Project Title: AAU Research and Education Networking Unit (RENU) – Phase 2

By: Boubakar Barry

Report Type: Final report

Date: 30 September 2013

IDRC Project Number: 106012-001

IDRC Project Title: Supporting the West and Central African Research and
Education Network (WACREN)

Region: Africa

Full Name of Research Institution: Association of African Universities

Address of Research Institution: Aviation Road Ext. 11,
Airport Residential Area
P.O. Box 5744, Accra-North, Ghana

Name of Researcher: Boubakar Barry

Contact Information of Researcher: Aviation Road Ext. 11,
Airport Residential Area
P.O. Box 5744, Accra-North, Ghana
Tel.: Tel: +233 21 774495
Fax: (+233) 21774821
Email: barry@aau.org

Table of Contents

Abstract:

The project "Supporting the West and Central African Research and Education Network (WACREN)" builds on the achievements of the project "Establishment of a Research and Education Networking Unit" that was co-funded by the International Development Research Center. It aims at consolidating these achievements.

The ultimate, long-term objective of the project is to contribute to providing to African teachers, students and researchers state of the art network infrastructures and applications that their peers are enjoying in other parts of the world, thus allowing them to play an active role in regional and global teaching, learning and research activities.

The project concentrates on West and Central Africa, where no NRENs were established.

Core activities of the project include awareness raising and advocacy, policy development at national and regional levels, and capacity building.

1. Rationale

In 2006, with the support of the International Development Research Centre (IDRC) and foundations of the Partnership for Higher Education in Africa PHEA, namely the Carnegie Corporation of New York, Ford Foundation and Rockefeller Foundation, a Research and Education Networking Unit (REN Unit) was set up at AAU's Secretariat. The main assignment of the Unit's Coordinator was to carry out activities that address issues related to connectivity and access to more and affordable bandwidth for African higher education institutions. These activities include advocacy, awareness activities for policy and decision makers, promotion of policy dialogue at national and regional levels for the establishment of research and education networks, and capacity building for campus and research and education network administrators.

During the implementation of the project, the REN Unit focused on advocacy, by supporting the development of a strong REN community in Africa, and building the capacity of academic network administrators. In this regard, the REN Unit succeeded in developing a platform for dialogue and experience sharing among all stakeholders, from African research and education networking, to other major stakeholders outside the continent: American, European and Latin American R&E organizations, donors, civil society, etc. Regulatory bodies and regional economic organizations of the continent as well as higher education institutions' leaders have been actively involved in the REN Unit's activities.

After the successful completion of this project in 2009, the REN Unit developed and submitted a new project, which aimed at consolidating and expanding the achievements of the REN Unit.

Subsequently, in 2010, the International Development Research Centre (IDRC) approved a grant of CAD238,200 (US$224,700) to the Association of African Universities for the second phase of the project "Establishment of a Research and Education Networking Unit" at AAU's Secretariat (2006 – 2009). The IDRC project name "Supporting the West and Central African Research and Education Network (WACREN)" expresses the wish of concentrating the efforts on West and Central Africa, the only African region that did not have any established research and education network (REN) at that time.
Other contributors to this phase of the project are: the Carnegie Corporation of New York, the Ford Foundation and the Partnership for Higher Education in Africa (PHEA)

2. Objectives

The ultimate objective of the project was to ensure that African teachers, students and researchers have access to state of art network infrastructures and applications that their peers are enjoying in other parts of the world, thus allowing them to play an active role in regional and global teaching, learning and research activities.
As stated in the project proposal, the specific objectives of the project were:
- To strengthen the policy dialogue process at national and regional levels in order to a) build trust and foster collaboration among African research and education networking stakeholders and b) create synergy between the REN-related activities in various parts of the continent;

- To get decision and policy makers at various levels (Ministers, Vice-Chancellors, Heads of Regulatory Authorities, providers of telecommunications infrastructure, etc.) familiar and aware of the importance of research and education networking and access to adequate bandwidth for the development of Africa in general, and its education and research sector in particular;
- To assist targeted countries in establishing their national research and education networks (NRENs);
- To catalyze the process of the establishment of a regional REN (RREN) in the only part of the continent where such a RREN doesn't exist, namely West and Central Africa (WACREN);
- To help provide African research and education network managers with the necessary skills needed through leveraging the existing expertise within strategic partner organisations, such as AfNOG (African Network Operators Group), AfriNIC (African Registry for Internet Numbers) and NSRC (Network Startup Resource Centre) that will provide training in identified essential fields;
- To strengthen the established collaboration between the African and the global research and education networking communities.

