosion



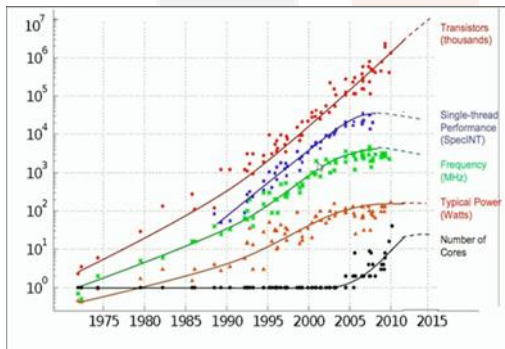
Drivers of Change (Adopted from Big Data International Accord)



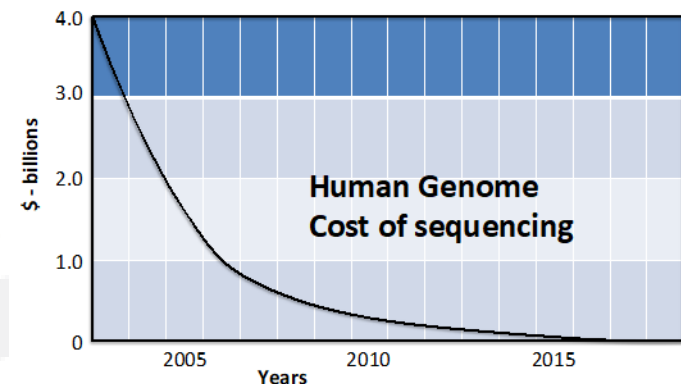
Increased connectivity



Increasingly diverse data Sources –
sensor networks for
monitoring environment / pollution?



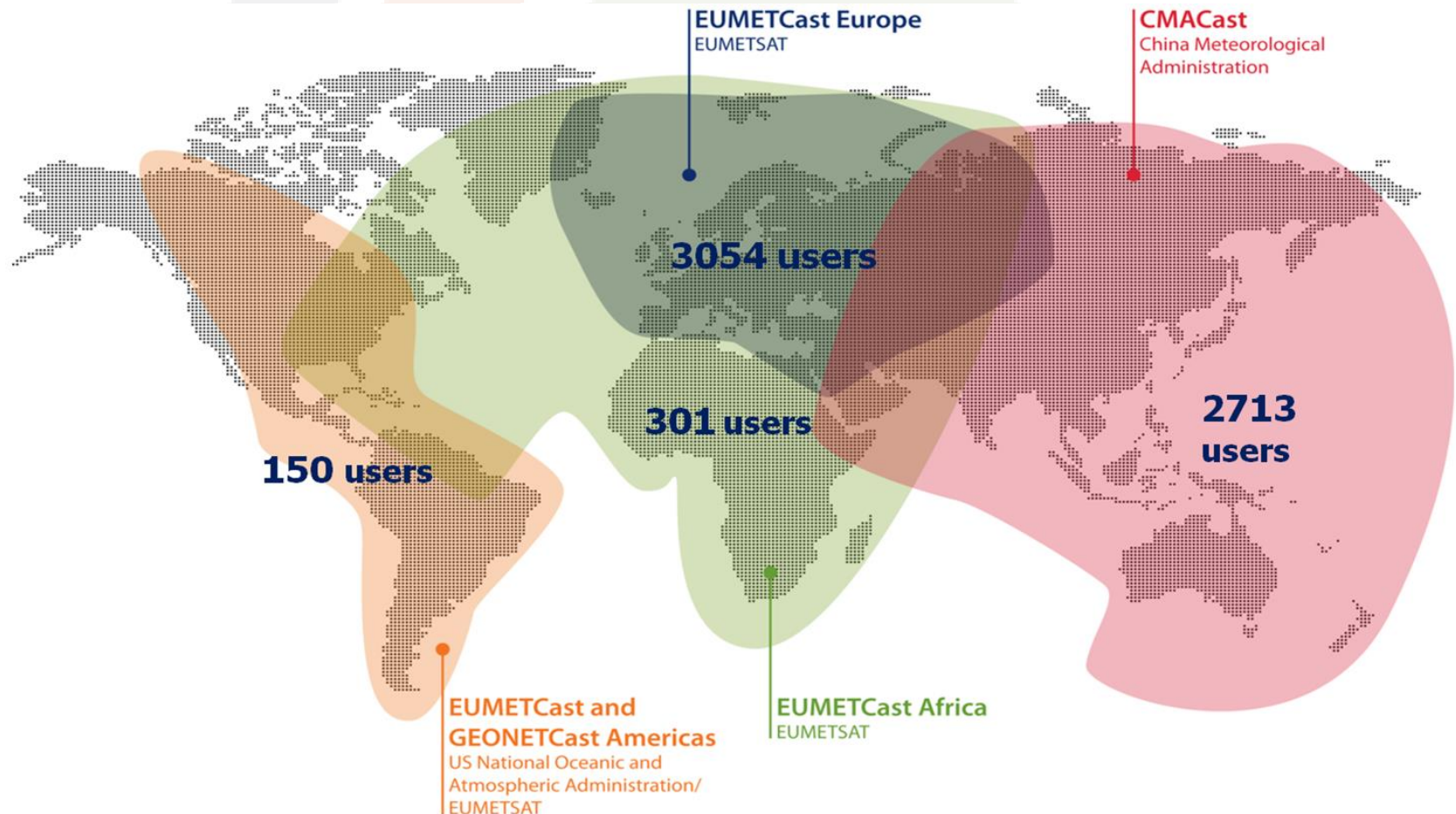
Increase in Computing power
Moore's Law
(Number of transistors double every 2 yrs)



