Consolidating Research and Education Networking in Africa Phase 2
IDRC Project Number 105717

Subtitle: Implementation

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FINAL TECHNICAL REPORT

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LIST OF ACRONYMS

AAU:	Association of African Universities
AfNOG:	African Network Operators Group
CHAIN:	Coordination and Harmonisation of Advanced e-Infrastructures
DANTE:	Delivery of Advanced Networking Technologies to Europe
Eb@le:	The NREN of DRC
EC:	European Commission
ERINA4Africa:	Exploiting Research INfrastructures potential for boosting Research and Innovation in Africa
EthERNet:	Ethiopian Education and Research Network
EU FP7:	European Union 7th Framework Programme
FEAST:	Feasibility Study for African – European Research and Education Network Interconnection
GEANT:	The pan-European Research and Education Network
GLOBAL:	Global linkage over broadband links
INFN	National Institute of Nuclear Physics, Italy
ISOC	Internet Society
ISSN:	International Standard Serial Number
KENET:	Kenya Education Network
MAREN:	Malawi Research and Education Network
NREN:	National Research and Education Network
NUANCE:	Newsletter of UbuntuNet Alliance: Networks, Collaboration, Education
PHEA:	Partnership for Higher Education in Africa
RENU:	Research and Education Network for Uganda
RUFORUM:	Regional Universities Forum for Capacity Building in Agriculture
SANReN:	South African National Research Network
SomaliREN:	Somali Research and Education Network
SUIN:	Sudanese Universities Information Network
TENET:	Tertiary Education and Research Network of South Africa
TERNET:	Tanzania Education and Research Network
WACREN:	West and Central African Research and Education Network
XNET:	Xnet Development Trust of Namibia
ZAMREN:	Zambian Research and Education Network

1.0 INTRODUCTION

UbuntuNet Alliance posits that digital isolation is a major contributing factor to the limited intellectual output from the African continent. This isolation is largely due to the excessively high cost of internet connectivity: during 2005, when the concept for this project was developed, many institutions were paying typically USD7,000 per full duplex Mbps per month, a capacity that would cost less than US$20 per month in North America and Europe for similar institutions. This reality was the backdrop for the formation of the UbuntuNet Alliance in 2005, with the intent of acquiring sufficient optical fiber capacity so that African research and education institutions would achieve not just equity, but equality to the rest of the world in terms of volume and cost of bandwidth.

During 2006/7, with funding support from IDRC, UbuntuNet Alliance developed a programme that was named "Consolidating Research and Education Networking in Africa, CORENA". CORENA consists of strategic activities that are planned to lead to the desired outcomes over a five-year period. The implementation of CORENA required, as the first step, the development of a comprehensive knowledge base about the Research and Education Networking (REN) environment within the region, capturing status, opportunities, and the challenges; and also using these to develop a more comprehensive strategy: This was the focus of Phase 1 of the CORENA project funded by IDRC and implemented between 2008 and 2009. A number of guiding documents to support implementation, including a Policy and Master Plan for UbuntuNet Alliance were developed.

Having successfully completed the first phase of CORENA and understood the African NREN environment, UbuntuNet Alliance started Phase 2 of CORENA: this being the main implementation that would cause the major transition for the Eastern and Southern Africa REN community over a five year-period ending 2014.

Support from IDRC for the second phase of CORENA funded four elements of the UbuntuNet Alliance Policy and Master Plan as developed in the first phase as follows:

a) Monitoring and Evaluation, which involves testing our hypothesis;
b) Capacity building;
c) Dissemination;
a) Policy analysis and advocacy

2.0 PROJECT DESIGN AND IMPLEMENTATION

2.1 Background

CORENA was conceived as a five-year project covering the period January 2008 to December 2012, but realism, combined with the procedural time frames required to secure funding for delays in key elements of the programme led to this being changed to 2010 – 2014. CORENA focuses on the provision of intra-African and global connectivity at bandwidths and costs that are comparable to the rest for African National (and Regional) Research and Education Networks (RENs). Attendant to this is the establishment of an environment in which this access is sustainable: robust national and regional research and education networks; competent human capacity; conducive policy and regulatory environments; and content networks as well as applications that bring value to the data networks.

2.2 Operational Context

The success of CORENA hinges on the effectiveness of the Alliance in forging relationships, designing new products and services, and prospecting for new ideas and resources to expand its network. Besides spanning multiple countries, diverse factors and many players at different levels pose challenges and give rise to a variety of issues that UbuntuNet Alliance needs to address in order to achieve its goals. It was therefore necessary for the Alliance to institute a systematic process of knowing what the status of the project's operating context is and also to know what the intentional/non-intentional changes in the behaviour of its beneficiaries are. This knowledge is important in ensuring that the Alliance adapts its strategies, competencies and approaches to fit the evolving situation. In this strategy, four different levels (the institutional, NREN, Country and Regional) at which change is expected to happen and inevitably influence the implementation and effect of CORENA are conceived and used to define areas of focusing the monitoring.

2.3 The conceptual framework

Figure 1 illustrates the conceptual framework within which the M&E strategy was formulated. There are four basic elements of CORENA program logic: the Action/Output, the Ecological Context, the Change/effect and the Impact. The Action/Output captures efforts of key partners and direct implementers in translating available resources into program deliverables. The ecological context describes the portion of the environment that directly interacts with CORENA and that can influence its effectiveness. The Change/effect captures the anticipated changes in the target audience as a consequence of CORENA. The impact describes the contribution of CORENA to long-term changes within African educational and research institutions. The framework is discussed in detail within the detailed Monitoring and Evaluation Strategy document.[1]

2.4 Monitoring and Evaluation at Different Levels

The Monitoring and Evaluation Strategy developed during CORENA Phase 1 provided the main framework for monitoring and evaluation. Several activities were carried out as we measured the theory of change in relation to the impact of increased connectivity on intellectual property output.

The M&E strategy identified three levels at which strategic and tactical information for different stakeholder groups is required. This abstraction is necessary to focus the monitoring and evaluation since each level serves a unique purpose. Additionally, the following guiding questions informed what data/information is worth considering at each stage:

a) What type of data does the strategy at a specific level need to capture, analyse and disseminate?
b) Who needs this data?
c) Why do they need the data?
d) How, who and when will the information be collected, analyzed and disseminated?

At each level, the strategy is a build up from a rationale, to the strategic information needs of that level, which inform the focus on the data that needs to be collected and eventually the methods of effecting the M&E function.

Based on the model, the levels of M&E are:

a) Output level - focusing on implementation (activities, deliverables, and organization arrangements);

[1] UbuntuNet Alliance Monitoring and Evaluation Strategy enclosed as Annex 1

b) Outcome level – focusing on the effect on the target group
c) Impact level – focusing on project worth/merit.

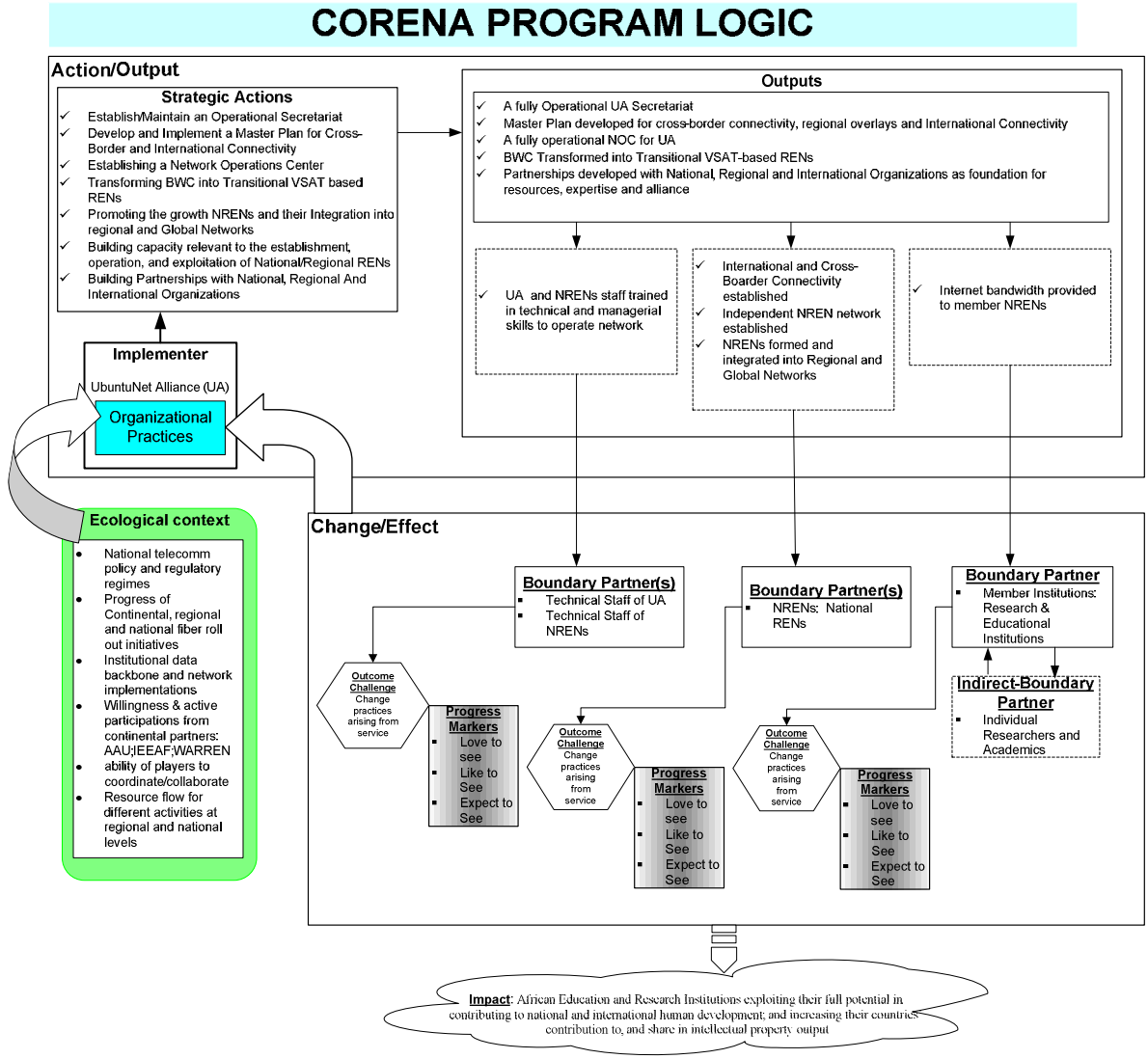

Figure 1: CORENA Programme Logic

3.0 OBJECTIVES

CORENA Phase 2 had four key objectives:

I. Making an evidence-based case that will help persuade developing countries within eastern and southern to invest in research and education connectivity and access.
II. Build the technical and managerial capacity of NREN personnel to ensure the existence of a human resource that can assure the implementation, availability, and security of advanced data networks to support research and education networking. This was linked to establishing mechanisms for sustainable capacity building.
III. Dissemination aimed at: sharing research findings about the linkage between intellectual property output and access and connectivity; best practices in the setting up and operation of NRENs and their data networks; and building up the regional and international image of the Alliance.