3. Methodology

As in the first phase of the project, the project aimed at catalyzing and supporting the development of national research and education networks (NRENs) in Africa and to raise the awareness of key policy decision makers about the importance of NRENs. The focus for this phase was on West and Central Africa for the reason stated above. Additionally, the REN Unit had to facilitate and promote collaboration between the REN communities in Easter/Southern Africa, West and Central Africa, and Northern Africa.

To achieve the objectives of the project, the REN Unit used various techniques, including supporting the development of policy briefs. It has also organized national policy development workshops on the establishment of NRENs in several countries, facilitated the establishment of the West and Central African Research and Education Network (WACREN) and carried out research studies which results can be used to raise awareness of policy and decision makers and to efficiently develop NREN topologies in West and Central Africa.

4. Project Activities

The project had 4 core activities:

i) Supporting the establishment of NRENs as well as a regional REN in West and Central Africa;

ii) Carrying out research studies and developing policy briefs to support the above activity;

iii) Awareness raising and advocacy;

iv) Capacity building.

4.1. Supporting REN Establishment Processes

Supporting REN establishment processes especially in West and Central Africa was one of the major activities of the project.

During the implementation of the project, facilitation of REN establishment processes led to the formal establishment of the West and Central African Research and Education Network (WACREN) as well as the establishment of NRENs in 8 countries in the region, namely in Ghana, Senegal, Mali, Niger, Côte d'Ivoire, Gabon, Togo and Nigeria. A REN establishment process is also underway after facilitation by the REN Unit. Although the REN Unit was not directly involved in the final process that led to the incorporation of the Nigerian NREN, there is no doubt that previous actions of the REN Unit in Nigeria and the general momentum in the region positively influenced and catalyzed this process.

4.1.1. WACREN

The establishment process of a regional REN for West and Central Africa goes as far back as November 2006 when a side meeting was organized during the first regional workshop the REN Unit organized in Accra shortly after the set up of the Unit.

Unfortunately, despite the set up of a Task Team to drive this process, little progress was made by November 2009, when another meeting was organized by the AAU as a side event of the Open Access 2009 Conference, which AAU co-hosted in Accra.

The delegates of the meeting, among them participants from a dozen of West and Central African countries, gave the AAU the mandate to form another Task Team composed of committed stakeholders who will work on 5 key areas: i) Administrative structure, Governance and Financing; ii) Connectivity, Infrastructures and Regulatory issues including interconnection; iii) Implementation strategy and Partnerships; iv) Capacity building; v) Content and Applications.

This new Task Team was established in January 2010 and, following another request by the REN community in West and Central Africa, the AAU started a process for a formal incorporation of the regional REN for West and Central Africa. WACREN, the West and Central African Research and Education Network was subsequently incorporated in Ghana in August 2010 as a "Private Company Limited by Guaranty", equivalent to a not for profit organization.

WACREN elected its first Board in March 2011 in Dakar, at a stakeholders retreat hosted by the AAU. It also drafted its short-term strategic plan at the same occasion.

However, at a Board meeting extended to the Leads of the various Technical Committees held in Dakar in May 2012 in the eve of AfREN 2012 (the annual meeting of the African REN Community), the participants recognized that no significant progress was made in getting WACREN operational. The shared opinion was that it would be difficult to make such a progress without a Secretariat with staff dedicated to WACREN activities. Example of a breakthrough in effective operation is the UbuntuNet Alliance, which experienced tremendous progress in its region once it was able to set up a Secretariat.

A medium-term Strategic Plan was developed as well, with the following salient strategic objectives:

1. A WACREN Secretariat and its governance framework established;
2. Awareness on NRENs and WACREN is raised in West and Central Africa;

3. An advanced cost effective physical network built and in service of research and education institutions in West and Central Africa;

4. NRENs established in all countries in West and Central Africa;

5. Capacity of research and education institutions developed in deploying advanced networks, applications and services;

6. Applications and services supporting education and research communities rolled out;

7. Adequate technical and financial resources mobilized to support the activities of WACREN.

A major milestone of WACREN history was the organization of its first Annual General Meeting held in Abuja in July 2013, with the support of AAU and ngREN as host. An important step was made with the appointment of WACREN's first CEO and the designation of its new Chair of the Board. By the end of August 2013, the other members of the Board of Directors were designated, after a Search and Nomination process.