Cost reduction

Other sources of Big Data for Science

Satellite weather forecasting data – Kenya National Meteorological Center subscribes to EUMETSAT services



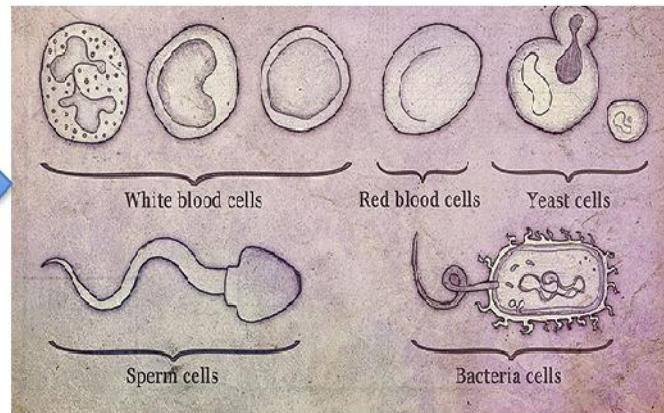
Q: So what does all this data offer to science?

A: Not causality, but the capacity to identify patterns in multi/hyper-dimensional data

Q: Is that all?

A: Recognition of new patterns leads to new questions and new answers – its what Darwin, Newton and Marx did

Remember Anthonie van Leeuwenhoek (1632-1723)



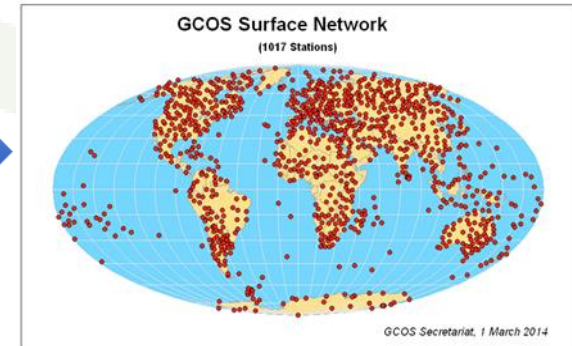
Leeuwenhoek saw a microscopic world that had not been seen before. We now have a “Digital Microscope”.

