

*The Effect of ICT, Research and Education Network in Improving the Quality of Research and Higher Education*

**Rising John Osazuwa**

**Management Information System Unit  
University of Ibadan  
Nigeria**

**234 8034721419, 234 8050441304**

**risingosazuwa@gmail.com, risingosazuwa@yahoo.com  
rising.osazuwa@ui.edu.ng**

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**INTRODUCTION**

This paper examines the critical role of ICT and Research and Education Network (REN), as well as National Research and Education Network (NREN) on the quality of research and Higher Education.

Advances in information technology have accelerated knowledge generation and globalized communication, thereby threatening the relevance of education system that cannot keep pace. (Saint 1995:3)

The basic objectives of creating an African Higher Education and Research Space (AHERS) would be to strengthen the capacity of African higher education institutions through collaboration in teaching and research, to improve the quality of higher education and to promote academic mobility across the continent through the recognition of academic qualifications.

Development of research is vital for Africa and research cannot be divorced from higher education - one needs to reinforce the other.

Regional university associations especially the Southern African Regional Universities Association, the Inter-University Council for East Africa and the Conseil Africain et Malgache pour l'Enseignement Supérieur (CAMES) - are playing an increasingly important role in efforts to harmonise African higher education and to promote university collaboration and quality assurance, among other things.

The foundation of the present global information economy age is heavily dependent on the strength and dynamics of qualitative, timely and appropriate research. Research and educational institutions need to maximize scarce resources for optimum results in a highly competitive global economy.

The availability of research infrastructure is a prerequisite for the evolution of a knowledge economy, which is required for sustained development (NUC-STEP-B)

NRENs and information and communication technologies have become essential for the advancement of research, science and education to maintain competitiveness. (UbuntuNet, 2010) ICT is essential for supporting the development and sharing of online information and e-resources, supporting collaborative research among Nigerian Universities, Research and Higher Educational Institutions (in addition to collaborative research with others), running joint online courses and sharing expertise, sharing of experiences and best practices. (AVCNU)

Effective information system management, Science and Technology, and Information and Communication Technology are key vectors for bridging the scientific and digital divides, for reducing poverty, ensuring a socio-economic development and for reaching the MDGs. (EuroAfrica-ICT, 2010). A strengthened and enhanced cooperation on ICT research within institutions, nations and continents is required for international, cutting edge research to solve the challenges facing organizations.

Competitiveness of Research and Educational Institutions are strengthened through strategies which emphasize economic diversification, development of new competences, and the exploitation of available economies of scale. (Sylvester, 2010)

Research and Education Network (REN) is an association of institutions that is focused on conducting research and educational instructions, with the aim of institutional collaboration for the purpose of maximizing scarce resources, proffering solutions and improving infrastructure for the realization of their organization objectives. It may be geographically related or otherwise. An Example of a non-contiguous geographic REN is the Partnership for Higher Education in Africa (PHEA).

A National Research and Education Network (NREN) is a specialised internet service provider dedicated to supporting the needs of the research and education communities within a country. It is usually distinguished by support for a high-speed backbone network, often offering dedicated channels for individual research projects. (Wikipedia)

The ultimate goal of a National Research and Education Network is establishing a robust academic research and education network that facilitates the sharing of content among its members. This implies the need for establishing a strong driving link between the university research and teaching strategies and the NREN strategy, building the capacities of members in optimizing network resources for sharing learning resources. (UbuntuNet, 2010)

## **ANALYSIS OF THE EFFECT OF ICT AND REN ON THE QUALITY OF RESEARCH AND HIGHER EDUCATION**

The medical school in Dakar, Senegal is collaborating with medical experts in Toulouse, Strasbourg and ULB Bruxelles to strengthen the quality of teaching, learning research by using Distance Learning And Telementoring in Surgery programmes to upgrade critical surgery skills. (Toure)

The University of Ibadan has been able to reduce the withdrawal rate of undergraduate students from 14% to 2.6% as a result of introducing ICT based admission process and Post-UME test. The Distance Learning Institute have increased enrolment of students from 1,000 in 2005 to 17,000 in 2011, through the deployment of ICT-driven open distance learning (ODL) mode of delivery at significantly reduced cost when compared to the traditional classroom model.

The University of South Africa (UNISA) operates an ODL mode of delivery and has students' enrolment of close to 250,000. This is more than ten times the enrolment at the University of Ibadan. UNISA operates with physical assets that are less than 20% of the assets being deployed at the University of Ibadan.