The first assignment of the CEO is now to mobilize resources needed to the establishment of an operational Secretariat that will coordinate and catalyze REN activities in the region.

Below is the proposed network topology of WACREN, with 3 main Network Operation Centers (NOCs) in Dakar, Accra and Lagos. More information can be found at http://www.wacren.net/.
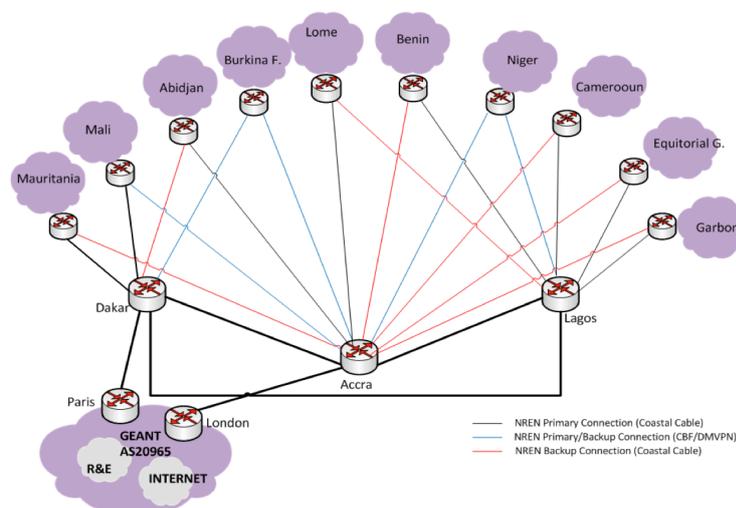

4.1.2. GARNET

GARNET is the Ghana Academic and Research Network. The AAU REN Unit has facilitated and supported a policy development process for the establishment of a NREN in Ghana since 2008. This effort, the commitment of actors in Ghana and the sensitization of key Ghanaian higher education institutions' leaders by the AAU has led to the incorporation GARNET in September 2010 as the first formally established NREN in West and Central Africa.

With its legal status, GARNET was able to enter into contract with connectivity providers. With the assistance of the AAU, GARNET was able to negotiate

bandwidth prices at less than US$100 per Mbps and month for a STM-1 (155 Mbps) from prices of around US$1,000 to US$1,500 per Mbps and month. This negotiated price is independent of the location of the participating institutions and includes last mile connectivity.

The GARNET topology is showed below. It is being implemented with 5 institutions joining in the initial phase.
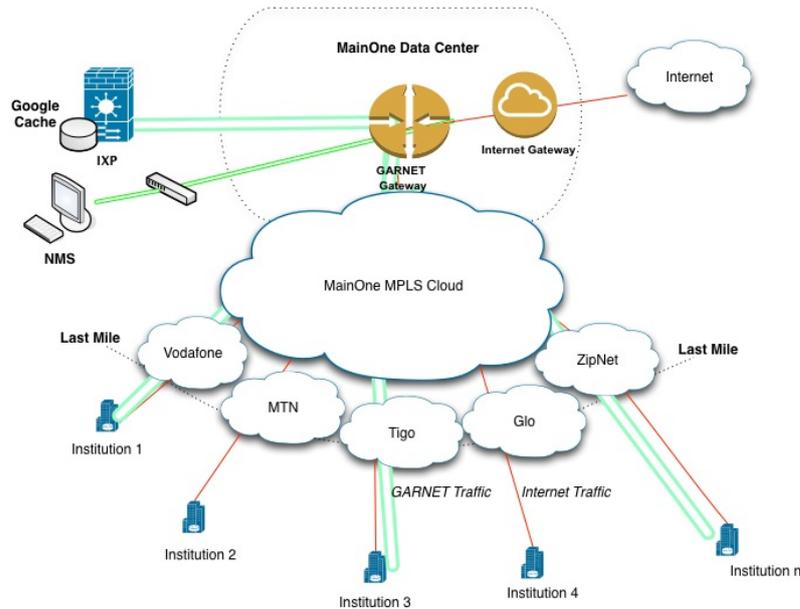

4.1.3. snRER

snRER, the Senegalese NREN, was formally established in 2011. Its incorporation followed a process facilitated by the AAU REN Unit, which started in 2009 with the organization of a national policy development workshop.

