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# Higher Education in Africa Phase III: Identifying Successful Regional Networks & Hubs

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**Overview**

This paper is the third in EPAR's series on Higher Education in Africa. Our research tasks in this phase build on Phase I, in which we sought to identify measurable rates of return on tertiary agricultural education in Africa and describe the current state of African higher agricultural education (HAE), and Phase II, in which we identified countries' experiences with national higher education capacity building through partnership building, cross-border opportunities such as 'twinning,' and various retention and diaspora engagement strategies.

In this phase we discuss successful regional education models, particularly in Sub-Saharan Africa. We have organized our findings and analysis into three sections.The first section organizes the literature under categories of regional higher education models or 'hubs' and discusses measurement of the regional impact of higher education.The second section provides bibliometric data identifying academically productive countries and universities in Sub-Saharan Africa.The final section provides a list of regional higher education models identified in the literature and through a web-based review of existing higher education networks and hubs. We also include a list of challenges and responses to regional coordination.

**Approach**

We have identified several regional higher education models through a web-based literature review. We searched for peer-reviewed journal articles using Google Scholar and the University of Washington Library system using phrases such as "top universities Africa," "higher education impact," "transnational higher education Africa," "regional hubs higher education," "quality assurance education," "regional education network". We used the bibliometric database Scopus to conduct an analysis of research output by countries and institutions in Sub-Saharan Africa, following Greg Traxler's (2011) methodology and updating his bibliometric analysis of South Africa.

**Background: Hubs as a Regional Education Model**

As higher education institutions increasingly pool their resources to establish regional or subregional *centers of excellence*, the concept of educational hubs is a common theme in the higher education literature (Knight, 2011; Dessoff, 2012; Ho Mok, 2011). The term 'hub' typically refers to a government ministry-led effort to signal global competitiveness and attract international students and capital. However, regional cooperation and capacity building is not always facilitated by a government planning agency. A centrally coordinating university, inter-governemental organization, or facilitating nonprofit organization can also serve as the driver of regional cooperation and foster the "crucible within which more dynamic and open higher education institutions can be forged, both responding to and shaping developments in the wider society" (OECD, 2007).

We have identified three conceptual categories of regional education networks with hubs, each with unique characteristics and potential lessons for the development of higher education networks in other regions. We briefly discuss each category before listing illustrative institutions or organizations and extracting best practices.
The three categories of hubs we identify are listed below and summarized in **Figure 1**.

- **High-Producing University Hubs**
- **Facilitated Network Hubs**
- **Branded Hubs**

Note that these categories are not mutually exclusive. For example, the University of Capetown is a high-producing university (first hub type) that also engages in several facilitated networks (second hub type).

**Figure 1: Hub Categories and Characteristics**

| | Intention | Defining Characteristics |
|---|---|---|
| **High-Producing University Hubs** | Universities with high research output and quality that **organically attract partnerships** with smaller local universities and high-producing foreign universities, making them *'de facto'* hubs. | • High-quality research output<br>• Well-funded<br>• Usually centrally located in region of influence<br>• Most commonly host post-graduate programs |
| **Facilitated Network Hubs** | Regional organizations, inter-governmental organizations, NGOs, research centers, or universities that **intentionally facilitate coordination** among members organizations | • Facilitate policy forums, dialogues, and exchanges, both in-person and virtually<br>• Promote knowledge sharing and research collaboration<br>• Standardize curricula and quality assurance |
| **Branded Hubs** | Education and economic development government ministries in coordination with private interests that intentionally develop international branch campuses. Governments adopt policies to attract and retain international students in order to signal **global competitiveness** and create **knowledge economies.** | • High-level government support and funding<br>• Bounded geographical area of many universities<br>• Marketing to attract foreign students and international branch campuses<br>• Commercialization of education by private universities |

**Section I: High-Producing University Hubs**

Institutions with high research productivity and regional prominence can, in effect, serve as a *de facto* hub for the region's academic activities. These institutions draw students and faculty from the surrounding region, attract research partnerships from less prominent regional schools, engage in international collaboration, and provide degrees, jobs, and economic spillover effects to the region. Despite their central role to the region, the universities themselves do not necessarily self-identify as a hub, nor are they necessarily the center of a facilitated network hub (discussed below) approach to regional higher education capacity. These universities become hubs organically as a result of their high research productivity and prominence and provide the majority of post-graduate education. These universities often engage in regional networks in which the other members benefit from a relatively highly productive university.