SANReN ('South African National Research Network) is a new National Research and Education Network in South Africa. However, unlike most other NRENs, SANReN provides its clients with both connectivity to the world's research networks as well as commodity Internet access. (wikipedia) The first nine universities in the January 2011 webometric ranking of Africa Universities are based in South Africa. It justifies the heavy investment of the South Africa government and institutions on ICT and e-infrastructure.

TENET (Tertiary Education and Research Network of South Africa) is actively engaged in the construction of Access Networks connected to the SANReN network. provides Internet and information technology services, involving, inter-alia high-speed Internet access, inter-campus connectivity, ancillary operational functions in support of service delivery, and the provision of other value-added services as may be needed from time to time in support of higher education and research in South Africa.

National LambdaRail (NLR) the innovation network for research and education operates her 12,000 mile, nationwide, advanced optical network infrastructure supports many of the world's most demanding scientific and network research projects.

With no restrictions on usage or bandwidth, NLR is the platform of choice enabling cutting-edge exploration and discovery in the biomedical, engineering, network research, physics and many other disciplines at over 280 leading research institutions and federal agencies. And NLR offers users the choice of Ethernet-, IP- or Lambda-based connectivity and transport services, as well as highly customized technical support.

With virtually unlimited capacity, speeds of up to 40 Gbps, an existing footprint throughout the U.S. and new links to international organizations, NLR opens up unprecedented opportunities for collaboration, innovation and commercialization among the global research community and between private and public partners.

GARNET, The Ghanaian Academic and Research is assisting to fulfill a very crucial need for research and education within Ghana by providing services aimed at fostering collaboration among research and educational institutions in the region as well as between them and peer institutions worldwide. (Dakubu, 2010)

The Belgian Research and Education Network (BELNET) supplies Internet access with very high bandwidth to Belgian educational institutions, research centres and government services. More than 550,000 end users utilize bandwidths up to 2.5 gigabits per second. The organization offers Plus services such as an e collaboration platform for research, communication, teaching and learning.

Research and Education Network for Uganda (RENU) was formed in January 2006 and achieved formal legal registration in November 2007. (Ndiwalana, 2010) She has been instrumental for the provision of dedicated high- speed physical network, cost effective internet access, network services and applications. In addition, RENU have been supporting teaching and learning, as well supporting advanced research. She has helped to develop ICT capacity within members and nurture local content networks.

There has been some increase in the quality of research and academic collaboration among Ugandan Universities as a result of the infrastructure support by RENU. She has provided dedicated high speed physical network. She undertakes and supports advanced research, collaborative research and consultancy - accession survey with KENET and CORENA M&E strategy for UbuntuNet Alliance.

Capacity building workshops were organised; ICT Policy and management for ICT Directors and technicians (2007), and Bandwidth Management and Optimisation, for ICT personnels and Librarians (2008). Thus, contributing to the growth and development of libraries and ICT services for research, teaching and learning.

The Research and Education Network Unit (RENU) of the Association of African Universities made significant contribution for the formation of West and Central African Research and Education Network (WACREN). WACREN is charged with the responsibility of providing necessary assistance for the formation and sustenance of NRENs in the region. Currently only 30 percent of West African countries have national Internet Exchange Points, a low percentage compared to East and Southern Africa. (Mwangi) The late inauguration of West and Central Africa regional REN is one of the major reasons for the low rate of national Internet Exchange point in the region.

On the African continent today, West and Central African countries are the most deprived in terms of not having adequate access to resources for research and education from the Global Research and Education Network.

The Universities in the various countries have not been able to mobilize themselves into formidable NRENs. (Dakubu, 2010) WACREN supports the development of properly structured campus networks as NREN basic building blocks. Provide models and templates for NREN's in capacity building, organizational structure, financing access to bandwidth, business analysis and strategic plans. (Oaiya, 2010)

WACREN provides logistic support for the establishing new NRENs and consolidation of existing NRENs;

The Nigeria NgREN is in the development stage. The model adopted is the formation of clusters or sub-national RENs. The sub-national RENs are at various stages in several places. An example is the Eko-Connect. Some are growing clusters in the ICT Forum's way, using local NOG to build capacity and communities. (Ibrahim, 2010) The National Universities Commission (NUC) has begun moves to establish a National Research Educational Network (REN). The World Bank would finance the project. It is desirable that the funding agency would allow local consultants to use the peculiarity of local situation in the process of the development of the NgREN.