IV. Policy analysis and advocacy, aimed at creating national and regional environments that enable and support the growth and exploitation of research and education networking.

The methodology and achievements related to each of these objectives is separately discussed in the following sections.

4.0 INVESTIGATING THE IMPACT OF CONNECTIVITY ON RESEARCH OUTPUT

It should be noted that this section gives only the highlights of the research, the findings, and the recommendations. A full paper[2] covering this research is enclosed at Annex 2.

4.1 Introduction: Key Research Activities

4.1.1 Inception Research Workshop

The first activity in Monitoring and Evaluation was a Research Workshop that was held in Nairobi in September 2009. The purpose of the workshop was to validate, refine, and develop a specific action plan for the research activities based on the M&E Strategy that was developed in the first phase of CORENA. The workshop in addiion defined outcomes/indicators, and provided clarity and specificity on M&E parameters that the framework only defined at a broad level. Participants at the workshop included representatives of NRENs in the UbuntuNet membership region; the AAU; academics and researchers with valuable input from a gender and behavioural science aspect in addition to participation from UbuntuNet and the IDRC. It was facilitated by the M&E experts from Uganda who developed the M&E framework.

4.1.2 Baseline Data Collection and Analysis

The original intent was to engage a consultant to carry out the M&E activities. Unfortunately, there was no response to the Request for Proposals to carry this out. With the consent of IDRC, this was transferred as a core activity to the staff of the Alliance led by the CEO and assisted by contracted Research Assistants as and when needed. The data collection and subsequent analysis is discussed further in the research description below.

4.1.3 Baseline Research Workshop[3]

A Research Workshop was held on 8-9 September 2011 in Nairobi Kenya. The purpose of the workshop was to present and validate the preliminary output from the baseline survey. The workshop was attended by CEOs of all 13 member NRENs of the Alliance. Participants received the research output and observed that the findings were generally consistent with their expectations.

4.2 The Research Problem

The CORENA framework asserts that a major cause of the current disproportionately low generation of intellectual property in Africa is the current isolation of Africa based researchers from the knowledge age that is driven by easy and cheap access to the global information infrastructure (GII). Isolation has two key aspects: *infrastructure* and *cost*. Our thesis is that:

"Improved and affordable connectivity will enable African researchers to produce proportionate intellectual output and generate a proportionate amount of intellectual property goods"

[2] Tusubira, F.F., Ndiwalana A., Obbo, H., and Dindi, S.(2012), The Impact of Improved Access and Connectivity on Intellectual Property Output: Baseline Report. Proceedings and report of the 4rd UbuntuNet Alliance annual conference, 2011 http://www.ubuntunet.net/ubuntunet-connect_2011_proceedings (Annex 2)

[3] The Alliance took advantage of the convergence of the CEOs for the Research Workshop to also conduct mid-term Strategic Plan Review, and to discuss opportunities presented by the new IDRC prospectus on Information & Networks

The implementation of CORENA is aimed at creating the right conditions to reverse the situation and therefore imposes, outside pure programmatic requirements, a need for evaluating the theory of change that is the basis for our intervention.

Figure 2 illustrates the theoretical concept used in this research. A researcher, with a given set of attributes (level of qualification, discipline, research competence, ICT literacy, information literacy, teaching competence, gender, etc) gets immersed in the research environment of a university. This environment will then shape the researcher's behaviour, stimulating them to conduct research and generate intellectual property output. Conversely, the environment, if not conducive, can instead discourage the researcher from conducting research.

The illustration focuses on the specific behaviour we have assumed would be shaped by access and broadband connectivity to the global research and education environment, namely:

i. Time spent online
ii. How the time online is used
iii. The relative amount of time spent on research
iv. Active involvement in collaborative activities (internal and external)
v. Publication culture

This behaviour leads to two specific outputs: publications, and patents. What happens next will then condition the researcher in a way that either reinforces or weakens positive aspects of researcher behaviour. If the incentives (as captured in the research policy) reinforce the positive behaviour, the researcher becomes more conscious of the shortcomings in the research environment and will push for improvement. Where the environment is responsive to such pushing, a virtuous cycle will be created and overall research output will be increased.

The following suppositions, not illustrated in Figure 2 (and not addressed in this research) need to be noted:

i. The actual fact of publication reinforces a good research culture because it leads to satisfaction and a feeling of confidence.
ii. Where there is positive reinforcement, the researcher will work on improving their attributes especially where the environment supports or enables this: holders of master's degrees will join PhD research programmes, and PhD holders will seek post-doctoral research opportunities as well as other ways of improving their research capacity.
iii. Experienced researchers, if immersed in a poor research environment, will immediately start to push for improvement. If they fail, they will either leave or degrade.

It should also be noted that while we have included National Development in our model, the real connection is not as simplistic as it appears: there are many other factors that are not illustrated that will determine whether or not intellectual output will positively impact on national development. This aspect will be expanded on and examined during the next round of data collection.

Looking at all the factors that define the research environment, and taking into account the typical pace of change of major policies in universities, it is reasonable to expect that access and connectivity is the only one that will change rapidly over the five year period starting 2010 because it is strongly driven by external factors, providing a window of opportunity for monitoring impact while the other factors remain on a path of gradual change.

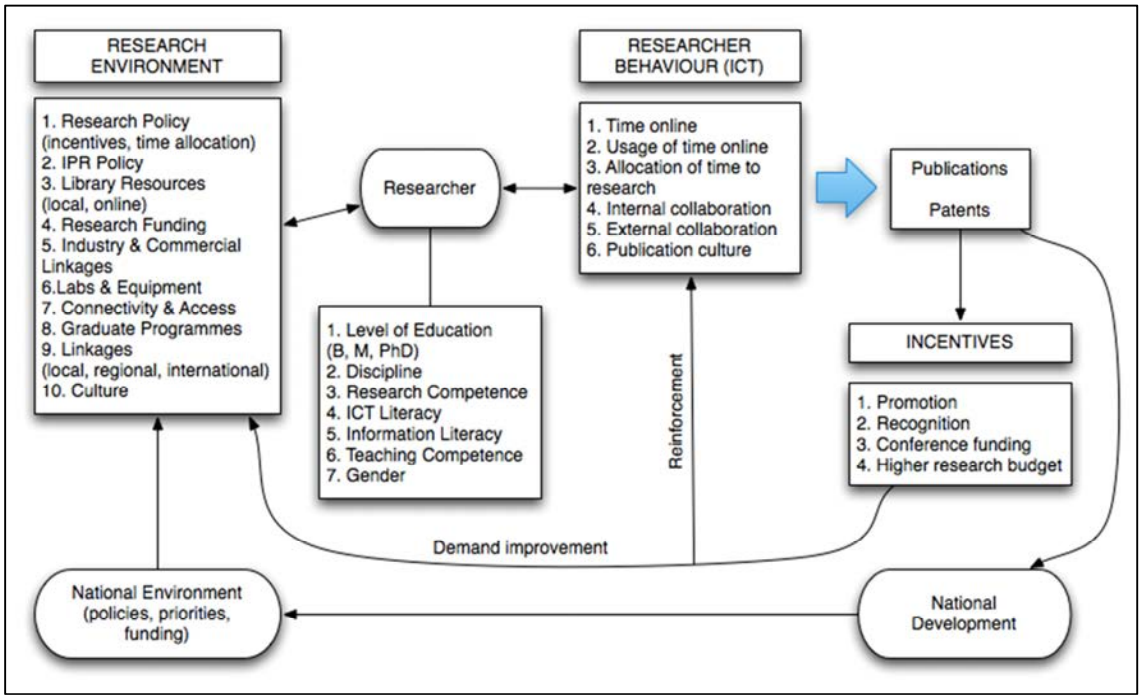

Figure 2: Concept of the relationship between the researcher, researcher behaviour (ICT specific) and the research environment

4.3 Methodology

The stage of research discussed here is the baseline survey and analysis. We created two survey instruments for the baseline study. The individual tool collected individual researcher perceptions about how their institutional environment supported or stifled their research activities, and also solicited data based on which the researcher behaviour could be inferred. The institutional tool collected various types of data about higher education institutions that were NREN members in participating countries, aimed at capturing the research environment.

The resulting instruments were structured and included either single-option or multi-option variables. A 5-point Likert scale was used for responses, and an "other" option provided wherever necessary to capture responses that did not match the structured options. The instruments were self-administered, under the management of a researcher or the NREN CEO in each of the countries that participated.

By the deadline, UA had received returns from five member NRENs out of the eight that had agreed to participate in the survey: the challenge in all cases was the lack of response from both institutions and researchers. Only Ethiopia, Malawi, and Uganda returned sufficient numbers of the individual questionnaires from a sufficient number of universities to assure statistical representation. These three countries were therefore carried forward for the current focus of baseline analysis, with the plan to add more countries during the second round of surveys. All institutional questionnaires from all the countries (Ethiopia, Malawi, Rwanda, Uganda, and Zambia) were however carried into the institutional analysis.

a. Individual Returns

Valid returns were obtained from 271 academic staff of universities: Malawi (66), Ethiopia (140), and Uganda (65). The following major categories, each broken down into sub-categories, were examined through this instrument:

i. Demographic characteristics: gender, age, academic rank; qualification; duration of employment by current institution; main employment assignments;

ii. Research policy: existence and satisfaction;
iii. Sources of research funds;
iv. Library: resources and satisfaction;
v. Laboratories and equipment: sufficiency and satisfaction;
vi. Computers: access, ownership, usage, and applications used;
vii. Internet: access, quality, utilisation;
viii. Conduct of research: individual leadership, volume, time allocation, collaboration;
ix. Research output: type, where published, attitude to creative commons;
x. Barriers to, and motivation for research

b. Institutional returns

Returns were received from a total of 16 institutions: Malawi (3), Ethiopia (5), Uganda (2), Rwanda (3) and Zambia (3). The institutional returns covered the following major categories:

i. ICT in the Institution: ICT support unit, Internet and email access, ICT in education functions, ICT in research, ICT curricula, data and network security
ii. Library: Automation, access to online resources, user training (information literacy);
iii. Research and intellectual property: documentation, dissemination, commercialisation;
iv. Research support services

4.4 Analysis and Findings

4.4.1 Analysis of Individual Returns

4.4.2 Demographic characteristics

The demographic characteristics of the sample for the individual survey are summarised in Table 1.

61% of the respondents had a Masters qualification and only 26% a PhD qualification, a challenge to research capacity. The main assignments of almost all respondents were teaching and research.

4.4.3 Research policy: existence and satisfaction

While we did not specifically look into the content of research policies, 84% of the respondents confirmed that their institutions had research and publication policies. However, of these, 49% indicated that they were not satisfied with their institutional research and publication policies.