Identifying High-Producing Universities

Methodological approaches to measure the impact of universities and regional higher education models include bibliometric analysis, expert reviews, rates of return, case studies, surveys, analysis of competition for funds, retrospective analysis, webometric analysis, and faculty quality measures (Goldstein & Renault, 2004). Traditional indicators of higher education institutional quality were focused on educational activities and research and development *expenditures* but have more recently shifted to include measures of research *production and quality*. Few indicators take into account the national or regional relationships of universities. However, researchers are increasingly attempting to measure these relationships to better understand student and faculty flows and to design educational policies that facilitate research collaboration (Seeber et al., 2012).

A U.S. study found that research productivity and the number of academic awards are a more significant predictor of the universities' regional impacts than the number of degrees awarded, teaching quality, and other 'milieu factors'(Goldstein & Renault, 2004). A high number of degrees awarded may potentially oversaturate the labor market, while academic awards and publications are more significantly related to knowledge spillover and increased productivity.

In this section we use bibliometric analysis, webometric analysis, indexes, qualitative methods, and a network analysis framework as approaches to identify high-producing university hubs that may have the potential to serve as a regional catalyst for higher education.

Identifying High-Producing Universities in Sub-Saharan Africa through Bibliometric Analysis

Our bibliometric method is modeled on Traxler (2011) and updates his bibliometric analysis on Sub-Saharan African countries from 1997-2009 at the country level for Agricultural and Life Science research output. In addition, our analysis identifies the top-producing university hubs in the ten countries with the highest research output.
We used the bibliometric database Scopus due to its top-rated access to life science journals and articles and its country-specific search functions. We analyzed forty-nine countries in Sub-Saharan Africa (SSA) from 1997-present (February 2013),[1] examining three bibliometric classification categories:

- **AGRI** (agricultural and biological sciences): 64,748 total citations
- **BIOC** (biochemistry, genetics, and molecular biology): 28,679 total citations
- **TOT**-(total article counts among all countries selected): 266,876 total citations

*Country Level Bibliometric Analysis*
**South Africa** by far contributes the largest number of academic citations across all three categories analyzed (37% of AGRI, 42% of BIOC, and 45% of total citations), accounting for almost half of all Sub-Saharan Africa citations. **Nigeria** and **Kenya** contribute the next highest number in each category, and the three countries together, which we have labeled "high producers," account for 62% of AGRI, 68% of BIOC, and 66% of total citations in Sub-Saharan Africa. **Figure 1** illustrates the top six most academically productive countries in Sub-Saharan Africa. For a full list of figures by country, see **Appendix 1**.

**Figure 1: Bibliometric Analysis of AGRI, BIOC, and TOT (total) Article Citations in SSA by Country, 1997-2013 (present)**

| Country | Agricultural and Biological Sciences (AGRI) | Pct SSA total | Biochemistry, Genetics and Molecular Biology (BIOC) | Pct SSA total | Total Citations per Country | Pct SSA total |
|---|---|---|---|---|---|---|
| South Africa | 23769 | 36.71% | 12074 | 42.10% | 120928 | 45.31% |
| Nigeria | 10442 | 16.13% | 4977 | 17.35% | 39408 | 14.77% |
| Kenya | 5713 | 8.82% | 2527 | 8.81% | 16166 | 6.06% |
| Tanzania | 2026 | 3.13% | 739 | 2.58% | 7756 | 2.91% |
| Ethiopia | 2834 | 4.38% | 828 | 2.89% | 7710 | 2.89% |
| Cameroon | 2106 | 3.25% | 980 | 3.42% | 7402 | 2.77% |