The effectiveness and organizational accountability of the ICT Forum in Nigeria is attested to by the commendation by the Partnership for Higher Education in Africa (PHEA). It has resulted in the receipt of a \$500 million grant for the improvement of internet infrastructure in Nigeria tertiary institutions.

Eko-Connect - Lagos Higher Education Connectivity Project (LHECP), has helped fostering collaborative research in network technology, development and sharing of content applications and other resources as well as stimulating capacity building among institutions. It has achieved some level of inter-connectivity between some research organizations and higher educational institute (HEI) in the country, as well as easy network that are accessible to students, teachers and researchers at a faster speed. (Uwadia, 2011)

Partnership for Higher Education in Africa (PHEA) coordinates the support of four international foundations to support select higher education in Africa. The Partnership made indispensable contribution to development of teaching, learning and research in the select higher education, through the provision of affordable bandwidth, capacity building and infrastructural development. A special fund of \$100 million was invested in the African higher education over five years to devote their support to the institutional revitalization of selected universities. (PHEA)

According to Lewis, Friedman and Schoneboom, some key achievements of the PHEA in Strengthening the Space of Higher Education in Africa are

1. The Bandwidth Consortium (BWC), a signature PHEA initiative, "saved" universities \$19.7 million in its first three years and laid the foundation upon which many other capacities could be built. This savings equals 3.5 times the PHEA investment of \$5.5 million for subsidized bandwidth and the administrative and technical support of the BWC unit. The lower cost afforded through the Bandwidth Consortium allowed universities to increase their purchase from an aggregated 12 to 72 Mbps.

2. Universities developed the capacity to manage their IT networks, digitize content, improve library services and publish research findings. Researches have shown that the minimum return on investment of each dollar spent on the Library and ICT is between \$4.48 to \$8.83. (Havens and Storey, 2010)

3. Seven universities are implementing action plans to use educational technology to improve teaching and learning, through the PHEA ICT/Educational Technology Initiative (ETI). Projects include deploying learning management systems, developing digital content for health sciences, engineering, and other fields, creating multi-media “tele-classrooms,” exploring mobile phones and radios for distance learning, digitizing dissertations and past exams, developing student e-portfolios, and studying the effect of gender on educational technology use, in order to compete favourably with other world institutions.
4. Gender equity in enrollment and graduation rates improved. The University of Dar es Salaam moved from 5% female enrollment in the early 1990s to 30% in 2009, with particular progress in the sciences, engineering and mathematics. Female undergraduate engineering students increased from 7% to 16% over the same time horizon.
5. Strategies to increase university access for marginalized groups are in place. In Nigeria, the University of Ibadan is using distance learning programs based on information and communication technology platforms to extend university access to marginalized groups, and in Egypt, Cairo University established a new Professional Training Program for Skills Development and a Career Advising Center.
6. The PHEA helped to build a stronger empirical base on African higher education to support effective advocacy and policy reform through Policy research and advocacy for African higher education expansion.
7. University physical infrastructure were strengthened through the provision of improved internet access, modernization of equipment and the construction of laboratories and other facilities to help ensure high quality research. In Nigeria: the University of Ibadan built and equipped its Multidisciplinary Research Laboratory; Obafemi Awolowo University built its Central Science Laboratory to pool equipment and improve research production and postgraduate training; and the University of Port Harcourt’s new central administrative block serves as the campus’s nerve center.
8. Universities established new and more efficient systems for strategic planning, financial management, quality assurance, library automation, computerization/digitization of materials and resource mobilization.
9. African institutions were strengthened to respond to development needs and create high level talent. PHEA universities created new or substantially revised programs to increase the relevance of university research, teaching, and learning to national problems.
10. Postgraduate training capacity is expanding at universities and through regional networks. In Nigeria, the University of Ibadan increased faculty with PhDs from 50% in 2001 to 62% by 2007. The university’s overseas training and re-entry grants for junior faculty has maintained a 100% return rate. Bayero University, Kano, supported 20 faculty members to pursue PhDs, while the University of Port Harcourt supported 63.

Malaysian National Research and Education Network (MYREN) is used by academia and research institutions for collaborative research. Several of the largest universities in Malaysia are connected to MYREN. It is linked to international research communities in Asia Pacific, Europe and North America via the Trans Eurasia Information Network 3 (TEIN3). Researchers connected to MYREN are able to communicate and collaborate over the virtual work space and their counterparts in Malaysia and overseas at improved network performance and lower latency.