Table 1: Demographic characteristics of respondents

Rank	Attribute	Frequency	%-share
Gender	Female	53	19.6%
	Male	214	79.0%
Missing data		4	1.5%
Cumulatively		271	100.0%
Age	Younger than 22	6	2.2%
	22-32	82	30.3%
	33-43	109	40.2%
	44-54	51	18.8%
	55-65	19	7.0%
	Older than 65	3	1.1%
Missing data		1	0.4%
Cumulatively		270	100.0%
Highest degree attained	Bachelors	34	12.5%
	Masters	166	61.3%
Missing data	PhD	70	25.8%
Cumulatively		1	0.4%

		270	100.0%
Academic rank	Professor	7	2.6%
		48	17.7%
	Ass. Professor	38	14.0%
		130	48.0%
	Senior Lecturer	18	6.6%
		6	2.2%
	Lecturer	2	0.7%
		12	4.4%
Missing data	Assistant Lecturer	10	3.7%
Cumulatively		271	100.0%
	Tutor		
	Research Associate		
	Other		
Duration at current academic rank (years)	Less than 1 year ago	45	16.6%
	1-5 years ago	155	57.2%
	6-10 years ago	41	15.1%
	11-15 years ago	9	3.3%
Missing data	More than 15 years ago	13	4.8%
Cumulatively		8	3.0%
		271	100.0%

4.4.4 Sources of research funding

Typically, most respondents (54%) got their research funding from their institutions. While this would normally be a positive indicator, it should be noted that research budgets in these institutions are meagre. International development agencies and charitable foundations, from which a total of 48% get their funding, spend much more in real terms than the local institutions. The result is that the local research agendas are often driven by considerations that are not cognisant of the needs of African countries, are largely managed outside of the developing countries and lack sustainability beyond the foreign support[4].

4.4.5 Library: resources and satisfaction

It emerged that the heavy users of the library resources – using them on a daily basis – use mainly electronic access, pointing to the importance of e-services in libraries. The majority of those who visit the libraries physically tend to do so only once a month (very likely linked to the lending period and number of allowed items). Usage of e-access is still very limited, which is consistent with some of the observations by both Afeworki[5] and Harle[6]. On the other hand there are very few users satisfied with the quality of library e-services. In many of the universities, the services were reported not to be available.

4.4.6 Laboratories and equipment

The majority of the respondents pointed to insufficiency or lack of laboratories and equipment as one of the two biggest barriers to research. This is a challenge that would hit especially the science-based disciplines, keeping researchers out of a lot of the front line research.

[4] Nakabugo, M., Barrett, E., McEvoy, P., Munck, R.,(2010) "Best practice in North-South research relationships in higher education: The Irish African partnership model in Policy & Practice". A Development Education Review, Vol. 10, Spring, pp.89-98

[5] Afeworki P.(2008)"Library resources, knowledge production, and Africa in the 21st century." The International Information & Library Review, vol. 40, issue 4, December, pp 251-256, ISSN 1057-2317, 10.1016/j.iilr.2008.09.006.

[6] Harle, J., "Digital resources for research: a review of access and use in African universities". Issues paper prepared as part of an ACU study of Arcadia, June 2009. www.acu.ac.uk/publication/download?id=173

4.4.7 Computers

Almost 96% of the respondents confirmed having access to a computer/laptop at work. Institutions owned 89% of these computers, pointing to the very low level of ownership of computers. Computers are primarily used for research and teaching, both taking up 62% in almost equal measure as highlighted in Figure 3.

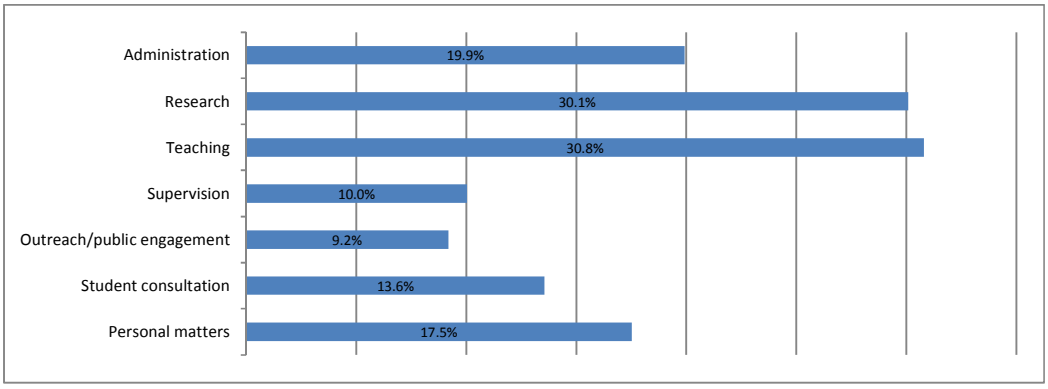

Figure 3: Use of computers/laptops for various functions.

4.4.8 Internet: access, quality, utilisation

Most respondents (77%) indicated that their institutions had a campus network, which they used to access the Internet. Among those with access, 73% access the Internet using a computer/laptop in their office, and 20% shared a computer in a lab or Internet café at the institution. Only 36% of respondents had Internet access at home.

Despite the clearly limited bandwidth available to universities and the generally poor quality of service, only 46% rated the speed of Internet access as slow or very slow; and only 37% had concerns about reliability. This could be because most respondents have not experienced faster speeds or better quality of service, or because they do not use any bandwidth-intensive application or downloads. As can be seen in Figure 4, use of the Internet is still dominated by non-research activities.

Lack of Internet access at home combined with limited ownership of computers discussed earlier will limit the amount of time academics can use to access online resources, especially taking into account time demands by other assignments during office hours.

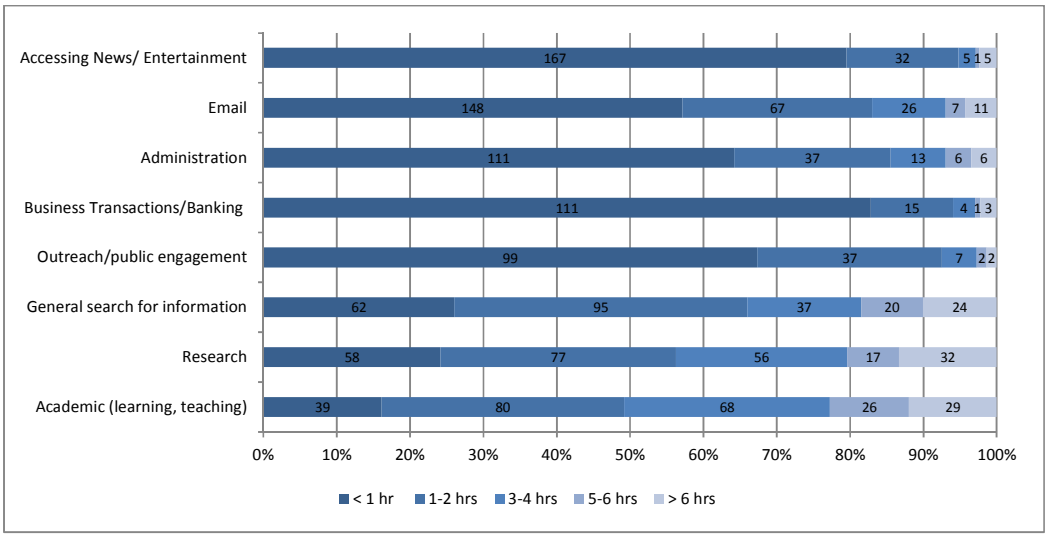

Figure 4: Use of Internet for different activities at educational institutions amongst respondents

4.4.9 Conduct of research

Figure 5 summarises the percentage time spent by respondents on different activities. It is evident that teaching related activities take up most of the time, with only 18.7% of the time allocated to research. While 90% of the responds felt they were giving enough time to teaching, 70% felt they were not giving enough time to research. Sawyerr[7] has also reported the challenge of the limited time spent on research in African universities.

The majority of collaboration activities involve research projects that also lead to joint authoring. Collaboration networks however tend to be generally local, with most researchers focusing on others in their specialisation, in their discipline, in their faculty/school/college, in their institution or in their country. Only 33% of the respondents had collaboration beyond national borders. Cross-disciplinary research, one of the hallmarks of the knowledge society, still remains very limited, with only 24% of the respondents working with researchers from other disciplines.

In their analysis of research within the University of Stellenbosch, Pauw and Imbayarwo[8] highlight the importance of networks to research output, and illustrate the extensive collaborative networks of this university.

Responses indicated that where there is collaboration, the commonest tools are either mailing lists or various online platforms, underscoring the importance of access and connectivity to research collaboration.

[7] Sawyerr, A., (2004).“African Universities and the Challenge of Research Capacity Development.” Journal of Higher Education in Africa, vol. 2 no 1, pp 213-242.ISSN: 0851-7762

[8] Pauw, C., and Imbayarwo, T., (2010)“Tracking Research Collaboration and Research Output in Africa: A Case Study of Stellenbosch University”. African Science Trackers & Stellenbosch University,

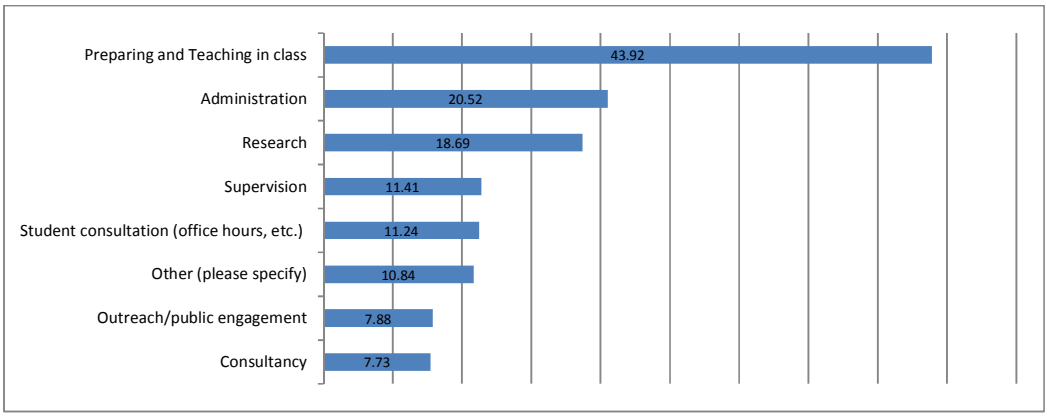

Figure 5: Percentage of respondent time spent on different activities (ranked, weekly)

4.4.10 Research output

The commonest form of research output is a journal article, closely followed by a conference publication. Books, chapters in books, and technical reports are also at a significant level. What is however especially worrying was the number of respondents who reported no output at all. Figure 6, shows the number of respondents (out of the 271) who had not generated any item of research output in the different categories during the previous year. There was only one patent during a period of five years among all the institutions surveyed.