In March 2011, due to the level of the advancement its establishment process, snRER was designated first WACREN NOC for connection of the region to the pan-European research and education network GEANT.

Despite a long delay, snRER is now close to being operational. The 5 public universities are already interconnected using the government optical fiber backbone and servers as well as equipment for the data and international bandwidth are being procured, using part of a World Bank loan to the government of Senegal for the improvement of the higher education sector.

snRER's topology is shown below and more information can be found at http://snrer.edu.sn/.
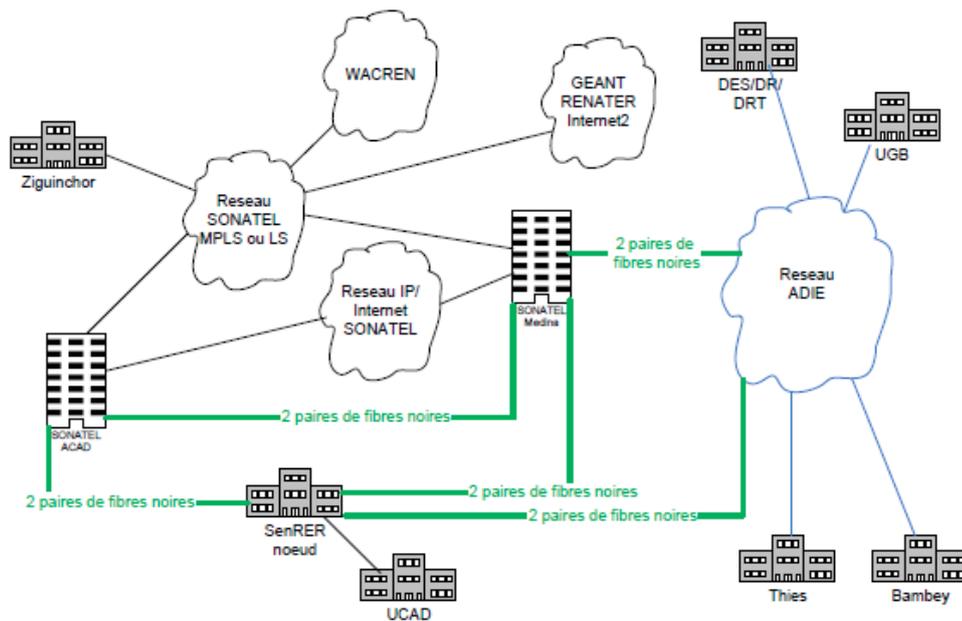
4.1.4. MaliREN

The AAU facilitated a national policy development workshop for the establishment of a NREN in Mali in July 2011. The workshop that was co-chaired by the Minister of Health and the Minister of Post and ICT was attended by high level officials of universities, research centers and ministries (Vice-Chancellors, Directors of research institutes, Senior Advisers of Ministers, etc.).

Subsequently to this workshop at which draft statutes of the future NREN were drafted and discussed, a Founding General Assembly was organized in August 2011, with more than 20 institutions and organizations represented. The statutes were adopted at that General Assembly and the members of the Board and the Executive Secretariat elected.

Unfortunately, not much progress has been done since in Mali, due to the civil war and the military coup in the country. It is hoped that with the recent developments that culminated in the election of a President, the NREN development process will be revived.

4.1.5. NigerREN

Like in other countries, the AAU REN Unit facilitated National Consultative Workshop on the Establishment of a NREN in Niger. The workshop was organized in November 2011 in collaboration with the Ministry of Education and Scientific Research of Niger and other Nigerien institutions.

One of the major outcomes of the workshop was the decision by all present stakeholders (more than 60 participants) to formally setup an organization that will drive the process of putting in place a platform for collaboration by interconnecting all higher education and research institutions of Niger.

A Founding General Assembly of NigerREN was subsequently organized in December 2011, in the presence of the Minister of Education and Scientific Research of Niger and representatives of other key governmental and non-governmental agencies. Members of the Board and the Executive Secretariat were elected at that occasion.

The Founding General Assembly was preceded by a 2-day training workshop for Nigerien campus network managers; this showed that activities on the ground started even before the formal establishment of NigerREN.

NigerREN is presently collaborating with a REN cluster in Sokoto, Nigeria (SokREN) with the objective of interconnecting NigerREN and ngREN through SokREN.