An example: data-modeling: iterative integration

Satellite observation



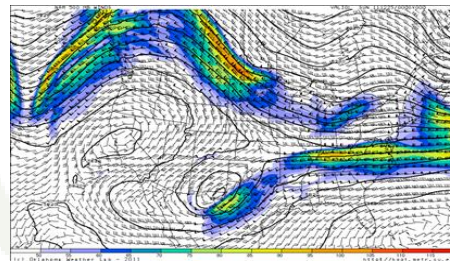
Surface monitoring



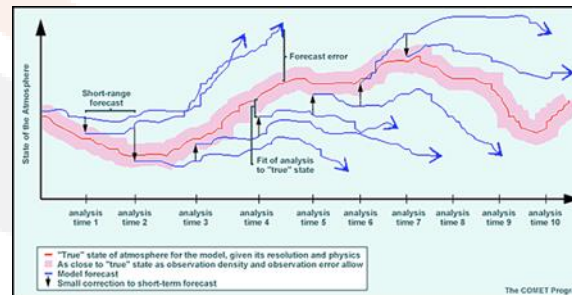
Initial conditions



Model forecast



Model-data iteration - forecast correction using learning algorithms



Artificial intelligence & learning machines

Learn from experience



Learn from experience



Follow instructions



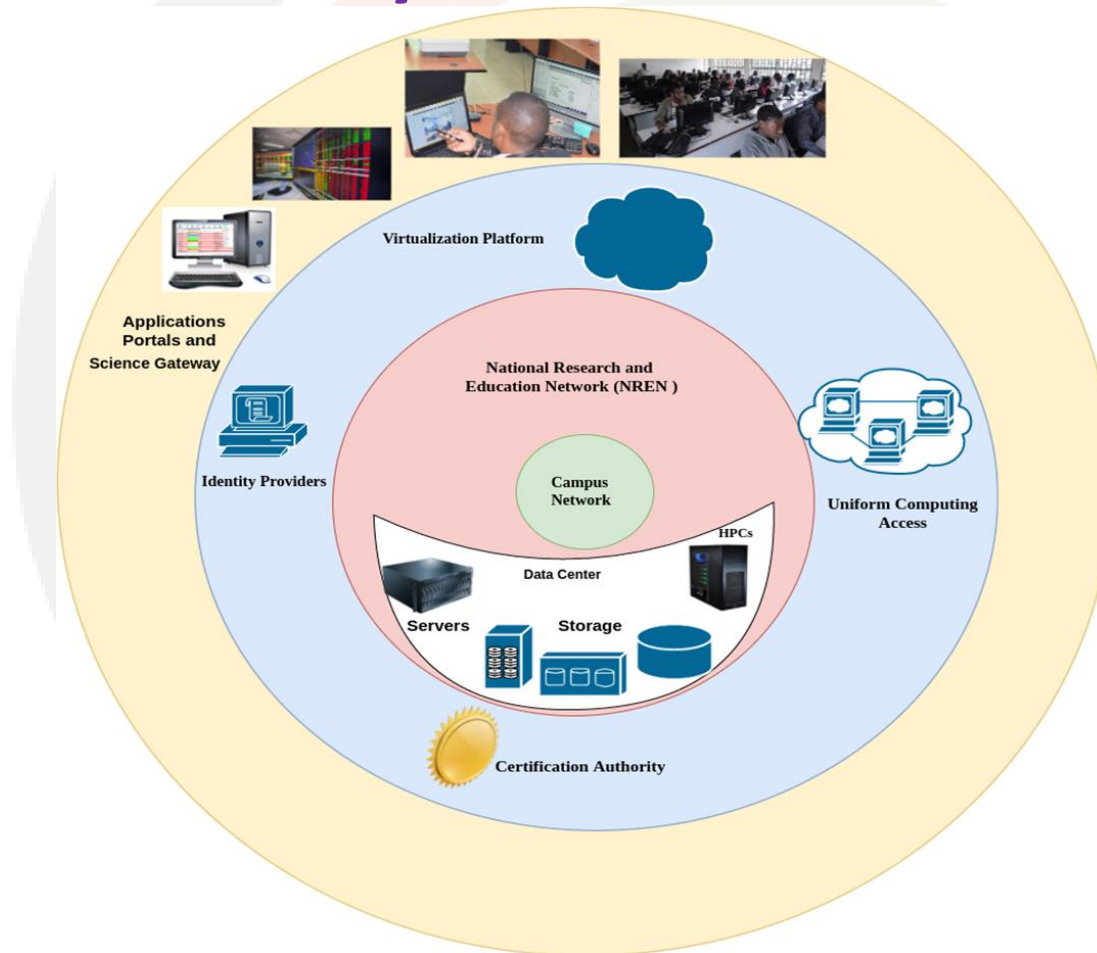
Q & A on Open Science Platforms (10 minutes)

- How is big data affecting your research? Do you have all the tools?
- <http://bigdata.cgiar.org/about/> - the Platform for Big Data in Agriculture;
- What is the equivalent platform that would support Agricultural Research Collaboration in Kenya?

KENET builds shared e-infrastructures for KE researchers

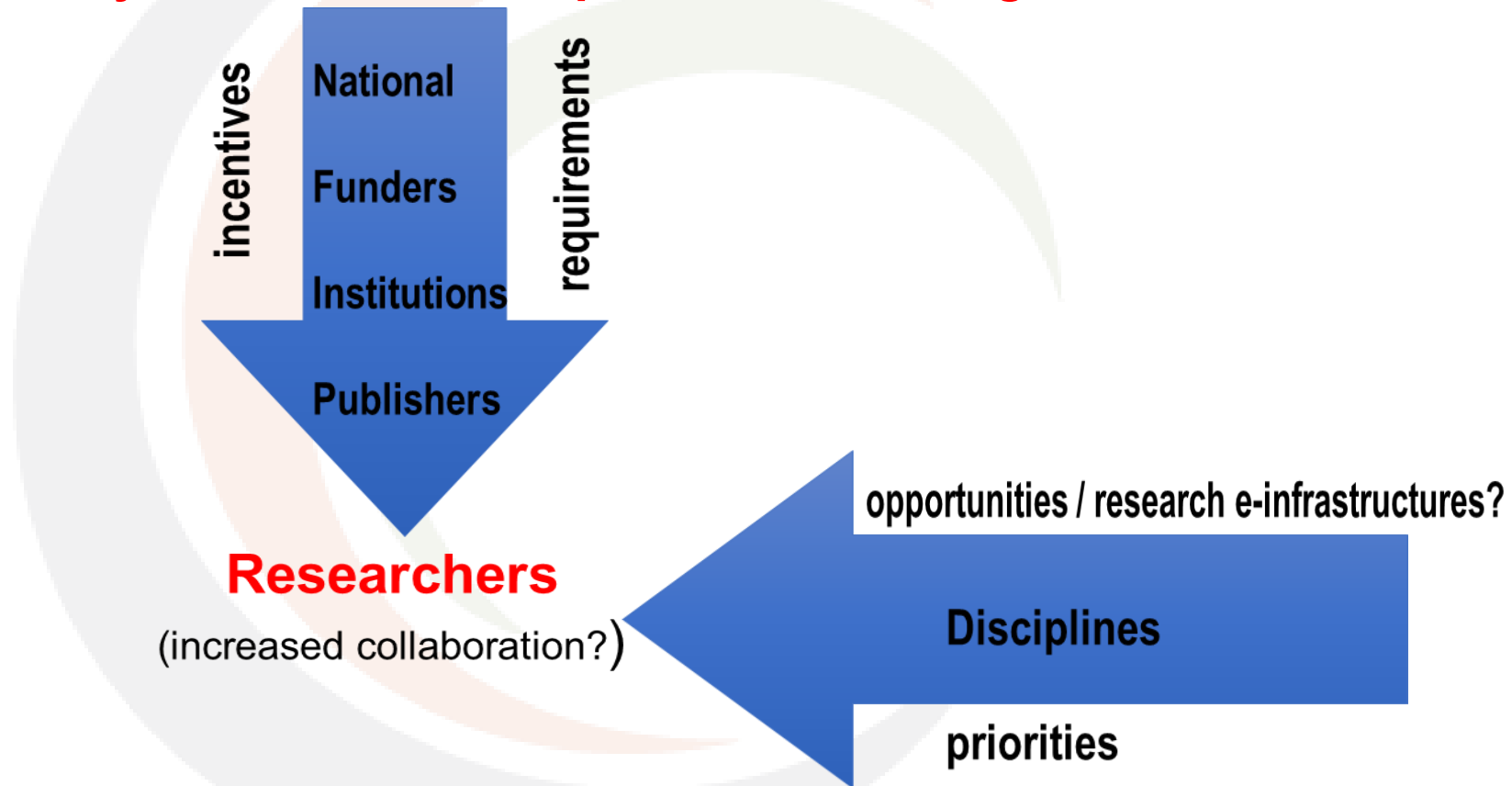
- Building and maintaining a high-speed national research & education network with connection to European research networks (e.g., GEANT)
 - Eduroam – secure WiFi for researchers
 - Initial World Bank / GoK funding for the network
 - Most member research institutes have last mile fiber at 1 Gb/s or above – e.g., KEMRI, Ampath, KALRO
- Critical elements:
 - Identity Provider for KE researchers (necessary for access to research resources worldwide)
 - Digital certification authority (accredited by EUGRIDPMA in January 2016)
 - High-end ICT talent to develop and manage the advanced e-infrastructures
- Research computing with Applications for Data Analysis using R
- Access to High-Performance Computing facilities in South Africa and European Grid Infrastructure (EGI)
- Open Research Data Repository – federated