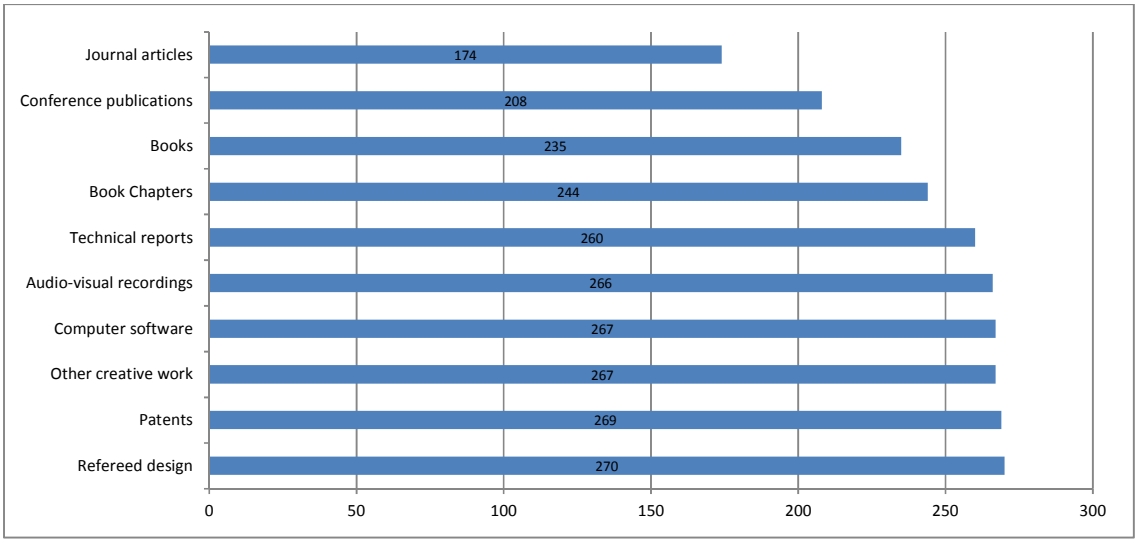

Figure 6: Number of respondents without any output in the indicated categories during the previous year

The choice of publication channel is heavily dominated by funding limitations, visibility within the discipline, promotion policies, and ease and clarity of the submission process. Electronic publishing, which would be comparatively cheap[9] is very limited. Outside other barriers to this, it is very easy to link it to the promotion policies in universities that do not recognise such publications as significant. Most respondents (88%) support open access repositories and 90% would be happy to share their publications free of charge.

[9] The reference to lower cost does not ignore the reality of cost and the other challenges around electronic publishing. See e.g. Crampton, M. and Hulley, F., (2004)"Online Access to the Research Output from and about Africathrough Database Aggregation and Full Text Linking", *NISC Pty Ltd, Grahamstown, South Africa*.

4.4.11 Barriers to, and motivation for research

The majority of respondents (70%) ranked both lack of sufficient time for research and inadequate research facilities/laboratories as the major barriers to research, followed by a heavy teaching load, lack of incentives, and inadequate remuneration (Figure 7). It is clear, considering this finding alongside how respondents spend their time (See Figure 5) that institutions need to critically rethink how best to allocate time for research activities amongst staff expected to both teach and undertake research.

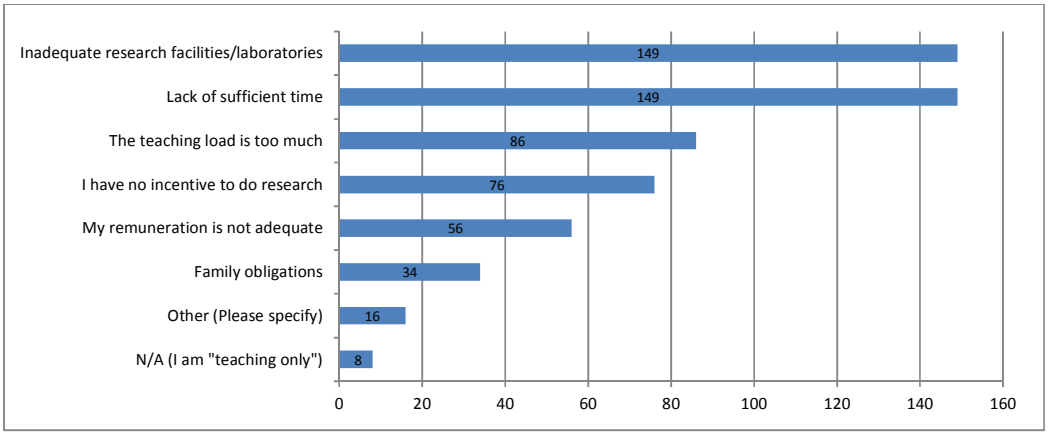

Figure 7: Biggest obstacles to undertaking research (multiple selections, ranked, no. of respondents)

When it comes to motivation for research, figuring out ways to recognize research output (promotions, awards, research funding that is not tied to specific areas, etc.) seems more important than increased remuneration to incentivize research activity as revealed in Figure 8. This echoes findings by Ragasa[10] in the study of research organisations in Ghana and Nigeria.

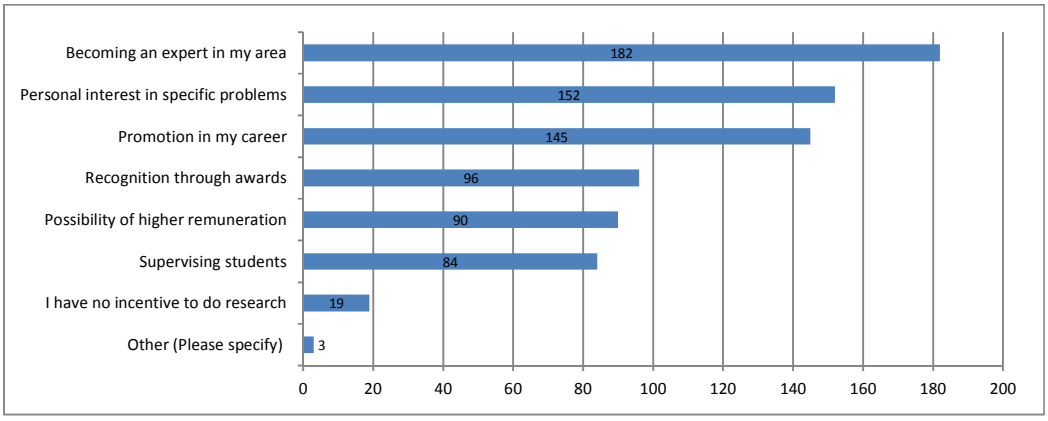

Figure 8: Motivations for research (multiple selections, ranked, no. of respondents)

4.4.12 Institutional survey

4.4.13 ICT in the Institution

In all but 4 of the 16 institutions surveyed, there were more non-academic than academic staff, perhaps indicating a lack of focus on their core mission, and limited or ineffective computerisation in the administrative

[10] Ragasa, C., *op cit*

aspects of universities. This is not what would be expected in a situation where 15 institutions reported integrating ICT within their educational functions and 12 within research as highlighted in Figure 9.

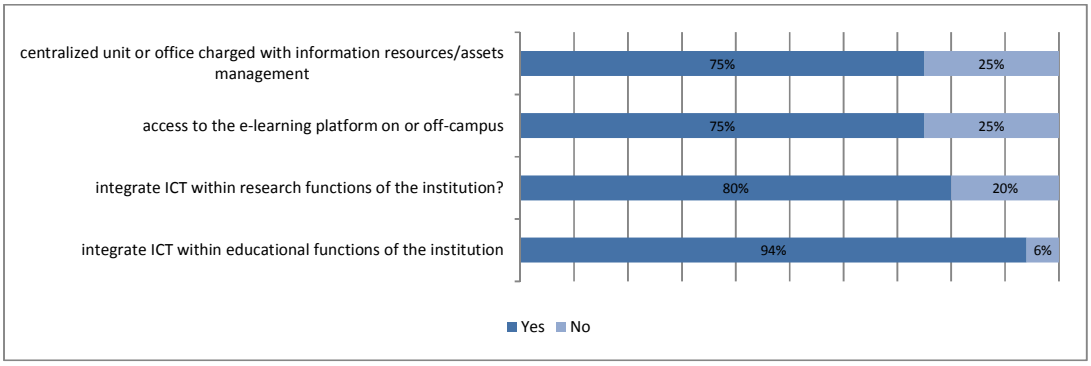

Figure 9: Integration of ICT within institutional core functions

More institutions (12) are adopting a centralised method of information resources/assets management as they increasingly rely on ICT by setting up a unit solely charged with this responsibility. The institutional policy environments however still have to catch up as summarised in Figure 10.

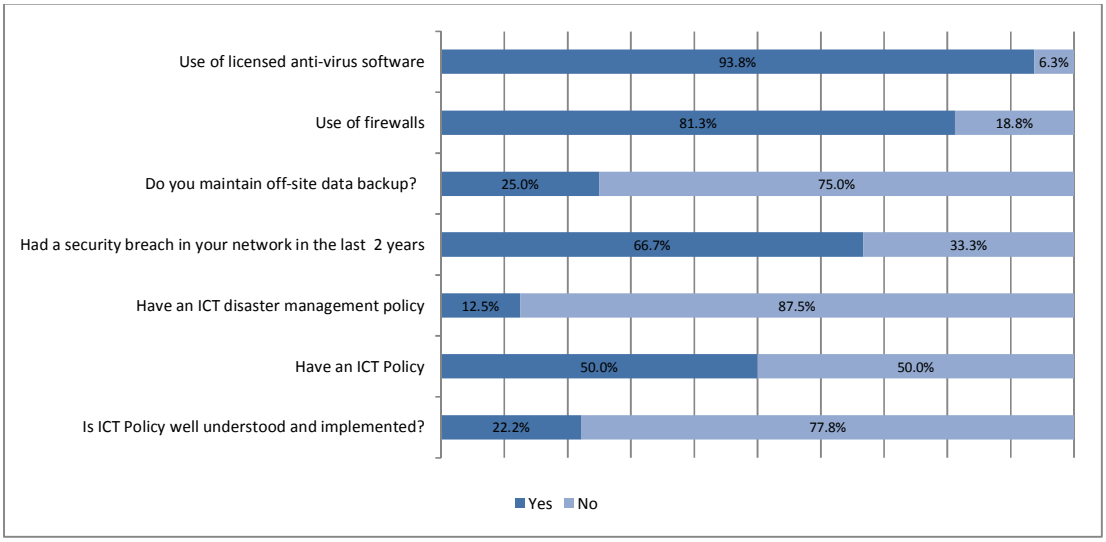

Figure 10: Overview of ICT policy and management practices adopted across institutional respondents

Internet access is still limited. Download capacities ranged from 512kbps to 40 Mbps, and upload capacities from 512kbps to 10 Mbps. Downlink/uplink asymmetry that characterises most Africa institutions is a reflection of the imbalance in intellectual property, with Africa running a very large deficit. Local hosting within institution, while it appears good, has serious drawbacks in a situation where bandwidth is constrained (in this compounded by the smaller uplink pipe). First, all who want to access the website and related resources share the limited expensive bandwidth, constraining it further. Second slow access speed means that the institution is invisible to the world and loses competitiveness. Third is the reality that most of the campuses do not have 24x7 data centres.