4.1.6. RITER

In collaboration with the Ivoirian Ministry of Higher Education and Scientific Reserach, the AAU REN Unit organized in December 2011 National Consultative Workshop for the Establishment of a NREN in Côte d'Ivoire. The Ivoirian authorities acknowledged with thanks the effort to assist Côte d'Ivoire in a post-crisis period. Due to the very sensitive political situation in Côte d'Ivoire, the Ivoirian authorities expressed their preference in managing the establishment of the Ivoirian NREN RITER (Réseau Ivoirien de Télécommunication pour l'Enseignement et la Recherche) by the Ministry of Higher Education and Scientific Research.

Presently, regional data centres that are part of RITER are being installed in various parts of the country and bandwidth for the interconnection of the universities in the country is being procured.

Below is the current topology of RITER. More information can be found at http://www.riter.ci/.

__ Existing links   ___ Planned links

4.1.7. GabonREN

The National Consultative Workshop on the Establishment of a National Research and Education Network in Gabon (GabonREN) was organized in collaboration with

the Ministry of National Education, Higher Education, Scientific Research, Innovation and Culture of the Republic of Gabon and AAU and was hosted by Université Omar Bongo, with the Rectors of all Gabonese public universities among the participants of the workshop.

Issues related to organizational form, infrastructure, capacity building, content and financing were discussed in the various workshop sessions.

Subsequently, it was decided that GabonREN would be a government agency.

Details on the workshop can be found at http://gabonren.blogspot.com. GabonREN is the first formally established NREN in Central Africa and its development process is being driven by Université Omar Bongo.

It is expected that GabonREN or the NREN to be established in Cameroon will host the main WACREN hub in Central Africa.

4.1.8. TogoREN

In December 2010, the AAU facilitated the organization of a National Consultative Meeting for the Establishment of a NREN in Togo. The various stakeholders then consulted among themselves to establish the NREN. Another workshop facilitated by the AAU on July 2012 was to finalize the statutes and rules of procedure of the NREN; it was followed right after by the Founding General Assembly of TogoREN.

Subsequently, another meeting was organized in August 2012 for the election of the Board and the Executive Secretariat.

Since then, a 155 Mbps link between the 2 public universities in Lomé and Kara was established and the TogoREN team is working on offering services on this link. There are however some challenges to address, namely that of the poor state of the campus network of Université de Kara (400 km from Lomé), a network that definitely needs to be upgraded in order to ensure provision of quality services on the established link.

4.1.9. ngREN

Nigeria is a very large country and it is obvious that it is very difficult to build a NREN from scratch. That is why, as early as November 2007, the AAU REN Unit recommended to have a cluster approach, namely establish RENs around some major institutions around Nigerian states and then link them to form a NREN.

Unfortunately, there was no accepted consensus on who should coordinate the process, despite mandates given by Nigerian University authorities.

However, some clusters have emerged, namely around Lagos, Sokoto, Ibadan. etc. Incidentally, ngREN was incorporated by the National University Commission of Nigeria and interconnection of federal universities is being carried out in the framework of a project funded by the World Bank.

Below is the network that is currently being implemented.
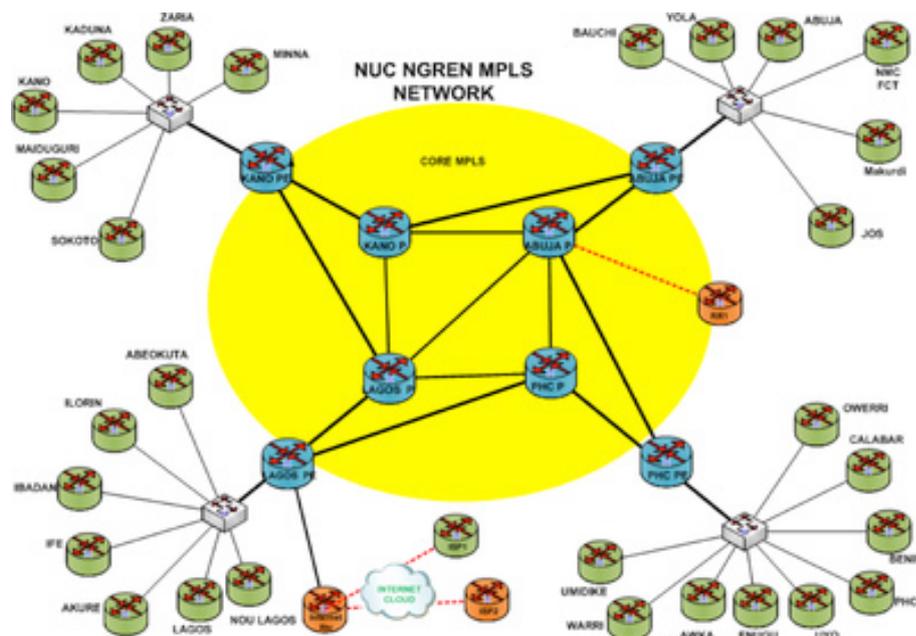
4.2. Research studies and Policy briefs