Components of KE E-Infrastructures or Cyberinfrastructures



Why is utilization of research infrastructures low in Kenya?

Are you aware what is possible in through KENET?



Do you think emerging Kenyan Research Platform / e-infrastructures shall increase KE research productivity?

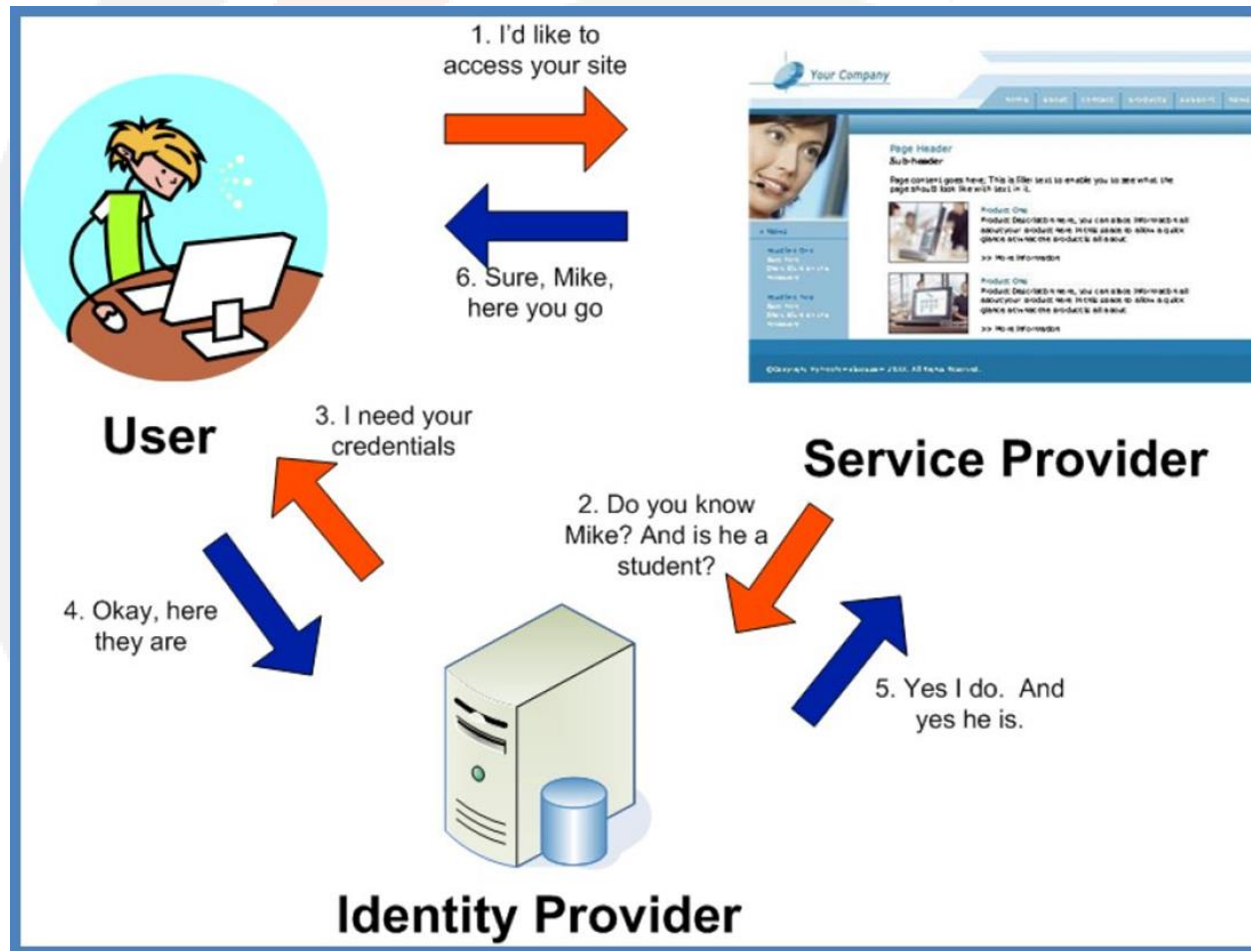


KENET Research Services & Infrastructures

What research ICT services do you need?