4.4.14 Library

All institutions have institutional libraries, but with varying capacity to deliver on their mandate. The first challenge for many libraries is competent leadership - one library reported that they do not have a head. The

second challenge is limited computerisation: only 4 libraries reported having an ICT budget and if it was not donor-funded, then it was really low. Despite the poor funding, libraries have moved to automate key core functions like the OPAC and issue desk.

Information literacy is a challenge that can slow down researchers, and libraries in Africa normally take a lead in developing this among researchers. 5 institutions reported offering no training whatsoever, 8 reported offering in-class training, but in a sporadic manner and only one institution reported taking advantage of the Internet to offer such training to researchers using online techniques.

4.4.15 Research and intellectual property

Documentation of research outputs and dissemination across participating institutions is still very poor. 12 institutions did not have adequate knowledge about recent publications by their own staff, 10 institutions did not know of any recent research recognitions and 5 reported neither. In such an environment, where keeping track of research activity is still a challenge, one can argue that commercialization of any research outputs must still be far off.

Having a good and up to date research database is absolutely crucial in the current environment if universities are to track research, collaboration, and take informed policy and strategic decisions about research: Most universities in the region appear to be steering research totally blindly. The kind of information-rich analysis conducted for example by Pauw and Imbayarwo[11] should be routine for universities in the region.

4.4.16 Impact of access and connectivity on intellectual property output

While this paper primarily presents the baseline study that was aimed at establishing the current status of the research environment, researcher behaviour, and researcher output, we have included this section as a preliminary examination of the relationship between connectivity and intellectual property output. In doing so, we underscore the fact that since there are many other factors that are components of the overall research environment, what is presented here should not be interpreted as conclusive findings: the research environment varies widely from institution to institution, making the interpretation of statistical correlation of impact of connectivity on research output with only one set of data both difficult and inaccurate. This will however be possible for each institution when a time series (surveys over the planned five years) of the data sets is generated, and some of the issues that have emerged from this study are examined further.

4.4.17 Comparison of connectivity

It was noted from that all the respondent institutions have a bandwidth per connected computer that is less than 25kbps. Many have only about 10kbps per connected computer. Even if one takes into account diversity, this is extremely low by international standards and emphasizes the continuing challenge of insufficient bandwidth.

In situations where there is a very high user to available computers ratio, the bandwidth per networked computer might be high, but sharing of access means that actual time online for each user is constrained. It therefore provides a more balanced view of access if the comparator is bandwidth per user, enabling comparison across institutions of varying sizes with varying levels of connectivity. This is illustrated in Figure 11. From this, the institutions with the highest connectivity are respondent 6, the Kigali Institute of Science and Technology (KIST) with 28 Mbps for 233 Academic staff and 3000 students; and respondent 15, Uganda Christian University (UCU) with 32 Mbps for 166 staff and 7800 students.

[11] Pauw, C., and Imbayarwo, T., *op cit*

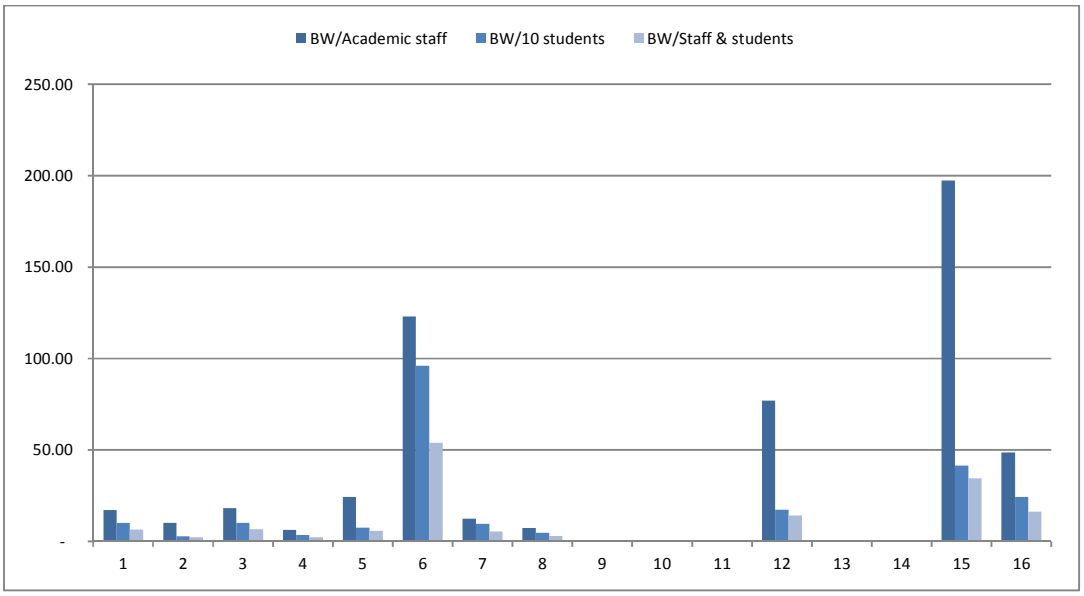

Figure 11: Bandwidth verses number of academic staff and students across participating institutions

4.4.18 Linking per capita intellectual property output to bandwidth

Intellectual property output per capita (publications in the last five years) is still very low amongst participating institutions as summarised in Figure 12. The highest per capita output is from respondents 6, 12 and 16. This is consistent with Figure 11, with the exception of responded 15, the Kigali Institute of Science and Technology that has the highest connectivity but no research output. This is not really surprising: KIST was established as a technical institute, not as a university. While it is apparent that institutions that have the highest connectivity also have the highest research output, we emphasize that this does not validate our claim at this point: it only gives an indication that there could be a correlation between the two.

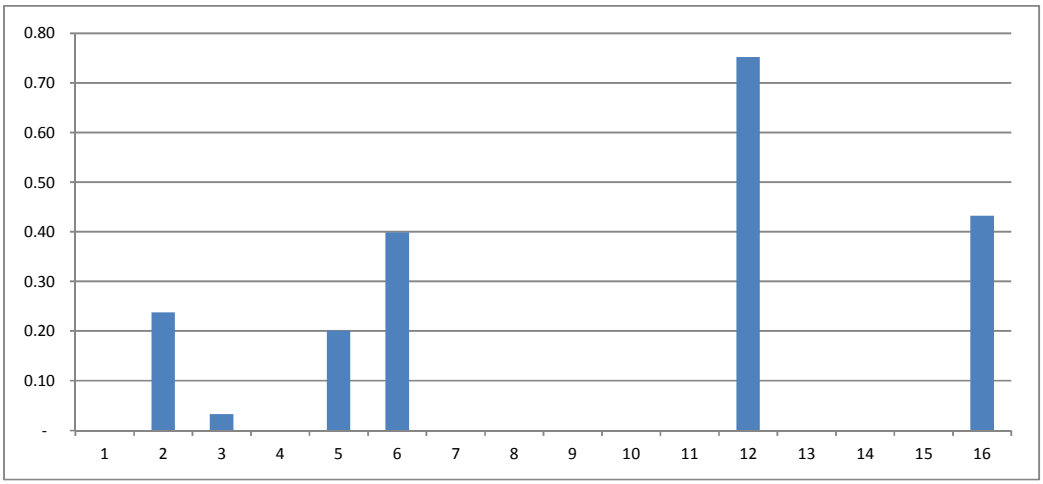

Figure 12: Research per capita (ratio of academic staff to research output) across institutions

4.4.19 Summary: Challenges and Opportunities

We recognise that improving connectivity and access will not have the expected level of impact on research output unless some of the key challenges identified by this baseline survey are addressed. In this section that is aimed primarily at African institutions, we highlight what we consider key challenges as identified in the findings,

and make some suggestions about how these can be converted to opportunities for improving the quantity and quality of research.

Applicability needs to be qualified: we have not, at this point in time, carried out tests of statistical validity, or indeed the level of depth of statistical analysis that would be required for conclusive and generalisable findings. These challenges and opportunities are therefore specific to the institutions and to some extent the countries examined, but they do provide lessons for other institutions and countries.

i. The departure of experienced researchers from universities into the public and private sector reduces research leadership as well as the opportunities for developing research capacity. The limited number of PhDs among the remaining young population of lecturers compounds the situation. On the other hand, the young population of lecturers can be an opportunity for the universities if it is properly channelled, especially when combined with steps to improve the overall research environment as discussed further below.

ii. There are very limited local budgets for research, a finding that echoes results from other sources. This results in research and research agendas that are driven from outside the countries, and not necessarily aligned to the research priorities of these countries. The opportunity for universities facing this challenge is making convincing cases about institutional and national priorities so that funding can be re-focused by development partners to these priorities; and making evidence based arguments (based on survey findings that are more country specific) to national funding sources so that research funding can be increased. Universities must learn to research their research environment, activities, and outputs.

iii. Online library services and resources have become increasingly available to African universities. There is however dissatisfaction among the majority of users regarding the quality of e-services provided by libraries. Leadership is still a challenge for many libraries. It is within the institutional capacity of universities to address these challenges, based on recognition of the importance of online services and competent library staff to the growth of research. The second aspect is objectively examining causes of user dissatisfaction (as opposed to a typical defensive reaction) so that users can increasingly drive services delivery (pull) rather than librarians (push). This should go hand in hand with concerted training for researchers in information literacy so that online research time is more productive.

iv. Laboratories that can support research are insufficient and lack equipment. This is a challenge especially for science-based disciplines. Realism must recognise the fact that advanced research equipment, along with the capacity to maintain and sustain it, can only come in the medium to long term. Connectivity however introduces the opportunity of accessing remote laboratories, especially taking into account the fact that modern research equipment is largely computer driven. This should be combined with specific training in modelling and simulation; an area, which will reinforce advanced research.

v. Access by academic staff to computers, more than 90% of them owned by the institutions, is close to 100%. Internet penetration in universities has also increased, even if it tends to be generally low speed with most universities providing less than 10kilobits per second per capita. Internet access is however heavily dominated by non-research activities. This increasingly high penetration of access and connectivity is an opportunity that still has to be harnessed for productive research. A key factor in doing this will be the incentives tied to research. As noted, the survey revealed that 49% of the researchers are not satisfied with the research and publication policies of their institutions, pointing to an area where changes are likely to have significant impact.

vi. Where there is a strong research culture that needs to be nurtured, the ability to access the Internet for research related purposes has to be a daily 24-hour reality for academic staff. The finding that most researchers have access at their places of work but do not own computers is a gap that needs to be addressed. The approaches used by countries like South Africa and Kenya to provide laptops for teachers[12] can be easily replicated at university level, the driving requirement in this case being increased research output.

vii. Research in the knowledge economy is increasingly defined by inter-disciplinary research as well as research collaboration beyond departmental, institutional, and national borders. The survey findings have revealed that this is still very limited. Research incentives targeted at stimulating interdisciplinary research and collaboration would have a positive impact on this.

viii. Research output, currently, largely journal papers, is still very limited. Universities need to seize on the willingness of researchers to share their research outputs freely as established by this survey to exploit online publishing where the ground is more level for institutions from developing countries. It should be especially noted that cost related to publishing was established as a barrier.

ix. The majority of staff devotes almost all their time to teaching, mainly due to teaching overload. Until institutions achieve a proper balance between time allocation for teaching and research, research output will remain limited. In Norway, for example, the general guideline is that staff should spend 50% of their time on research and 50% on teaching[13]. In many cases, this could be just a case of diverting budgets from bloated administration (as established, 75% of the institutions surveyed have more non-academic than academic staff) to support to the core missions of the universities, enabling the hiring of more academics. Limited computerisation of administrative functions could be one of the factors leading to the staff being dominated by non-core functions: This needs to addressed hand in hand with effective business-process re-design that would lead to a reduction in the number of administrative and support staff.

x. The failure to track research and research data is a major challenge across all the institutions surveyed. Most institutions do not have data about themselves, and where efforts have been made to collect the data, it is not well managed, severely reducing its utility. In addition to this, failure to put any such data online reduces visibility. The implication of this is that the institutions cannot make evidence-based policy and strategy decisions aimed at increasing research output. This is an area of action that should be an easy win for any institution.

xi. While the extent of data, and the ability to which it can be used to give meaningful correlations is still limited, it has emerged in this baseline survey that there might be a correlation between per capita internet bandwidth and per capita research output. In depth statistical analysis as a time-series of data is collected will examine this.