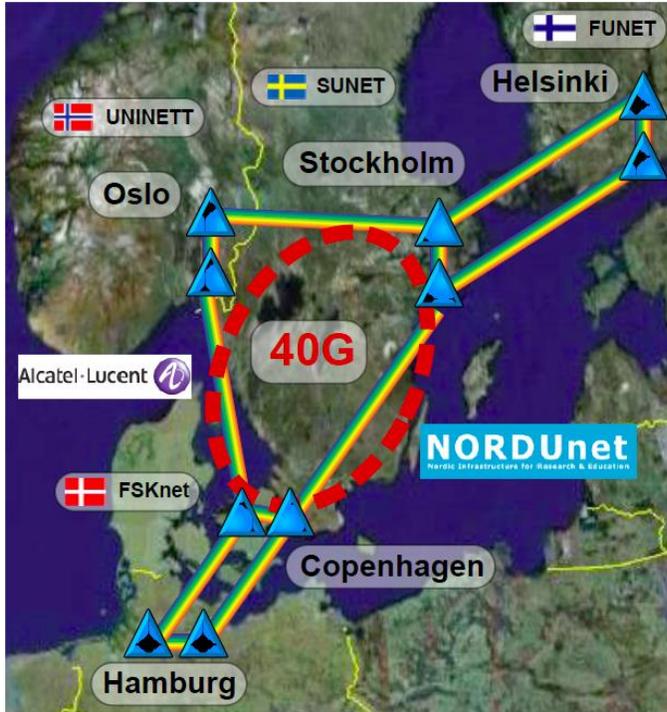
The economic and intellectual prosperity of any nation depends on her ability to significantly improve her global competitiveness; and to achieve this, she must upgrade and diversify the skills and knowledge of our human resource through greater collaboration and connectivity (Sylvester, 2011)

Foundation for National Scientific Computing (FCCN) the NREN for Portugal supports videoconferencing, video services, wireless network, VOIP, authentication and authorization (AAI) and institutional capacity building. In addition, she supports capacity building in Portuguese speaking countries in Africa (Angola, Mozambique and Cape Verde) by periodically organizing “hands-on” Seminars on IPv6, DNSSEC and information Society. (Ferreira, 2010) Members of the academic community can move from one institution to another using the same e-Credential to access the network and internet as a result of the eduroam. Thus, enhancing mobility and improving access to research network and quality.

The regional network for Nordic countries (Denmark, Sweden, Iceland, Norway, Finland), NORDUnet provides excellent network interconnectivity comprising of state-of-the-art regional network, dynamic E2E, virtualization capability, Trans-Atlantic & North-Atlantic infrastructure, Europe connectivity, cross-border fiber, peering fabric, Internet exchange and IP transit services.

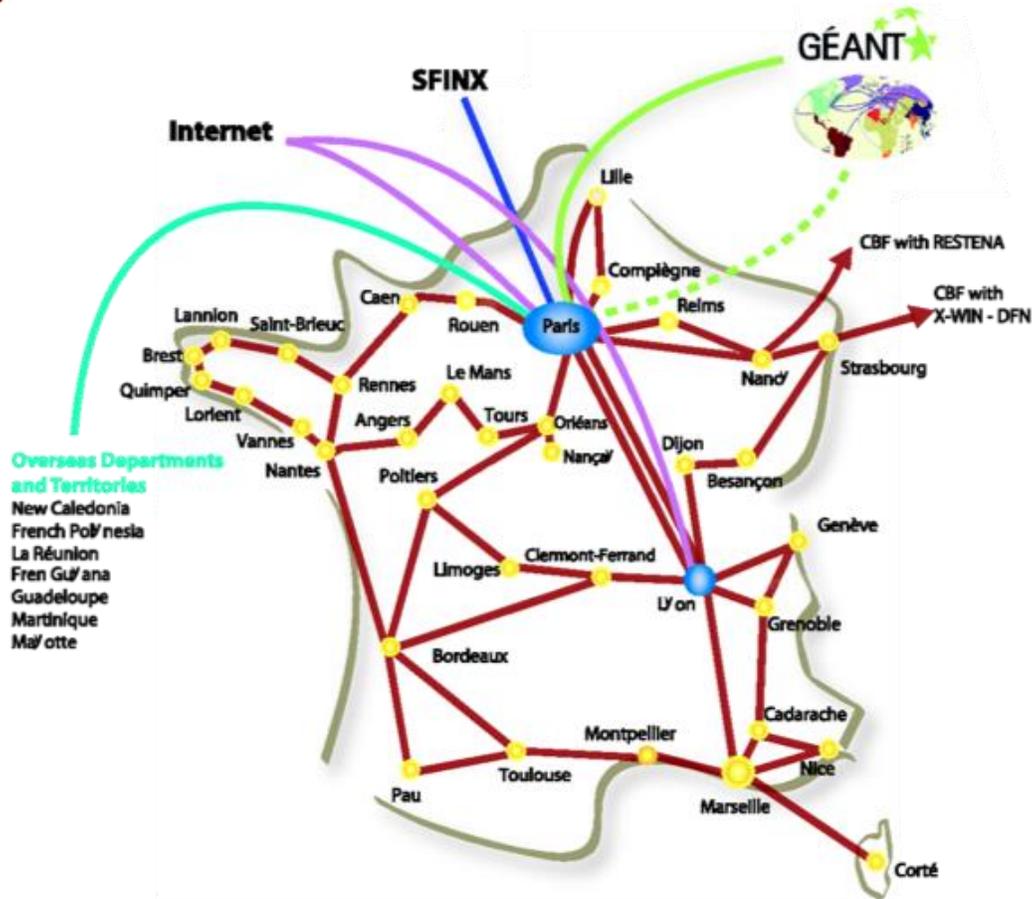
In addition, it is a forum for collaboration and coordination of Inter-NREN services, service sharing and sourcing, AAI, storage, hosting, video conferencing, design, operations of specific services, international projects and relations, global partnerships and 24/7 Network Operations Center (NOC).