During the implementation of the project, the following research studies and policy briefs were carried out or developed:

- A research study on the regulatory environment in West and Central Africa from a REN perspective;
- A research study on optical fibre opportunities for RENs in West and Central Africa;
- A policy brief on institutional Internet Protocol resources;
- A policy brief on policy brief on the Internet Protocol version 6 (IPv6);
- A policy brief on social networking technologies for teaching and learning.

4.2.1. Research study on regulatory environment

The study assessed the regulatory environment in order for the RENs to better plan their establishment and development by addressing the bottlenecks and barriers. It also assessed, from the regulatory perspective, the ability of NRENs to operate international gateways.

The executive summary of the research study states that a recent development of NRENs in West and Central Africa presents a significant opportunity to bring policy and regulatory issues confronting them to the forefront. A survey of the regulatory environment in the regions indicates that prices of broadband networks are still very high, although they have come down by 5 times between 2008 and 2013. The absence of platforms that bring NREN champions, university leaders, policy makers and regulators together means that the challenges facing NRENs are not well understood by the regulators; and NREN champions are not aware of the regulatory issues and their obligations.

The assessment shows a similar situation at regional levels. Regional Economic Communities such as the Economic Community for West Africa States (ECOWAS), the Economic Community for Central Africa States (ECCAS) are unaware of the challenges facing the regional REN- the West and Central African

Research and Education Network (WACREN). Regional regulatory issues are even very important since they involve different regulatory prescriptions across borders. The main issues include the ability for RENs to access cross-border networks on competitive and educational discount terms, open access to regional fibers and international submarine cable.

The starting point to NREN development in West and Central Africa is their acknowledgement in the policy documents. NRENs should be regarded as public goods with long-term benefits to social and economic growth of the regions. The public good nature and non-profit mode of operation of Research and Education Network means that they cannot operate on full cost recovery basis; therefore policy makers and regulators should provide them with the necessary financial and regulatory support to enable them to deliver affordable services to users.

A significant background work needs to be done to raise the awareness of policy makers and regulators. NREN champions need to develop country blueprints and strategies that discuss their intentions in terms of network and services and the policy, regulatory and resources support they wish to secure from the government.

Research experiments tend to require ultra-high speed networks in the range of Gbps; therefore authorities should strive hard to introduce a truly competitive environment for the provision of Gigabit network services. The focus of policy makers and regulators should be to enable leasing capacities on a competitive price basis or letting NRENs to build their own infrastructure.

Furthermore, there has been a significant development in the use of wireless networks by research and education networks in recent years to facilitate roaming. As a result the demand for radio frequency spectrum is on the rise. NRENs and regulators in West and Central Africa need to work together to develop new approaches for obtaining and using spectrum for research and education purposes.

The public good nature of research and education network implies that NRENs will continue to operate as non-profit institutions that will require continuous public subsidies. The initial capital cost for building initial NREN backbone is often the major hurdle in the development of research and education networks. Some countries have already started to use the universal access funds for the purpose of building NREN backbone. These experiences indicate that both the regulators and NRENs will stand to benefit from the use of the Universal Access fund. Regulators will be able to achieve universal access to broadband at least at the level of colleges and universities. They can leverage the experience to promote wider access to broadband throughout the country. NRENs will benefit from close working relationships with regulators in order to fulfill their obligations including the prevention of the spread of spam and promotion of regulation-friendly Acceptable Use Policies.

The full research study report is provided separately to this report. It futures findings and analysis of a survey conducted in 11 countries of the West and Central African region.

4.2.2. Research study on optical fibre opportunities for RENs

The study assessed the status of national fibre backbones and cross-border connectivity in West and Central Africa.