5.0 BUILDING HUMAN CAPACITY

5.1 Rationale

[12] Teacher Laptop Initiative: http://www.teacher-laptop.co.za/#; Department of Education, (2009). *Teacher Laptop Initiative Policy*. Government Gazette No 32007, 8 May 2009; 'Teachers to get laptops with financing under new PPP', CIO East Africa, August 2010, http://www.cio.co.ke/Main-Stories/teachers-to-get-laptops-with-financing-under-new-ppp.html

[13] http://www.eui.eu/ProgrammesAndFellowships/AcademicCareersObservatory/AcademicCareersbyCountry/Norway.aspx

CORENA Phase 1 elicited capacity gaps in the implementation, management, and operation of NRENs. This was the reason why in our Theory of Change in CORENA phase 2, capacity building at both managerial and technical level for the staff of UbuntuNet Alliance and member NRENs was a prerequisite and co-requisite to sustaining an environment in which change can occur. Multiple approaches to capacity building were considered: short, medium, and long term.

5.2 Short to Medium Term Approaches

Short to medium term capacity building approaches were carried out in three forms: NREN twinning and visits; UbuntuNet-Connect Conferences; and training workshops.

a) NREN Twinning and Visits

The approach is that NRENs in Africa form a relationship with peers in other world regions and share experiences as well as build capacity. The first twinning to mature is that between KENET of Kenya and DFN of German. The two NRENs signed an MOU in November 2009 at UbuntuNet-Connect 2009. Staff exchanges have since taken place allowing the NRENs to learn from each other. From UbuntuNet perspective, KENET has learnt a lot from DFN in terms of organization, technology and services.

Similar twinning arrangements have been either planned or discussed between MAREN (Malawi) and HEAnet (Ireland); RENU and SurfNet (the Netherland). Within Africa, KENET and TERNET (Tanzania) have been discussing another twinning arrangement and KENET has provided technical capacity to assist in linking TERNET to the UbuntuNet Routing Hub in London

Staff visits have been another short term approach to capacity building. This has been undertaken by KENET, visiting TENET (South Africa).

b) Training back-to-back and within UbuntuNet-Connect Conferences

UbuntuNet-Connect is the annual conference of the UbuntuNet Alliance. Preceding each UbuntuNet-Connect conference, the Alliance organises a series of capacity building events, especially technical workshops for NREN CTOs drawing on local and international expertise.

UbuntuNet-Connect 2011 was preceded by:

i. AfricaConnect Administrative Meeting was held on 21st November, led by Cathrin Stover of DANTE to look at administrative issues of the project;
ii. AfricaConnect Technical Meeting, held on 22nd November facilitated by Joe Kimaili and Daniel Lete, the project technical personnel to look at the technical aspects of the project;
iii. KENET IT Managers' Meeting;
iv. Pre-Conference Workshop of e-Infrastructures and Research Applications, organized by the EU FP7 CHAIN Project of which UbuntuNet is a Consortium partner;

UbuntuNet-Connect 2010 was preceded by:

i. AfricaConnect Preparatory Meeting was held on 15th November 2010 to refine the activities of the project as it was then hoped that the contract would be signed in December 2010. The meeting was attended by all NREN CEOs;
ii. A two-day Capacity Building Workshop for Technical Managers of NRENs was held on 15 and 16th November 2010. The workshop was facilitated by Ronald Milford and Dale Smith of the NSRC; Erik-Jan

Bos of SURFnet and Andrew Alston of TENET. Network Engineers from member NRENs participated in this training event and reported that it was very useful;

iii. A one-day Executive Development Workshop for Representative Members of NRENs was held on 16th November 2010 targeting CEOs and Representative Members of NRENs. The workshop was conceived after it had been noted that Representative Members and CEOs of NRENs needed a forum to discuss issues affecting NRENs;

and UbuntuNet-Connect 2009 was preceded by:

i. A 4 day hands-on training workshop on Advanced Routing for NREN technical personnel. The Workshop was co-sponsored by ISOC, AAU, and the Alliance. Network engineers from all member NRENs attended. In addition to this workshop, there was a one day training workshop on Grid Computing at Makerere University, facilitated by personnel from INFN, Italy.

ii. The FEAST Workshop was also held a day before UbuntuNet-Connect 2009. The workshop attended by representatives from NRENs, DANTE and the European Commission discussed the draft FEAST final report and presented an opportunity for NREN representatives to fill gaps on their NRENs in the report. The workshop also discussed prospects of AfricaConnect and its requirements. Through the experts available from Europe and the USA, this workshop took time to guide CEOs of NRENs about the approaches to as well as challenges in establishing and operating NRENs and regional RENs.

c) AfNOG Training Sessions

The African Network operators Group (AfNOG) runs annual training sessions on Network Technology. With savings made from UbuntuNet-Connect Conferences, and with the approval of IDRC, the Alliance was able to make available scholarships to Technical Managers to attend these training sessions in 2010 and 2011 in Kigali, Rwanda and Dar es Salaam, Tanzania respectively.

AfNOG 2010 in Kigali gave UbuntuNet Alliance a discount rate of US1500 per participant (from US$2000) and as such scholarships were given to 5 participants from Eb@le, SomaliREN, RwEdNet, MAREN, RENU and RwEdNet were sponsored for AfNOG 2010, and 4 from Eb@le, SomaliREN, SUIN and ZAMREN for AfNOG 2011 (Dar es Salaam).

Participation of UbuntuNet Alliance- sponsored participants at AfNOG training sessions is not only building capacity for the engineers, but has also built human networks in addition to cementing the partnership among the Alliance, AfNOG, and ISOC.

5.3 Long Terms Approaches

Long term approaches to capacity building planned within the framework of CORENA were to work to through supporting the development of potential centers of excellence. Several attempts were made to work with universities through NRENs. These were however not successful because the NRENs themselves are still weak and under-resourced, limiting effective follow-up. The Board of the Alliance discussed the challenge and agreed to defer contact of this nature until a new methodology was developed. While this was not directly carried out under CORENA, this experience led to the recourse to online training approaches that the Alliance is now pursuing (see Training Strategy under AfricaConnect attached as Annex 3).

5.3.1 UbuntuNet Network Engineering Group

The UbuntuNet Engineering Group has been set up to look at the engineering aspects of the network. The group comprises of Technical Managers from leading NRENs. Within the framework of the AfricaConnect project, the team has evolved to look at the different the technical aspects of the project under four sub-teams, namely:

- Point of Presence Standards
- Routing (includes IPv6)
- Network Management Services/ Security
- Services and Applications

The recruitment of a Technical Manager to oversee the implementation of AfricaConnect gives leadership to this group which has expanded beyond representatives of the leading NRENs. The groups both provide input and benefit from peer learning as they address issues around network implementation and operations.

6.0 DISSEMINATION

6.1 Development of a Communication Strategy

The concept of research and education networking and the awareness of the need for NRENs is relatively new in Eastern and Southern Africa. In that NRENs require the support of multiple stakeholders, the need for dissemination cannot be overemphasised. UbuntuNet Alliance has taken multiple approaches to ensure that all stakeholders are aware of the organization as the regional REN and of member NRENs in the respective countries.

The Alliance has developed a Communication Strategy (Annex 4) to streamline dissemination activities and also to properly monitor impact. The strategy was first presented at UbuntuNet-Connect 2011 in Nairobi, Kenya. The Communication Strategy design process identified target audiences for the Alliance, key messages, channels of communication and dissemination and the tools to be used to reach them. The Communication Strategy is being implemented over a period of 2 years, after which it will be revised.

The Alliance relies on three major channels of dissemination: the combination of the website, the monthly e-bulletin NUANCE, and Fliers; the UbuntuNet-Connect conferences; and presentations at international conferences.

The website, www.ubuntunet.net is UbuntuNet Alliance's gateway to the world. The site is rich in information about the Alliance, African NRENs and documentation about general research and education networking. It is regularly updated and receives about 1000 visitors a month. NUANCE, the Newsletter of UbuntuNet Alliance: Networks, Collaboration, Education, is produced monthly and distributed by email to over 1600 readers across the world. It is also available in both English and French in html format on the website. Collaboration is growing with CLARA in South America and DANTE in Europe in sharing articles for newsletters. So far, a number of our articles have featured in DeCLARA bulletin and GEANT Connect bulletin. The Balancing Act picks up material on occasion from NUANCE.

The French version of NUANCE was launched in April 2011 (http://www.ubuntunet.net/february2012_fr) and back issues starting September 2010 have been translated. While it had been expected that the French readership would only grow over a long time, Google Analytics indicate that already one third of readers use the French version. Professor Tiemoman Kone, the President of WACREN offered to and continues to proofread the NUANCE French translation.

The use of social media such as Twitter is becoming more important. The Alliance Twitter account has a small but growing number of followers.

The UbuntuNet also produces a flier that is updated and produced for distribution at conferences and meetings. For broader understanding of the Alliance, *What is UbuntuNet* booklet is also distributed to partners. Electronic versions of all disseminations materials are available for download from our website.

The Alliance used part of the support from IDRC (under the consultants budget line) to hire a Research Assistant for three months to generate an interactive map that shows, for the first time, the graphical data on Intra-Africa optical fibre cables combined with the fibre to Africa, both in pdf and Google Earth (.kml) versions. This can be viewed and downloaded from http://www.ubuntunet.net/fibre-map. The map receives many hits. A new contract was drawn and signed with the developer in December 2010 to update the Intra-Africa Fibre Map: The idea is to make the map more detailed and fully interactive with more information layers.

6.2 UbuntuNet-Connect Conferences

Since 2008, when the first conference was held in Lilongwe, Malawi, UbuntuNet-Connect has grown and become a major African event where research and education networking issues are discussed. The conference draws participation from major stakeholders in the region and as from Europe and North America. The current focus of UbuntuNet-Conferences is building capacity and insight into opportunities and challenges for NREN establishment and growth in Africa. Three others conferences have been held since 2008: 2009 in Kampala, Uganda; 2010 in Johannesburg, South Africa; and 2011 in Nairobi, Kenya. These are detailed below.