In addition to overall bibliometric contribution, we also isolated citations from 2010-2013 to update and compare to Traxler's bibliometric figures, which are based on data from 1997-2009. In the 2010-2013 period, there was a slight decrease in the proportion contributed by South Africa and a slight increase in the proportion contributed by Nigeria to AGRI and total citations. This may indicate a small shift in regional academic production toward countries outside historically academically dominant South Africa.

After the top three countries (South Africa, Nigeria, and Kenya) the next fifteen countries account for a relatively small proportion of total regional citations, as illustrated by Tanzania, Ethiopia, and Cameroon.[2] They contributed between 0.8%-4.5%-of AGRI citations, 0.9%-3.5% of BIOC citations, and 0.9%-3.0% of total citations. The remaining thirty-one, low-producing countries provided less than 0.9% of AGRI citations, less than 0.9% of BIOC citations, and less than 0.8% of total citations in the region, reflecting a wide disparity in bibliometric output between the highest and lowest producers.

*University Level Bibliometric Analysis*
Within each of the ten countries with the highest total citations, we also examined the total and AGRI citations of bibliometric output by institution. South African universities produced the highest number of total citations in Sub-Saharan Africa, led by: the University of Cape Town at 6.4%, the University of Witwatersrand at 4.9%, Universitiet Stellenbosch at 4.8%, Universiteit van Pretoria at 4.2%, and the University of KwaZulu-Natal at 3.9%. **Figure 2** illustrates the five most academically productive institutions in Sub-Saharan Africa. For a full list citations by institution, see **Appendix 2.**

[1] We have also included the U.S., Canada, China, and India in our Appendix for comparative reference.
[2] The fifteen next highest producing countries (also listed in Appendix 1) are: Tanzania, Ethiopia, Cameroon, Uganda, Ghana, Zimbabwe, Senegal, Sudan, Côte d'Ivoire, Botswana, Burkina Faso, Malawi, Zambia, Benin, and Madagascar.

**Figure 2: Total Citation Counts by Affiliation, 2010-present (February 2013)**

| Country | Affiliation | Total Citations | Pct of Total Home Country Citations | Pct of Total SSA Citations |
|---|---|---|---|---|
| South Africa | University of Cape Town | 5635 | 14.90% | 6.40% |
| South Africa | University of Witwatersrand | 4301 | 11.38% | 4.89% |
| South Africa | Universitieit Stellenbosch | 4179 | 11.05% | 4.75% |
| South Africa | Universiteit van Pretoria | 3652 | 9.66% | 4.15% |
| South Africa | University of KwaZulu-Natal | 3394 | 8.98% | 3.86% |

As illustrated by **Figure 3**, Four South African universities also account for the highest number of AGRI citations in Sub-Saharan Africa: Universitiet Stellenbosch at 5.25%, Universiteit van Pretoria at 5.2%, the University of KwaZulu-Natal at 4.8%, and the University of Cape Town at 4.4%. The University of Ibadan in Nigeria accounted for the fifth highest number at 2.3%. **Appendix 3** Provides a full list of AGRI citation counts by institution.