- **Basic services** – reliable broadband Internet + secure WiFi + email
 - Eduroam is a secure WiFi that allows you to roam all over the research world!
 - KENET provides reliable Internet services to institutions all over the country – no researcher is isolated!
- **Community cloud services** (requires community data centers)
 - Reliable leased servers and storage – no need to buy hardware when you are in remote areas
 - Research computing and applications – e.g., R for statistical analysis
 - Short-term and long-term research data storage (for 1 TB and above storage needs)
 - Web-conferencing / video conferencing applications – e.g., Vidyo
- **Digital Certificates and Identity Provider** for access to Global research infrastructures and services (e.g., Grid Infrastructures)
- **Grantee for collaborative research projects with ICT components** or research data repositories e.g., NRF, Newton Fund, USAID, etc.

KENET Identity Provider IDP – Part of GRIDP through Sci-GaiA project



KENET Digital Certificates allow researchers to Access global research resources

- Made possible by
 - Digital certificates – an electronic passport
 - Provides Federated login ID to research resources e.g. EduGAIN resources
 - Example is [ELIXIR](#) (European life-sciences Infrastructure for biological Information)
 - Supports research collaboration
- Example resources
 - ORCID - Open Researcher and Contributor ID (persistent digital identifier)
 - *Widely used in Europe for tracking the research productivity of researchers*
 - EGI – European Grid Infrastructures (*cloud compute & storage for virtual research communities*)

How does KENET support researchers / institutions?

- **“Discovers researchers” and facilitates Special Interest Groups and forums**
 - SIG on engineering education and research – 2014
 - SIG on Computational Modelling and Materials Science - 2016
 - SIG on computer science and information systems - 2018
 - SIG on Medicine and Public Health Education and Research – 2018
 - *SIG on Agriculture (includes Livestock) – 2018??*
- **Registration of researchers in need of access to global e-infrastructures**
 - High Performance Computing facilities
 - Cloud storage
 - Eduroam secure roaming WiFi for global research and education community
- **Offers Travel grants for researchers and graduate students**
- **Aims to employ a PhD-level part-time Research Associate for each SIG area**
 - Research associate must be full-time faculty/researcher of a member institutions with a PhD



KENET as NREN of Kenya

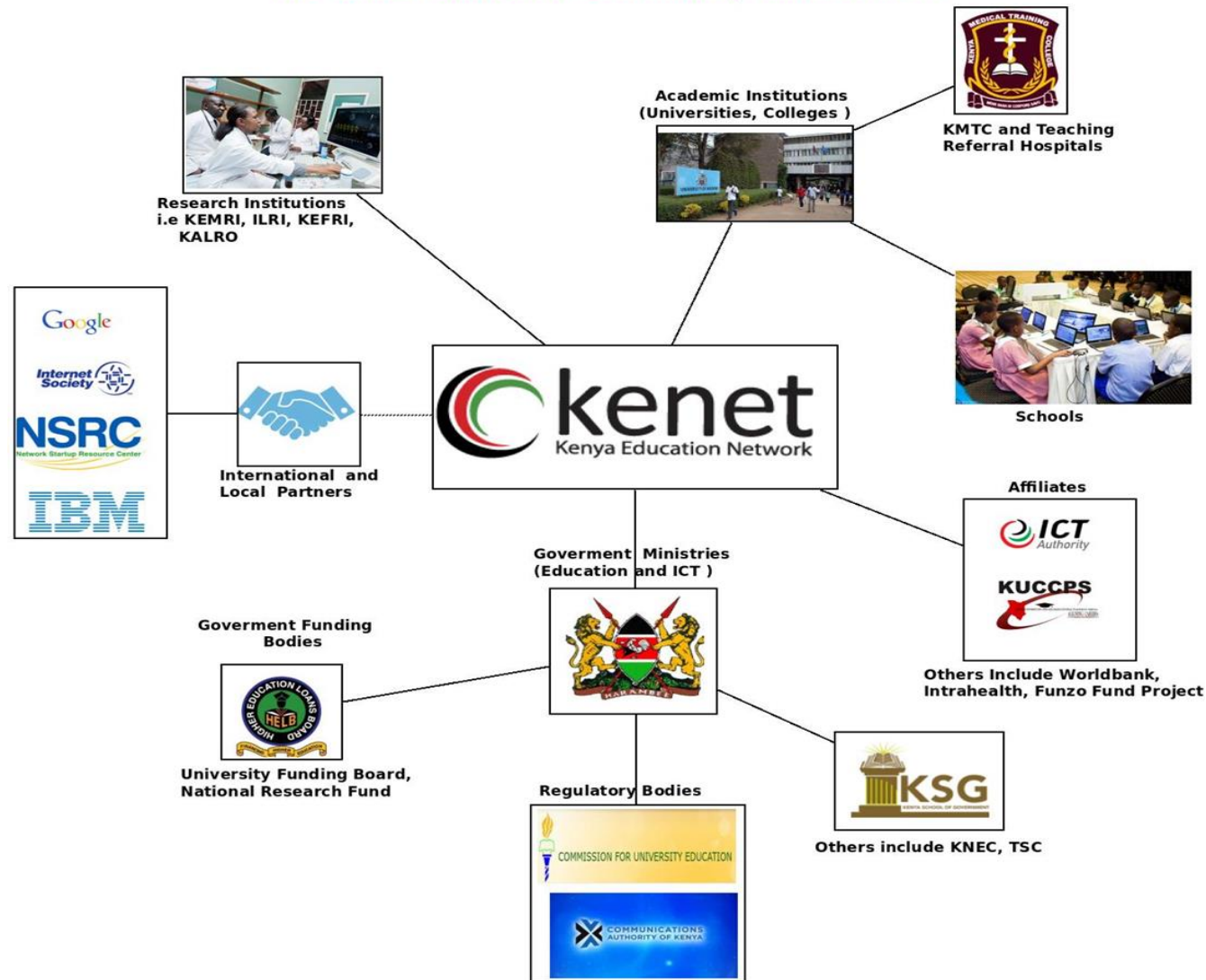
KENET Trust Objects (2000)