Key findings of the research study are:

- The study identified 246 HEIs in West and Central Africa, which were located in 138 different places. In terms of total user population, the staff and student population data was reported in the AAU African Higher Education Database for 115 of these 246 HEIs. The total population of these 115 HEIs that reported population was 2,189,892, split between 57,006 staff and 2,132,886 students.

- The study shows that 188 out of 246 HEIs were located in places where there is an operational fibre optic node. A further 19 (207) were located in places within a 10-km range of an operational fibre optic node. Of the 39 remaining HEIs, 3 would fall within a 10-km reach of a fibre node which is currently under construction when it is completed, and a further 22 would fall within reach of a fibre node which is either planned or proposed is completed.

- Only 14 HEIs remain beyond a 10-km would remain beyond the reach of an operational fibre node under existing known plans (see Table). These HEIs were located in Guinea, Guinea Bissau, Ghana, and Nigeria. Of these HEIs, the staff and student population of seven HEIs was available. The total population of these HEIs beyond the reach of fibre optic nodes was 82,859, split between 2,383 staff and 80,476 students.

It is important to note that in the framework of this research study, an application was developed to allow planning connections of universities in West and Central Africa; it shows distances between universities and the closest available fibre infrastructure.

A full report of the research study is provided separately.

4.2.3. Policy briefs

Policy briefs are efficient means to reach and inform policy and decision makers on critical issues. Some of the issues of interest include securing institutional Internet Protocol (IP) resources and the migration from IP version 4 to IP version 6. It is also important for institution of higher learning to harness the potential of new communication means, e.g. social networking technologies.

During the implementation of the project, the following policy briefs were developed:

- A policy brief on institutional Internet Protocol resources;
- A policy brief on policy brief on the Internet Protocol version 6 (IPv6);
- A policy brief on social networking technologies for teaching and learning.

These policy briefs are available in both English and French and were made available at various AAU events.

4.3. Awareness raising and Advocacy

As outlined in the project proposal, awareness of policy and decision makers is key for the success of the project. While the benefits of research and education networks are clear and well understood by the ICT Directors of higher education institutions, this is not always the case for decision-makers such as Vice-Chancellors and government officials. However, unless the policy and decision makers are informed

and convinced of the necessity of establishing such networks for their academic and research communities, there will be little success. Hence, it is crucial to carry out advocacy actions towards these key actors.

This is why awareness raising and advocacy activities have taken an important place in this project.

During the implementation of the project, many activities were carried out on awareness raising and advocacy; the below listed activities are the prominent ones:

1. Participation in dozens of conferences, meetings and workshops in and outside Africa during which presentations were made, giving several occasions to make the case for research and education networks;

2. Organisation of a high-level conference on the connectivity of African higher education institutions. This conference was organized in the framework of the IDRC funded project "Enabling affordable access to fibre infrastructure for West and Central African higher education institutions" and aimed at sensitizing policy and decision makers as well as other stakeholders on the need to substantially improve the connectivity of African higher education institutions.

   More 130 than representatives of governments (ministers, permanent secretaries, ministers' advisers, etc.), higher education and research institutions (vice-chancellors and vice-chancellors), continental and regional bodies, telecommunications regulatory authorities, telecommunications operators, development agencies and other stakeholders were given the opportunity to discuss the issue and draw an action plan.

   Recommendations of the conference were captured in the Accra Declaration that triggered the NREN establishment process in several countries (e.g. Gabon, Niger and Togo). Another outcome of the conference was the establishment of contacts between NRENs and connectivity providers. This has led for example to an offer to GARNET by a optical fiber operator for the provision of bandwidth at about $100 per Mbps and month, down from $1,000 – $1,500 per Mbps and month;

3. Organisation of several national policy development workshops that led in most of the cases in the establishment of NRENs. These policy development workshops were organized in the following countries, generally in collaboration with the ministry in charge of higher education and scientific research and/or with the ministry in charge of ICT: Benin, Cote d'Ivoire, Gabon, Ghana, Mali, Niger, Nigeria, Senegal and Togo;

4. Development of policy brief (see 4.2.3.).

4.4. Capacity Building

Ongoing training on network technologies and applications is critical for NREN development and their sustainable operation. The competency level in the region has been improved in recent years due to training provided by AfriNIC, AfNOG and the Internet Society; however, the critical mass of expertise in NREN development has not been fully built. Therefore, it is essential to build capacities of network experts in various aspects of network services ranging from routing to deployment of fiber networks.