**Figure 3: Total AGRI Citation Counts by Affiliation 2010-present (February 2013)**

| Country | Affiliation | Total AGRI Citations | Pct of Total Home Country AGRI Citations | Pct of Total SSA AGRI Citations |
|---|---|---|---|---|
| South Africa | Universiteit Stellenbosch | 1073 | 15.81% | 5.25% |
| South Africa | Universiteit van Pretoria | 1059 | 15.60% | 5.18% |
| South Africa | University of KwaZulu-Natal | 973 | 14.33% | 4.76% |
| South Africa | University of Cape Town | 897 | 13.21% | 4.39% |
| Nigeria | University of Ibadan | 466 | 12.82% | 2.28% |

Alternate Approaches to Identifying High-Producing Universities

*Webometric Analysis*

Webometric analysis provides another quantitative measure of university activitiy levels and web-based output. According to Thelwall (2008), webometrics is the "quantitative analysis of web phenomena, drawing upon infometric methods, and typically addressing problems related to bibliometrics." Webometric analysis measures the linkages between universities and how smaller universities link to national principal universities, which in turn link with international principal universities. While webometrics does not distinguish between academic and non-academic pages and links, it provides a measure of relative internet presence and may be useful to gauge productivity and prominence in a regional network.

The Webometrics Ranking of World Universities is produced by Cybermetrics Lab, a public research body in Spain. The index ranks nearly 12,000 higher education institutions on *impact* (link popularity and link diversity), *presence* (total number of webpages hosted in the main webdomain), *openness* (number of rich files available for free distribution of recent research), and *excellence* (quantity of scientific output among the 10% most cited papers in its respective fields). **Figure 4** illustrates the top five, and **Appendix 4** provides a list of the top ten universities according to their webometric ranking.

**Figure 4: Webometric Ranking of Sub-Saharan Universities**[3]

| SSA Rank | World Rank | University | Country | Presence Rank | Impact rank | Openess Rank | Excellence Rank |
|---|---|---|---|---|---|---|---|
| 1 | 400 | Stellenbosch University | South Africa | 639 | 639 | 212 | 473 |
| 2 | 456 | University of Cape Town | South Africa | 604 | 801 | 682 | 288 |
| 3 | 526 | University of Pretoria | South Africa | 737 | 1234 | 148 | 618 |
| 4 | 529 | University of the Witwatersand | South Africa | 1900 | 877 | 359 | 449 |

[3] For a fuller explanation of webometric rankings and methodology, see http://www.webometrics.info/en/Methodology.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 686 | University of Kwazulu Natal | South Africa | 1163 | 1001 | 1378 | 580 |

Ortega and Aguillo (2009) examine university web pages and links per country and inter-country connections and conclude that the two global regions with the least webometric data are Africa and the Middle East. As such, Onyancha cautions that some universities in Africa are not yet ready for webometric analysis as they do not have developed websites. Despite this caution, Knight asserts that ranking in the top 100 of African universities is a viable way to increase visibility internationally (Teferra & Knight, 2008).

*Qualitative Identification, Rankings, and Indexes*

Rankings, research studies, and indices also seek to identify successful regional models of higher education, such as the highly respected Academic Ranking of World Universities or the Shanghai Ranking. The methodology ranks universities on the number of alumni and staff awarded prestigious honors such as Nobel Prizes, highly cited researchers, and the per capita occurance of these indicators. In Africa, the three universities ranked in the global Top 500 in 2012 were all South African: University of Capetown (201-300), University of Witwatersand (301-400), and KwaZulu-Natal (401-500).

Outside of global rankings, EARTH University in Costa Rica is an example of a university identified as a hub in the literature (Juma, 2011). While it is not ranked highly on international indexes and may not be as research-focused as its regional peers, its unique, experiential learning approach to *undergraduate* agricultural education attracts a high percentage of international students and faculty, making it a hub for agriculture and sustainability studies in South and Central America.

*Relational Analysis*

In an Italian example, Seeber et al. (2012) create a model of "research relational arenas" to measure the forces shaping relationships among universities in an attempt to identify regional hubs. They explain the presence and strength of relationships between two institutions by *assortativity* (the creation of relationships based on compatible actor attributes) and *proximity relational mechanisms* (increased likelihood of creating relationships when two institutions share the same social, institutional, and geographic spaces). The model predicts university cooperation and competition by including measures of co-publications, co-patenting, and co-participation in projects, the share of projects and publications with at least one regional partner, the concentration index (Herfindahl index), and the leadership ratio measuring the tendency of a university to play the role of a leader in the regional state-granted research projects.