In June 2011, proceedings of the conference were assigned the number ISSN 2223-7062, starting with the peer-reviewed papers for the 2010 conference (see http://www.ubuntunet.net/ubuntunet-connect_2010_proceedings or Annex 5)

These Conferences have provided the host NRENs with wonderful opportunities for raising visibility. Commercial sponsorship grew from $30,000 in 2009 to $45,000 in 2010 to $67,000 in 2011.

6.2.1 UbuntuNet-Connect 2011

Hosted by KENET, the conference was a huge success with participation from all member NREN countries, Europe, West Africa, the Middle East and Asia (see Conference Report, Annex 6. The event received support from Soliton Telemec, Frontier Optical Networks Ltd, Lantec, Sight and Sound ltd., Safaricom, Cisco, WIOCC, JTL, Alcatel Lucent, Dimension Data, Jomo Kenyatta University of Science and Technology, contributing a total of US$67,000. The Conference Committee received 23 papers, 12 of which were selected for presentation through peer review. The Conference attracted 128 participants and was opened by the Dr Salome Gichura, representing the Kenyan Minister of Education.

6.2.2 UbuntuNet-Connect 2010

UbuntuNet-Connect 2010, with 78 participants, was hosted by TENET, the South African NREN and had participation from the African Union, Regulators from the region, African NRENs, WACREN, AAU, European NRENs, DANTE and Internet2. Mrs Vera Brenda Ngosi, Director of Human Resources, Science and Technology at the African Union Commission attended the conference, giving it a high profile at continental level. The conference raised US$45,000 from sponsorships from Cisco, Juniper Networks, SEACOM, Mweb. For the first time, papers presented at UbuntuNet-Connect were peer reviewed and 5 full papers were accepted.

6.2.3 UbuntuNet-Connect 2009

UbuntuNet-Connect 2009 was hosted by the Research and Education Network of Uganda, RENU. The Conference was officially opened by the Ugandan Minister of ICT Dr Aggrey Awori. The Swedish Programme for ICT in Developing Countries (SPIDER) became a co-funder through providing travel fellowships for participants from Africa. Commercial sponsorships generated $30,000 for the NREN and the Alliance. 105 participants registered. (Annex 7

6.3 Presentations at International Conferences

Dissemination of CORENA and broader UbuntuNet activities has also been achieved through representation and presentations at conferences and meetings that have included the following:

i. Tusu made a presentation of the Alliance and AfricaConnect to a Conference of the Sharing Knowledge Foundation in Valetta, Malta, 5 – 8 May 2011
ii. Tusu made a presentation, "Research and Education Connectivity – Unlocking the Intellectual Potential of Africa" to the UNESCO Broadband Commission, 27 June 2011, Paris
iii. Tusu made an extended presentation, "Research and Education Connectivity – Unlocking the Intellectual Potential of Africa" to the African Education Summit, 12 – 13 July 2011, Rabat, Morocco. http://www.ubuntunet.net/sites/ubuntunet.net/files/tusu_africa_education_summit.pdf
iv. The Alliance led a one day workshop focusing on research and education networking and e-infrastructure generally, content networks, and applications on 12 May 2011 during IST-Africa 2011, Gaborone, Botswana.
v. Tiwonge made a presentation on e-Infrastructure for Climate Change Research in Sub Sahara Africa at the Conference on the Role of e-Infrastructures for Climate Change Research 16-20 May 2011, Trieste, Italy (http://cdsagenda5.ictp.it/askArchive.php?subtalk=1&base=agenda&categ=a10141&id=a10141s2t21/slides)
vi. Tusu, Tiwonge Banda, and Margaret Ngwira, together with Dr Boubakar Barry of AAU including other WACREN people participated remotely using their local World Bank Video Conferencing facilities of AAU Internet2 Spring meeting, Arlington, Virginia, 18-20 April 2011. The session was entitled African Regional Research Networks: Creating Intra-African and Global Connectivity and Linkages, http://www.ubuntunet.net/april2011#green
vii. Euro-Africa-ICT Week, Helsinki, Finland, December 2010: F.F. Tusubira, Margaret Ngwira and Tiwonge Banda attended this event. F.F. Tusubira gave a presentation on shaping the NREN Landscape in Africa – the UbuntuNet Alliance. Margaret Ngwira chaired a Session on Harnessing on European NRENs – Best Practices.
viii. The Alliance Chair, Prof Z D Kadzamira and the CEO, Tusu, participated in a Consolidative Meeting to address issues of collaboration and communication aimed at accelerating African Research and Education Networking, held in Accra, 19 October 2010.
ix. 2nd ERINA4Africa Workshop, Lilongwe, Malawi, October 2010: UbuntuNet Alliance as partner in the EU FP7 project organised this 2 day workshop which looked at e-Infrastructure Applications of the Future.
x. Zimbabwe Vice Chancellors Meeting, September 2010: Professor Zimani Kadzamira and Dr Duncan Martin attended this meeting and presented the Alliance.
xi. Margaret Ngwira and Meoli Kashorda attended the East African Higher Education and ICT Symposium in Kampala, Uganda on 27 - 28 June 2010
xii. Margaret Ngwira and Tiwonge Banda remotely participated in the TNC2010 in Vilnius on 2 June 2010
xiii. Iman Abdelrahman (Board Member and Vice Chair) represented the Alliance at the AfREN meeting in Kigali on 29th May 2010
xiv. Tusu, Margaret Ngwira, Duncan Martin, Tiwonge Banda attended the IST-Africa Conference 2010 including full day REN Workshop for AfricaConnect in Durban on 19-21 May 2010 http://www.ubuntunet.net/istafrica2010renworkshop
xv. Tusu and Andrew Alston (then CTO, TENET) attended the Internet2 Spring Meeting in Arlington Virginia on 26-28 April 2010 as part of a Session proposed by the Alliance. The Session was well attended and very well received. The Moderator was Heloise Emdon of IDRC
xvi. Margaret and Tiwonge attended various events on behalf of the Alliance, particularly in relation to the EU FP7 ongoing and new projects: they both attended the 4th GLOBAL Consortium Face to Face meeting on 14-15 September in London in 2010, and Margaret attended the 7th EuroAfrica-ICT

Concertation in Brussels on 1 October 2009 followed by the ERINA4Africa kick off meeting in Brussels on 2nd October 2009. Tiwonge made a presentation at the Conference on the role of e-Infrastructures on Climate Change Research which was held ICTP, Trieste on 16-20th May 2011 http://www.ubuntunet.net/may2011#climate.

xvii. Margaret made presentations at the RUFORUM (Regional Universities Forum for Capacity Building in Agriculture) Annual General Meeting in Mombasa 26 to 28th August and Meeting of Pro-Vice Chancellors and Deans held at the Serena Beach 31 August to 4 September 2009. Working Together to Harness ICT for Effectiveness in Universities: UbuntuNet Alliance, the NRENs and RUFORUM Universities http://www.ubuntunet.net

xviii. Tusu, Duncan, and Margret participated in the Acacia Research and Learning Forum, Dakar, Senegal. This was a major IDRC event bringing together partners from various networks to participate in the evaluation of the networks from the point of view of outcomes; and to develop new skills in a peer learning environment.

xix. Tusu and Iman participated in a meeting of the proposed West and Central African Research and Education Network as resource persons sharing the experiences and challenges of the Alliance and giving guidance. This was followed by participation in Open Access 2009, hosted by GARNET, the Ghana Research and Education Network (also in formation). http://www.wideopenaccess.net/files/WACREN-2009-11-01-Ubuntunet-Alliance.pdf

xx. Participation (including a presentation) by the CEO and Head of the Secretariat in the FEAST meeting in Brussels: an official announcement was made about the approval of FEAST report and its recommendation for Africa Connect.

xxi. Participation and presentation on Transformational Information & Communication Technology in African Higher Education by the CEO in the African Grant Makers Affinity Group (AGAG) Annual Retreat, which, through a side meeting set by PHEA, led to the $135,000 grant reported earlier.

xxii. Participation by the CEO in a panel led by the Partnership for Higher Education in Africa at the African Studies Association Annual Conference in New Orleans.

6.4 Annual Reports

Annual Reports are a vital part of every organisation's management system, giving an insight into the welfare of the organization.. The Alliance Annual Reports from 2006 are available at http://www.ubuntunet.net/annual_reports . For the first time, a printed version of the 2010 Annual Report was produced and is included as Annex 8.

7.0 POLICY ADVOCACY

Under Policy Advocacy, the original intent was to have in-country workshops focused at countries where NRENs were experiencing policy and regulatory barriers to their operations. During the meetings of NREN CEOs in Nairobi (Sept 2009) and Kigali (April 2010), it was agreed that a more direct approach be adopted: A database of the key people who influence policy and regulation that impact on NRENs has been compiled for the countries of the member NRENs. Working with the AAU, the first customized letter was addressed to the ministers responsible for education by the AAU Secretary General, detailing Africa Connect and the requirement for formal government recognition of NRENs. This was amazingly successful in all the member countries, except Tanzania and South Africa, both of which still have complex situations.

The next target was international gateways and transit traffic for other NRENs: again working with the AAU, communication was sent to the Regulators copied to others captured in this database. This spelt out the kind of license or authorisation required for NRENs to participate effectively in a regional network, with direct mention of

AfricaConnect. This has already enabled member NRENs, except EthERNet, RwEdNet, and Xnet to get the required authorisation. The exercise will continue, focusing on each country where there are licensing challenges.

The Alliance and member NRENs maintain close relationships with National Regulators. These relationships are at various levels with some having them at NREN boards while others are getting financial support from them. Regulators are also invited to UbuntuNet-Connect conferences.

Current contacts with governments go beyond enabling policy and regulation to advocating active financial support through citing what other countries in the region are doing.

8.0 FULFILLMENT OF OBJECTIVES

The purpose of CORENA was to enable the integration of African universities and research institutions into the global research and education community through the provision of intra-African connectivity as well as access to sufficient and affordable international bandwidth. The specific objectives of this research as part of Phase 2 were three and their fulfillment is described below.

Objective #1

To make a well-researched case for increasing investment for research and education networking by demonstrating the veracity of our hypothesis

As stated earlier, this is a long term objective that goes well beyond the current phase of IDRC funding, and cannot be reported conclusively in this report. Nevertheless, examination of what are early results provides some interesting revelations as outlined in Section 3 of this report, including the preliminary establishment of the relationship that universities with higher per capita bandwidth are the same as those with higher per capita research output. A causal relationship cannot however be claimed without additional data that will be provided y the subsequent surveys.

Objective #2

To enable the implementation of sustainable approaches to capacity building for RENs

This was an attendant objective: the delivery of bandwidth at low cost is not sufficient – there must be assured availability and the necessary support, which requires competent skills to operate and maintain the networks. It is a pre-condition to the proper evaluation of impact of availability of sufficient and affordable bandwidth. Capacity building at technical and managerial level has been core to the activities of the Alliance.