The REN Unit has adopted the strategy of leveraging the strength of its strategic partners with regards to capacity building. Thus, it has chosen to sponsor participants from the academic and research community to attend training workshops organized by these partners, mainly AfNOG, AfriNIC and NSRC.

During the implementation of the project, campus network and NREN managers have been sponsored by the AAU REN Unit to participate in the following capacity building workshop:

i) IDLELO IV workshop, Accra, May 2010 (open source software solutions);
ii) AfTLD workshop, Bamako, September 2010 (network management);
iii) AfNOG training workshop, Dar es Salaam, June 2011;
iv) snRER-NSRC training workshop, Dakar, November 2011;
v) AAU-ICTP-NSRC-UG-UCT training workshop, Accra, December 2011;
vi) AfTLD workshop, Ouagadougou, January 2012;
vii) IDLELO V workshop, Abuja, March 2012;
viii) AfNOG training workshop, Banjul, May 2012;
ix) UbuntuNet Connect training workshop, Dar es Salaam, November 2012;
x) AfNOG training workshop, Lusaka, June 2013.

Close to 100 campus network and REN managers were sponsored to attend the above mentioned workshops.

4.4. Other activities

The organization of the annual AfREN meetings is one of the major activities that were carried out during the implementation of the project.

AfREN is an annual meeting convened by the AAU; it is organized back-to-back with other meetings of the so-called Af* organizations (AfNOG, AfriNIC, AfREN, ISOC-Africa). It is a platform for collaboration with the aim to build an all inclusive African research and Education Network community that addresses issues of access to high bandwidth and other critical scientific resources at affordable prices, capacity building and content. It is an integral part of what has become the Africa Internet Summit (AIS).

Over the past years, AfREN has succeeded in building a strong community of practiners (in Africa and beyond) who share experiences and establish collaboration across communities.

5. Project Outputs

The major outputs of the project are listed below:

i) 5 national policy development workshops organized in West and Central Africa;
ii) 2 regional policy development workshops organized in West and Central Africa;
iii) 4 continental policy development meetings organized (annual AfREN meetings);
iv) 8 national research and education networks (NRENs) and one regional REN established in West and Central Africa as direct or indirect results of the policy development process in the region;

v) Close to 100 campus network and REN managers trained in advanced networking and other relevant subjects;

vi) 2 research studies carried out;

vii) 3 policy briefs developed.

6. Project Outcomes

The major outcomes of the project are listed below:

i) Increased collaboration between higher education institutions in West and Central Africa through the establishment of several NRENs as well as a regional REN for West and Central Africa;

ii) Better understanding of the importance of research and education networks by policy and decision makers;

iii) Increased support to REN activities by policy and decision makers;

iv) Increased skills for campus network and REN managers;

v) Increased engagement between the undersea cable operators and the NREN community that led to much more affordable bandwidth prices;

vi) Increased engagement between NREN community in West Africa and the NREN community in Eastern and Southern Africa.

7. Final Reflections

The project had a lot of challenges, especially in its first phase. This was mainly due to the fact that the concept of research and education networks was quite new or unknown, even among IT professionals.

However, due to intensive awareness raising and advocacy, RENs have found their place in the agenda of many African countries. This has indeed led to the establishment of 8 NRENs and one regional REN during the second phase of the project. This confirms the assert made in the final report of the first phase of the project, namely: "Sensitization and awareness raising take time -often several years- to show tangible results. Behavior changes are generally not measurable, but only noticeable, which, of course, implies a certain degree of subjectivity". It was therefore worth building on the achievements of the first phase and sustaining the efforts made.

A main challenge that the project had was to deal with the absence of a technical Assistant to the Coordinator, due to space constraints at AAU. The Coordinator had for instance to rely on the availability of the Senior IT Officer of the institution for making the resources collected for the clearinghouse available online. Unfortunately, the position of Senior IT Officer was vacant for more than one year and was filled only recently.

One option to make these resources available to the general public would be to host the resources database on AAU partner's server (e.g. WACREN, UbuntuNet Alliance) and provide a link to the database from the AAU website.

Finally, AAU should continue to play a major role in the development of RENs in Africa. It's recognized neutral position is a good asset for the facilitation of policy development at national, regional and continental levels. AAU should also continue to play an important role in advocacy and sensitization of policy and decision makers.