The research concludes that the primary predictors of collaboration are the size of the academic faculty and the research productivity of the cooperating institutions, while other variables such as research intensity and national reputation are not significant. Students are more likely to choose the highest rated faculty with the best reputation in their discipline instead of the nearest faculty in their discipline. Students also prefer bigger universities that are located centrally in terms of the transportation system and in closer proximity to other universities. However, the study does not measure the universities' stated intent to cooperate or any formal intentions to promote inter-university regional cooperation.

Although the results are specific to the Italian education system, the study provides a model to analyze organizational relationships and determine which universities are potential hubs with other universities in their region.

**Section III: Network Hubs**

The second type of hub we identify are multi-institution networks formed to increase collaboration and regional education access among member institutions. Network hubs differ from High-Producing University hubs in that they are deliberately rather than organically formed to facilitate regional higher education collaboration. These networks vary and can operate on a national or regional scale. Network facilitators include universities, government ministries, NGOs, and research centers. They provide the technological and/or organizational infrastructure to enable network members to:

- Share best practices in management, cooperation, and dissemination
- Increase research and technical capacity
- Facilitate student and faculty exchanges
- Develop internships for students with the business community
- Establish regional higher education policy
- Establish mechanisms for regional education quality assurance
- Coordinate the public sector, academic institutions, and private firms to accomplish mutually beneficial projects
- Increase high-speed connectivity through optical fibre-based networks for the research and education community

While some networks are formed within member institutions such as universities or government ministries, others are initiated by external, third-party facilitating organizations such as NGOs or private economic development interests. The distinction between internal and external facilitation is significant to the degree that it affects the barriers to network entry, expected contributions from members, financing opportunities, communication channels and forums, and the benefits members receive from network participation (e.g. scholarship opportunities through collective funds, increased research capacity, faculty exchange). Like 'branded hubs' (discussed below), membership in these networks can be used to signal global competitiveness through a network approach that builds regional capacity rather than through a single university or ministry's economic development agenda. An example of a facilitating network is the Pan-African Agribusiness and Agroindustry Consortium (PanAAC), which supports the development of agribusiness in Africa by creating a platform for the private sector, government, and universities to coordinate agribusiness goals and projects. PanACC also supports the UniBRAIN project,which advances agribusiness incubation and improved agribusiness education as well as PSIP, a student internship program which matches agribusiness students to a private sector mentor.

**Figure 5** provides a snapshot of the list of Facilitated Network hubs we have identified. **Appendix 5** provides a more complete list of these networks and theirdefining program characteristics.

**Figure 5: Sub-Saharan Regional Higher Education Networks**

| African Union (AU) Organizations | USAID Organizations | University Associations | Post-Graduate Training Networks |
|---|---|---|---|
| • African Union **(AU)**<br>• New Partnership for African Development **(NEPAD)**<br>• Comprehensive Africa Agriculture Development Program **(CAADP)**<br>• Forum for Agricultural Research in Africa **(FARA)**<br>• Pan African University | • USAID<br>• Higher Education for Development **(HED)**<br>• Modernizing Extensionand Advisory Services **(MEAS)**<br>• Partnerships for Enhanced Engagement in Research **(PEER)**<br>• Higher Education Solutions Network **(HESN)**<br>• Association for Strengthening Agricultural Research in Eastern and Central Africa **(ASARECA)** | • International Association of Universities **(IAU)**<br>• Agence Universitaire de la Francophonie **(AUF)**<br>• Association of African Universities **(AAU)**<br>• South African Universities of Technology **(SATN)** | • Regional Universities Forum for Capacity Building in Agriculture **(RUFORUM)**<br>• African Economic Research Consortium **(AERC)**<br>• University Science, Humanities, and Engineering Partnerships in Africa **(USHEPiA)**<br>• Regional Initiative in Science and Education **(RISE)** |
| **Virtual University Networks** | **AfDB Organizations** | **Private Sector Network** | **Network of Foundations** |
| • Learning International Networks Consortium **(LINC)**<br>• African Virtual University **(AVU)** | • African Development Bank Group **(AfDB)**<br>• Association for the Development of Education in Africa **(ADEA)** | • Pan African Agribusiness & Agroindustry Consortium **(PanACC)** | • Partnership for Higher Education in Africa **(PHEA)** |