1. provide **sustainable and high-speed** Internet connectivity to educational and research institutions;
2. facilitate **electronic communication** among beneficiaries in educational institutions;
3. support **sharing** of teaching and learning resources among educational institutions;
4. support **teaching and learning** over the Internet for beneficiaries in educational institutions both in Kenya and outside;
5. **collaborate** in developing locally relevant learning materials in educational institutions; and
6. **collaborate in research** in educational and research institutions.

KENET Governance

- KENET is constituted as a **not-for-profit** TRUST with 11 Registered Trustees
 - Seven Vice Chancellors + Director KMFRI; PS, TVETs ; DG CA; CEO Private sector (see <https://www.kenet.or.ke/node/10> for biographies.
 - Governed by Board of Trustees, Assisted by Management Board
 - Member institutions and academic community are the beneficiaries
- KENET is a membership organization and only serves members
 - *All KENET services are therefore VAT exempt because not considered a business*
- KENET licensed as a Alternative Network Facilities Network Operator by Communications Authority of Kenya since 2002
 - It builds and maintains the physical national broadband network
- KENET is an implementation agent of the Government of Kenya and other donors (KTCIP, Google, Foundations etc)
 - Partnerships for research and infrastructure expansion
- KENET is **endorsed** as the National Research and Education Network for Kenya by Ministry of Education
 - *Largest African NREN in Africa after TENET in South Africa (Internet bandwidth subscriptions now 18 Gb/s)*
 - Exchanges traffic with other NRENs in the world at NO cost
 - Connects KE universities and research institutions to Global Research & Education Networks