The initial approach was the engagement of universities within the member NRENs in order to guide in the review of curriculum and establishment of centers of excellence that would assure the continuous production of human resource f the right caliber. The response of the universities was however very slow. Recognising the challenge of cost, the Alliance has moved on to developing a training programme based on using online interactive methods (audio-visual, but not full video) that recognize the limited bandwidths available to most institutions. These will run on a monthly basis starting March 2012. They will initially focus on NREN staff, but will gradually expand to training the staff of individual institutions. Initially, the content will address the immediate practical capacity needs for rolling and out and operating advanced network. In the future, this will move to addressing fundamentals and certification.

While a great deal of energy has gone capacity building for Technical Staff, a stimulating and energetic workshop for NREN Managerial Staff was held as an adjunct to UbuntuNet- Connect 2010 in Johannesburg: The Executive Development Workshop, with a target Audience: Chairs of Boards, CEOs and Board Members of NRENs. It was reinforced with a session during the main conference.

Objective #3

To document and disseminate best practices in the implementation of effective research and education networking, especially in a developing context

The Alliance has developed "How To" toolkits and will continue developing these based on the surveyed needs of the African NREN community (See http://www.ubuntunet.net/how-to The annual conferences, UbuntuNet-Connect, have always included sessions aimed at sharing best practices. This has gone beyond the technology side to important topics like strategic communication. In addition to a presentation at UbuntuNet-Connect 2010, (http://www.ubuntunet.net/sites/ubuntunet.net/files/tusuuc2010.pdf), the Alliance has developed a communication strategy (see Annex4) that will be shared as an example with the NRENs.

9.0 PROJECT MANAGEMENT

The original Memorandum of Grant Conditions (MGC) for CORENA Phase 2 was signed on 14 August 2009 with University of Malawi and the project is undertaken in collaboration with UbuntuNet Alliance. The MGC was amended in April / May 2010 to reflect the requirement for technical and financial report every 6 months until the end of the project (Attachment B: Schedule of Project Milestones). Following the submission of the second financial and technical report submitted in February 2011, an amendment was made in May 2011, extending the completion date of the project to 14th February 2012 (Section 5 and Attachment B).

The project was implemented by UbuntuNet Alliance staff and in some instances consultants were hired to carry out specific activities. A few approved changes were made from the original plan and they are reported in respective sections.

10.0 PROJECT OUTPUTS

The specific outputs have been detailed under the detailed discussion of the objectives of the project (Sections 3 – 8).

11.0 PROJECT OUTCOMES

IDRC support within the framework of CORENA enabled UbuntuNet Alliance to register many other success stories that were not directly supported by the grant. The Alliance has grown as an organization and as a service provider, and has also attracted funding support. Some highlights elaborated in the following sections.

11.1 Growth in Membership

Since the kick-off of CORENA, three more NRENs joined UbuntuNet Alliance. SomaliREN (Somalia) joined in November 2010; EthERNet (Ethiopia) joined a month later in December 2009. In October 2010, Xnet, the Namibian NREN became the 13th NREN and announced at the UbuntuNet-Connect 2010. The rest of the members are committed to UbuntuNet Alliance; they pay their annual membership fees and participate in various activities, including the annual Council of Members Meeting.

There are NRENs in formation in Mauritius and Zimbabwe, with contacts in Botswana, Lesotho, Swaziland, and Angola at a more nascent stage.

11.2 Services to NRENs

The UbuntuNet Alliance network is now the most peered network on the African continent, boasting 480 autonomous system adjacencies. Major infrastructure is in London and Amsterdam. The UbuntuNet Routing Hub established in London is critical and central to the services offered by the Alliance to member NRENs. It has been operational since January 2008 and has undergone several upgrades to keep up with growing traffic. A major asset at the London Hub is a router that was a donated by Cisco Systems. A second point of presence in Europe was established in Amsterdam around mid 2011 to provide redundancy. The London Hub connects to GEANT at 20Gbps, and GÉANT provides up to 5Gbps transit to other regional RENs around the world.

The Alliance now offers the following services to member NRENs:

- Backbone connection service, interconnecting any member NREN with all other NRENs in eastern and southern Africa, enabling regional collaboration and the sharing of applications and content resources;
- Intercontinental connectivity service, providing intercontinental connectivity (between Africa and Europe) to either the London or Amsterdam Alliance Gateways;
- Regional gateway services, providing interconnections with local Internet service providers ("ISPs") that permit any UbuntuNet NREN to exchange Internet traffic with ISPs in the region; and
- Rest-of-World gateway services, providing Internet interconnectivity in both directions to GÉANT and through that to the global to research and education networks worldwide; and second, connectivity to the commodity Internet worldwide.

11.3 Financial Sustainability

There has been a significant increase in revenue for services offered, and the Alliance is on couse to reach financial sustainability by the end of 2013 as projected.

Figure **13** below shows the increase in UbuntuNet Alliance income in relation to the annual budget over the years. This is income raised from sources other than grants – this includes annual membership fees, time spent on funded research projects and service charges.

11.4 AfricaConnect Project

The UbuntuNet Alliance Membership Region was identifed for the AfricaConnect Project because of its state of readiness, enabled by IDRC support for CORENA Phase 1. The AfricaConnect contract was signed during May 2011. This €14.8 million 4-year project will build the regional research and education network in East and Southern Africa interconnecting researcher through their NRENs and connect them to GÉANT. The EU will fund 80%, and the African partners will contribute 20%.

The project is currently at connectivity and equipment procuring stage. Further details about the project are available at www.africaconnect.eu.

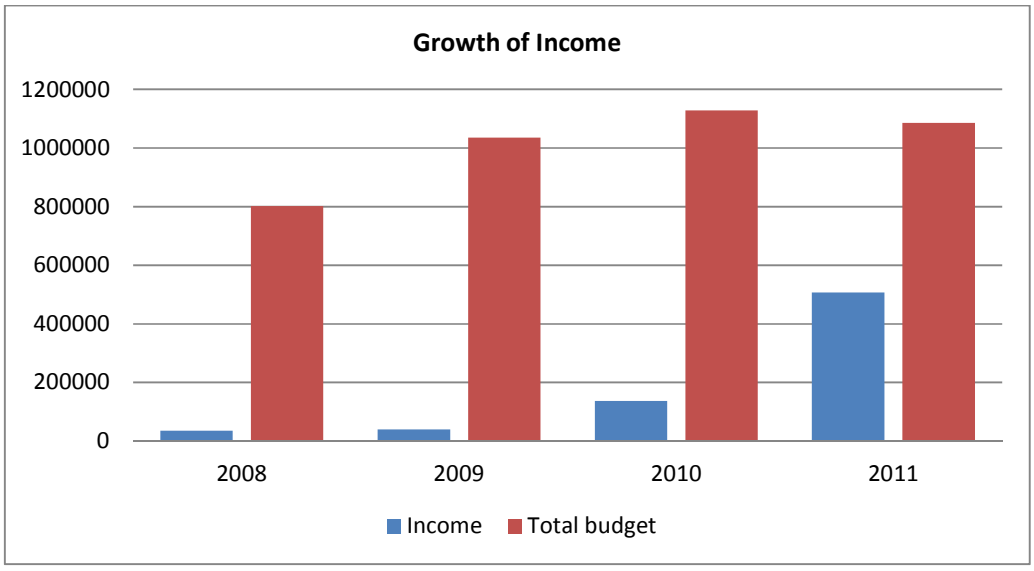

Figure 13: Growth of income in relation to budget

11.5 EU FP7 Projects

Since 2008, UbuntuNet Alliance has been participating in European Union 7th Framework Programme (EU FP7) projects. The projects have enabled the Alliance to interact with other international projects and start stimulating the development of communities that will use for the regional network.

Currently, the Alliance is involved in the CHAIN project: Coordination and Harmonisation of Advanced e-Infrastructures (www.chain-project.eu). The project aims to coordinate and leverage recent efforts and results with a vision of a harmonised and optimised interaction model for e-Infrastructure and specifically Grid interfaces between Europe and the rest of the world. The project will elaborate a strategy and define the instruments in order to ensure coordination and interoperation of the European Grid Infrastructures with other external e-Infrastructures.

The Alliance has in two other consortia and submitted two more EU FP7 proposals, eI4Africa and CHAIN-REDS, and the latter has been identified for possible funding.

Previously, the Alliance participated in ERINA4Africa (www.erina4africa.eu) and GLOBAL (www.global-project.eu) projects. ERINA4Africa, a 1 year project mapped Africa's e-Infrastructure potential for boosting research and innovation. The GLOBAL project was a 30-month project that build the Virtual Conference Centre (VCC), by using advanced communication technologies and concepts to support the promotion of e-Infrastructure topics in the world. The main goal of GLOBAL was to allow and help research projects to disseminate their results and training events to a wider audience located in multiple geographical locations through the support of virtual community building and the organisation of virtual conferences.

11.6 Global Recognition

The global recognition of the UbuntuNet Alliance as a key driving force in the developing of research and education networking in Africa: the Alliance has led the formation of NRENs in its membership region and also played a major role in the formation of the West and Central African Research and Education Network. The two, working together as well as with the Arab States Research and Education Network, ASREN, will extend REN activities and connectivity to the whole of Africa.

11.7 Education Rates for Access to Marine Fibre

The acceptance of discount rates for research and education networks by the major cable providers, leading to an increase in international connectivity for NRENs from less than 800Mbps in 2005/6 to about 14Gbps now, and at prices that are now typically below $500 per full duplex Mbps per month.

11.8 National, Regional, and Global Awareness about Challenges to RENs in Africa

This increased awareness has been a contributing factor to the following:

a) The stimulation of external funding for research and education networking in Africa through creating higher international visibility of the challenges. While direct attribution is not claimed, we believe the work of the Alliance through CORENA has contributed to the increasing support to NRENs by the World Bank (Kenya, Tanzania, Mozambique, Rwanda) and bilateral development agencies like NUFFIC (now supporting ZAMREN in Zambia).
b) The trends revealed by the baseline research results will start having a transformative impact on in-country investment into ICT facilities and internet access in universities and research institutions;
c) The growing human networks that come out of the joint training workshops and AfricaConnect is fast becoming a critical, though largely invisible player, in shaping the REN landscape in Africa;

12.0 OVERALL ASSESSMENT AND RECOMMENDATIONS

From the perspective of the Alliance, CORENA is running successfully, and the specific objectives expected of the IDRC funding for Phase 2 have been achieved. We however recognize that data collection from institutions has taken longer than expected, but this has not impaired the overall research direction and objective.

The major achievements are at the outcome level as detailed above: based on this we can definitively state that IDRC support for CORENA Phase 2 has achieved much more than we planned for.

The key recommendations are for the action of the Alliance:

a) Review the survey instruments, and organize focus groups if necessary to address some of the gaps identified;
b) Develop a strategy for working with NRENS to address the major gaps noted with regards to supportive research environments and management of research output in academic and research institutions.