**Section III: Branded Hubs**

Several countries, particularly in East Asia, have adopted official agendas to internationalize their higher education systems and have branded themselves as higher education "hubs." These include Malaysia's "Wawasan 2020 (Vision 2020)," South Korea's "Brain Korea 21 (BK 21)," Singapore's "Global School Project," and China's "211" and "985" projects.

Governments in countries as seemingly diverse as South Korea and the United Arab Emirates have established Free Economic Zones (FEZs) specifically to attract international branch campuses (IBCs), private universities, and private secondary schools. Largely government-driven, development ministries and corporations have funded the development of international IBCs on multi-institution campuses or 'academic parks' through policies promoting transnational education

flows. Other policies to promote higher education hubs include regional scholarships to attract non-local students or increasing the non-local student quota at publicly funded institutions (Dessoff 2012).

However, many studies have described the hub label as a branding exercise without necessarily providing high quality education (Dessoff 2012, Ho Mok 2012). While many countries have successfully spurred university innovation through central planning and government involvement, critics argue that an academic culture can not be "bought off the shelf" and suggest that these countries should keep a "fine balance of institutional autonomy and a sense of public interest in the processes of university innovation" (Moon & Kim 2001). Further, these official, centralized efforts with accompanying national targets may produce disparate effects across gender and previously marginalized groups as they relate to access and exclusion in the new systems (Kim 2005). Oachi (2009) and Oyewole (2009) agree that focusing on internationalizing education in Africa raises questions about its relevance and "capacity to address issues of access, equity and regional research and developmental needs."

Jane Knight, adjunct professor at the Ontario Institute for Studies in Education at the University of Toronto, identifies three major types of branded hubs:

- **Student Hub**: most prevalent, focused on international recruiting for revenue and reputation building
- **Skilled Workforce Hub:** establish international branch campuses (IBCs) or centers; privately run training and education companies also establish programs
- **Knowledge/Innovation Hub**: foreign research institutions and R&D companies establish a base and collaborate with local universities to create a "critical mass of talent and expertise" (Knight, 2011).

Critics of these self-identified hubs note the emphasis on commercialization, prestige, educational mobility, and the vocational rather than academic curriculum. These factors, they argue, have the potential to undermine the spillover effects of the higher education institutions to the region (Ho Mok, 2012). However, the principal objective of some 'branded' hubs such as South Korea's Songdo Global University in the Incheon Free Economic Zone (IFEZ) is to curb the outflow of top Korean students studying abroad. By attracting and partnering with prestigious universities such as George Mason, Duke, Columbia, and Carnegie Mellon, South Korea's hub strategy is less so a branding exercise as it is a brain drain retention strategy (Dessoff, 2012). **Figure 6** provides a summary of 'branded hub' strategies by country, particularly in East Asia.