The KENET Academic Community And Partners

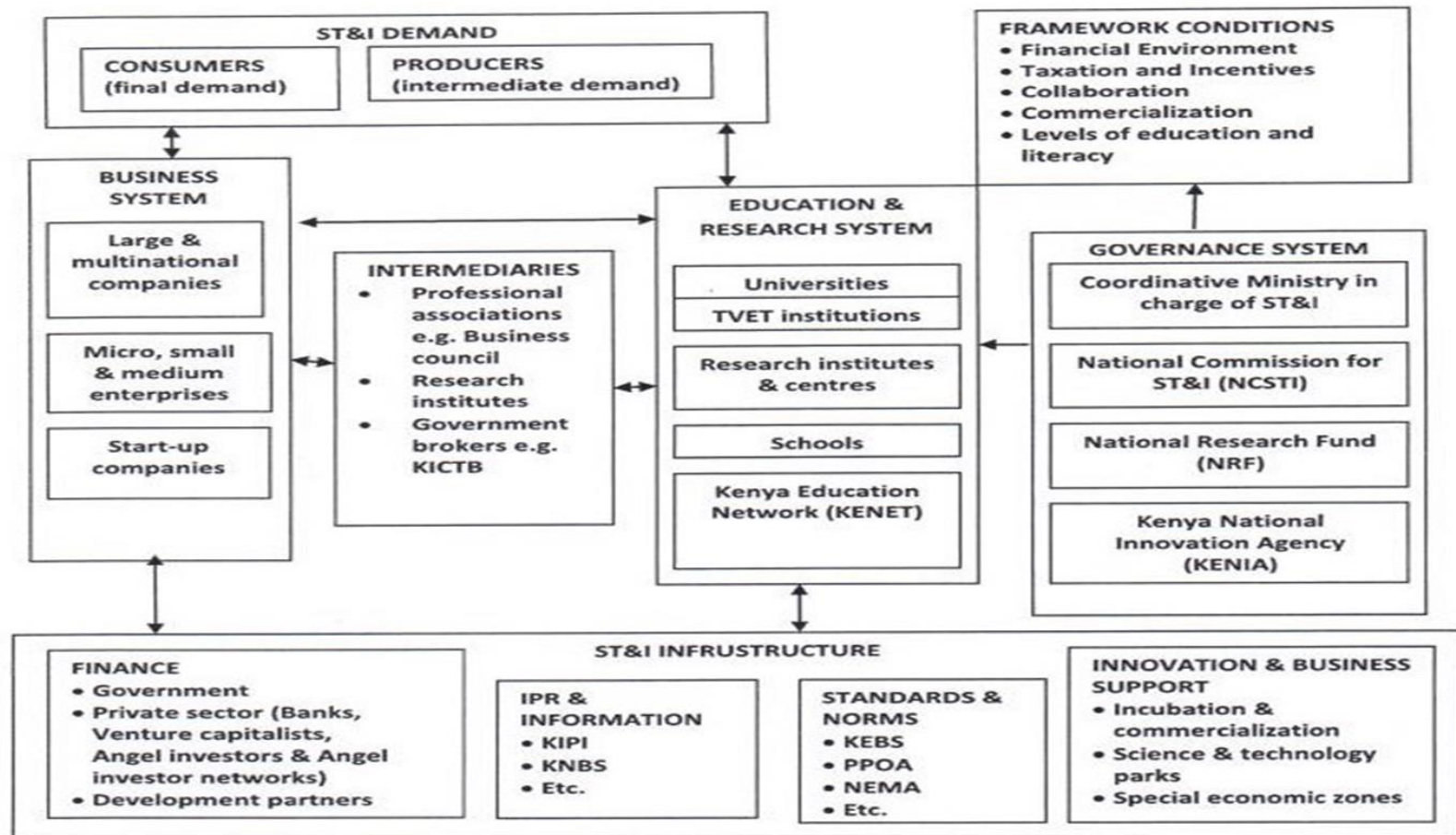


Size of KENET Community – over 740,000 users

Member category	Number of members	Size of Beneficiary community (i.e., students, faculty, researchers, staff)
Universities / University college	67	651,362
Research Institutions	16	3,319
Tertiary colleges (TVETs, medical colleges, TTCs etc)	20	83,095
Government Institutions/ Affiliate members	19	4,877
Total	122	742,653