The benefits of Nordic NRENs from the activities of NORDUnet include excellent connectivity, Cost efficiency, greater reach, efficient eScience infrastructure services, networks for major projects, grid computing, storage services, and as well enabling 5 countries to operate one network and to speak with one voice. (Fischer, 2010) She assists Nordic research with projects in Africa - astronomy, satellite data downlink, as well as provision of logistic support for research and educational community development and local NRENs operations.



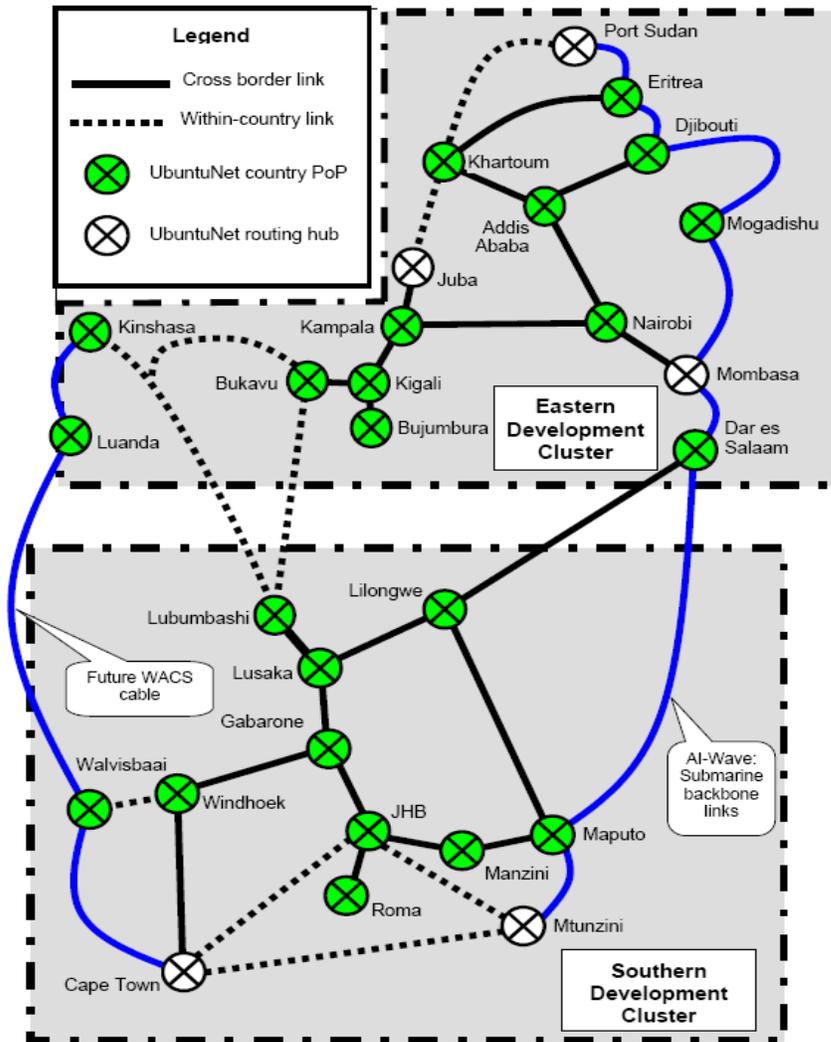
## Scandinavia Core network

RENATER, the French NREN support tool to promote the development of local Internet and significant impact on the telecommunication sector.