**Figure 6: List Branded Hubs by Country and Strategy**

| Region | Hub Institutions/ Initiatives | Strategies & Characteristics |
|---|---|---|
| **Malaysia** | • **Kuala Lumpur Education City (KLEC):** 'academic park' with expected student population of 30,000. Currently has arrangements with international institutions including Dublin Business School, Newcastle University, and Xiamen Univerisity<br>• **EduCity** at Iskandar. | First country to strategically establish itself as a regional education hub through formal policy decisions (as early as 1990). The Educational Act of 1996 opened doors for foreign universities to partner with local universities. Growth continues as the Ministry of Higher Education supports development of multi-university campuses to attract international students and boost the knowledge economy. |
| **Singapore** | • **"Global Schoolhouse" initiative** launched in 2002 has already attracted 1,200 privately run higher education institutions, 44 pre-tertiary schools, and 16 leading foreign tertiary institutions. | Economic Development Board (EDB) has attracted a diverse mix of top tertiary institutions including MIT and developed programs to complement EDB's industry development efforts. Considered the most advanced country in creating a true knowledge hub through International Branch Campuses (IBCs) as well as joint academic programs. |
| **Hong Kong** | • **Government-driven internationalization:** doubled its non-local student quota from 10 to 20% since 2008 at publicly funded institutions. | Offers scholarships to Southeast Asian students who enroll in its publicly funded programs and relaxes immigration restrictions. |

| | | |
|---|---|---|
| **South Korea** | • **Songdo Global University** in the Incheon Free Economic Zone (IFEZ) has primarily attracted U.S. institutions such as Stony Brook (SUNY), George Mason, Duke, Columbia, and Carnegie Mellon.<br>• **Jeju Global Education City**: also aims to attract prestigious schools from abroad | Six free economic zones (FEZs), two of which are already under development as hubs. Interested in attracting international students for knowledge economy as well as retaining its top students and stemming brain drain from foreign study.<br>Primarily for the benefit of Korean and neighboring Asian students and secondary education. |
| **Persian Gulf** | • **Abu Dhabi**<br>• **Dubai Knowledge Village/ Dubai International Academic City**<br>• **Dubai International Financial City**<br>• **Dubai Health Care City**<br>• **Dubai Silicon Oasis**<br>• **Bahrain**<br>• **Qatar** | Several emirates have stated an intention to become hubs and set up a series of free zones importing international investment through establishing IBCs.<br>Some emirates (e.g. Abu Dhabi) use a targeted approach of attracting elite, recognizable university partnerships.<br>The Government of Dubai has also established sector-specific centers to become a hub of technological research and production in health and technology. |
| **Latin America** | • **Republic of Panama- City of Knowledge** | Developed by law in 1998 to become a knowledge-generating hub for the Latin American region. It has also become a regional base for the UN in Latin America and Carribean. Florida State University IBC as well as several U.S. and Canadian study abroad programs and government offices. |

**Higher Education Network Challenges and Responses by Countries and Organizations**

In our review of several national, regional, and organizational experiences, common challenges to building successful regional networks have been mentioned. Below we list these challenges with examples of some country responses:

- **Standardization of degree requirements, educational services, exchange feasibility, pricing across universities**
  - Southern Africa Development Community (SADC): Protocol on Education & Training promotes standardization of entrance requirements, credit transfers, and harmonization of academic years in SADC countries.
- **Scholarships and financial reciprocity**
  - Singapore: international student fees were lowered to 10% above the local tuition rate, and international students can receive state-funded financial assistance
  - South Africa: students from SADC countries can study at any South African university for the same rate as domestic students. Approximately 70% of all international students in South Africa are from SADC countries. All SADC countries are working toward offering financial reciprocity.
- **Explicit policies toward foreign branch campus development**
  - Malaysia: At first the government worked hard to attract foreign branch campuses, but now the high number of applications from foreign universities has made the Ministry of Education raise their quality standards for foreign branch campuses.
  - South Africa: rejects GATS trade agreement condition to guarantee market access for foreign institutions to establish branch campuses with the rationale that quality of foreign institutions is lacking.
- **Quality assurance and regulation of private institutions**
  - Association of Southeast Asian Nations (ASEAN): facilitates frequent roundtable meetings to ensure quality among member countries' participating universities.
  - Singapore: administers quality accreditation for private education institutions.
  - Kenya: has a legal framework to facilitate private university development, including foreign providers.
  - Africa: Billing (2004) argues that universities may actually benefit from greater autonomy and delinkages of performance from funding rather than penalized from external, performance measuring organizations.