KENET recognized as part of National Innovation System of Kenya

Source: STI Policy and Strategy 2014

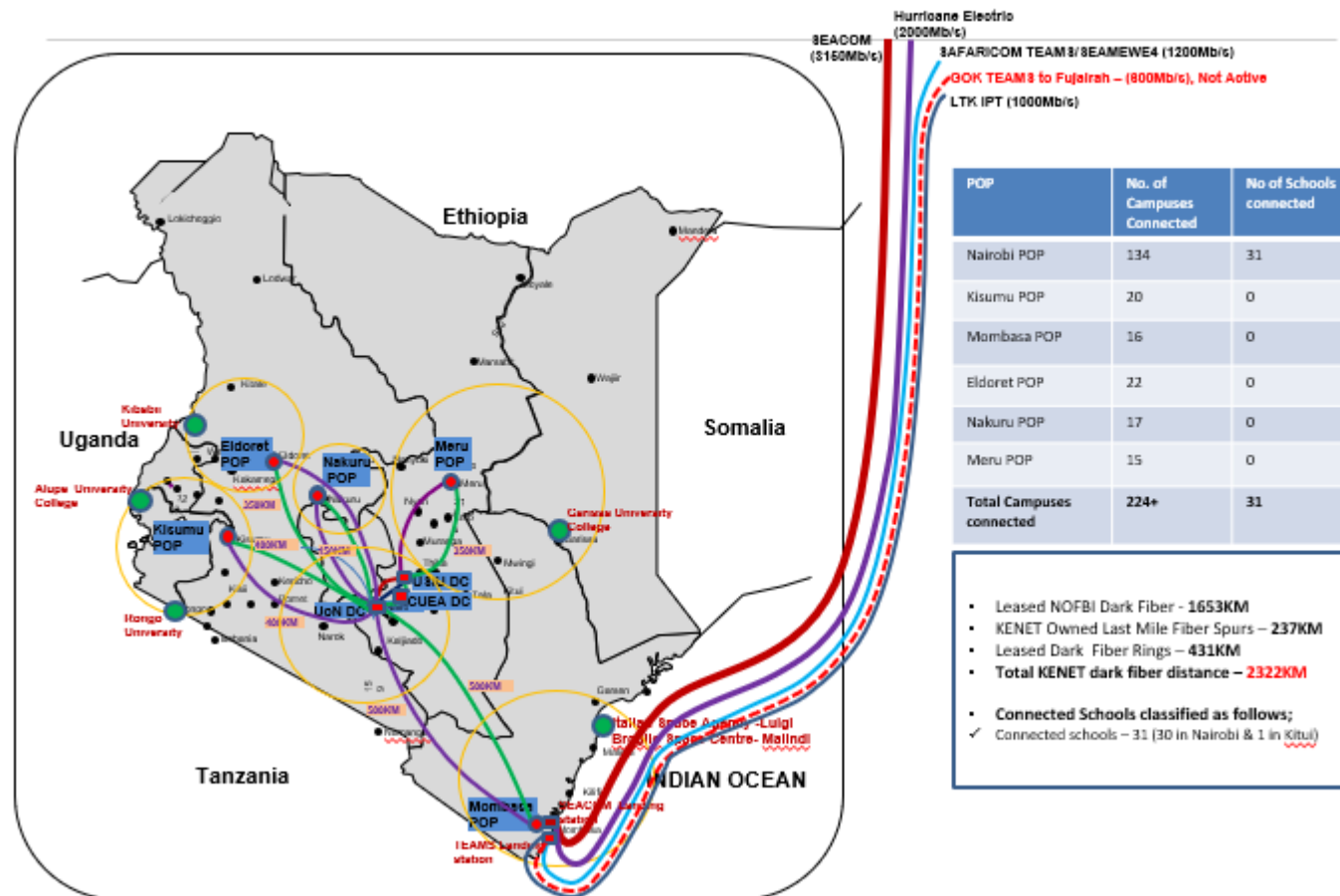


KENET as the NREN of KE

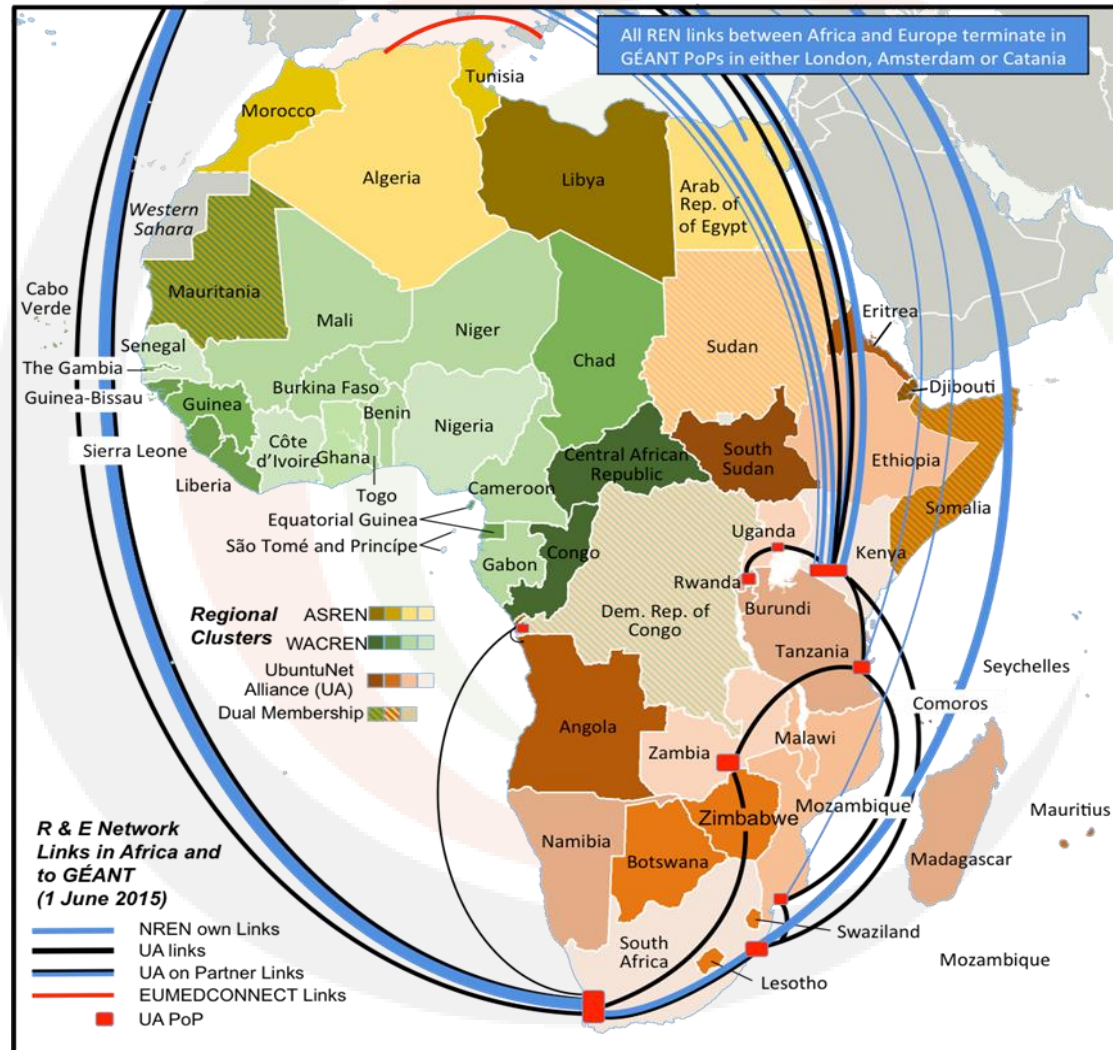
- **Mission - Catalyst** for transformation of education and research using ICT
 - Discovers and supports research and innovation champions
 - Facilitates and funds the activities of Special Interest Groups in STEM areas
- **Collects Annual Core Data of Connected Member Institutions**
 - *Data-driven advocacy*
- **“Monitors and generates”** research productivity reports (includes collaboration, benchmarking) for Kenyan universities and research institutes – (*Source: Elsevier SciVal tool*)

KENET National Broadband Network Coverage and part of Global Research & Education Networks

KENET National Broadband Network Coverage



Africa NRENs – source: World Bank report 2016



Conclusions

- KENET builds and operates national research e-infrastructures on top of its national broadband network
 - **Foundation is a broadband national network and data centers**
 - **KENET is the Trusted Identity Provider for the research community in KE**
 - **It issues digital certificates that are "digital passports" for access to research resources outside KE**
- Setting up the research e-infrastructures or cyberinfrastructures is slow and requires very specialized skills
 - **KENET has taken 5 years to develop the capacity and build necessary critical research infrastructures**
 - **Requires critical mass of high-end ICT talent (network engineers, computer scientists, and data science professionals)**
 - Resources are shared and increasingly community cloud-based (i.e., outside research institute data center / server room)
- **KENET is also a human network, an academic community**
 - **Special Interest Groups building expected to spur collaboration**
 - **Has a budget for organizing capacity building forums for faculty and researchers**
- **KENET is not the only catalyst for research in KE – research funding is also crucial**
 - **Kenya now has its own National Research Fund (2% of GDP by law)**
- **Is it possible for KE researchers to achieve 10x or 100x increase in research productivity with improved Research ICT Services?**

Q & A and Researchers' Survey 2018

- Please take some 10 minutes to complete the researchers' survey questionnaire

*Transforming education
using **ICT***

Thank You

www.kenet.or.ke

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