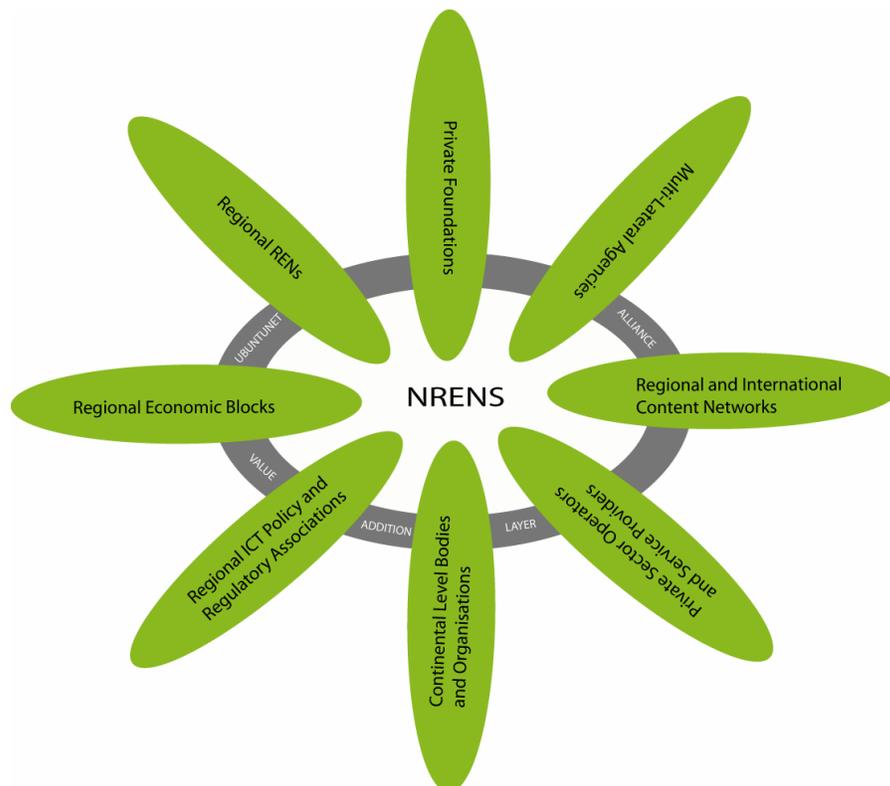


Over the years, UbuntuNet Alliance has invested heavily on capacity building. She would be sponsoring ten of her members to the 2011 AfNog and Afrinic Conference, for further capacity and technical development.

Future UbuntuNet Backbone as envisaged on 1 Nov 2008



**UbuntuNet Stakeholders Map**



## CONCLUSION

Africa has very high capacity strengthening needs. Strategic approach to harmonizing the existing and future research capacity strengthening programmes is required.

ICT and good management are indispensable keys to enhance the capacity African higher education to provide quality training, conduct high caliber research and produced skilled graduates for the labour market.

Research and Education Network (REN) help to foster information exchange among researchers, facilitate the interactions and collaboration of researchers to produce high quality research and world class institutions.

NRENs and deployment of ICT driven collaboration in teaching and research is developing the next generation networking and applications in research and higher education.

Solving the Next Generation problem require highly trained academics, administrators, students and graduates working within functional tertiary institution and collaborating through local and international networks.

Improved and affordable regional and international connectivity will enable African researchers and higher education institutions to generate a proportionate amount of intellectual property goods to achieve parity with the rest of the world, with higher return on investment.

Research and Educational Network is a platform of synergy, growth and development for increased collaboration, cost effective application of resources, improved infrastructure and capacity building. It enables institutions to collectively own and achieve what would have been impossible for a single institution to attain, as result of expertise and cost.

The success and achievements of RENs, NRENs and RRENs validate the biblical injunction of the limitless power of unity.

Democratization of the management of higher education through stakeholders' consensus building and involvement would help to foster conducive and enabling environment for high quality research and institutions.

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