Through our research, we have found no evidence that countries benefit from isolating their higher education efforts to a national rather than regional scale. Governments and development organizations appear to be increasingly looking to regional higher education models as a means to pool resources, increase access for students, and increase the scale of social and economic benefits that higher education provides.

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**APPENDIX**

**Appendix 1: Bibliometric Analysis of AGRI, BIOC, and Total Citations in SSA, by Country**

| | Number of articles published by scientists at institutions in SSA countries 1997-2013 (present) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Country | Agricultural and Biological Sciences (AGRI) | Pct SSA total | Biochemistry, Genetics and Molecular Biology (BIOC) | Pct SSA total | Total Citations per Country | Pct SSA total |
| High Producers | South Africa | 23769 | 36.71% | 12074 | 42.10% | 120928 | 45.31% |
| | Nigeria | 10442 | 16.13% | 4977 | 17.35% | 39408 | 14.77% |
| | Kenya | 5713 | 8.82% | 2527 | 8.81% | 16166 | 6.06% |
| Medium Producers | Tanzania | 2026 | 3.13% | 739 | 2.58% | 7756 | 2.91% |
| | Ethiopia | 2834 | 4.38% | 828 | 2.89% | 7710 | 2.89% |
| | Cameroon | 2106 | 3.25% | 980 | 3.42% | 7402 | 2.77% |
| | Uganda | 1658 | 2.56% | 740 | 2.58% | 7260 | 2.72% |
| | Ghana | 1755 | 2.71% | 551 | 1.92% | 6637 | 2.49% |
| | Zimbabwe | 1385 | 2.14% | 370 | 1.29% | 4903 | 1.84% |
| | Senegal | 1136 | 1.75% | 471 | 1.64% | 4855 | 1.82% |
| | Sudan | 1158 | 1.79% | 438 | 1.53% | 3880 | 1.45% |
| | Côte d'Ivoire | 955 | 1.47% | 356 | 1.24% | 3575 | 1.34% |
| | Botswana | 658 | 1.02% | 262 | 0.91% | 3363 | 1.26% |
| | Burkina Faso | 969 | 1.50% | 374 | 1.30% | 3290 | 1.23% |
| | Malawi | 623 | 0.96% | 291 | 1.01% | 3267 | 1.22% |
| | Zambia | 523 | 0.81% | 163 | 0.57% | 2536 | 0.95% |
| | Benin | 1135 | 1.75% | 282 | 0.98% | 2473 | 0.93% |
| | Madagascar | 928 | 1.43% | 306 | 1.07% | 2185 | 0.82% |
| Low Producers | Congo | 529 | 0.82% | 194 | 0.68% | 1997 | 0.75% |
| | Mali | 557 | 0.86% | 230 | 0.80% | 1730 | 0.65% |
| | Mozambique | 361 | 0.56% | 126 | 0.44% | 1479 | 0.55% |
| | Gabon | 313 | 0.48% | 190 | 0.66% | 1451 | 0.54% |
| | Gambia | 218 | 0.34% | 245 | 0.85% | 1443 | 0.54% |
| | Namibia | 546 | 0.84% | 104 | 0.36% | 1411 | 0.53% |
| | Mauritius | 311 | 0.48% | 159 | 0.55% | 1402 | 0.53% |
| | Niger | 428 | 0.66% | 106 | 0.37% | 1140 | 0.43% |
| | Togo | 251 | 0.39% | 69 | 0.24% | 984 | 0.37% |
| | Rwanda | 191 | 0.29% | 74 | 0.26% | 887 | 0.33% |
| | Swaziland | 178 | 0.27% | 46 | 0.16% | 680 | 0.25% |
| | Angola | 83 | 0.13% | 47 | 0.16% | 430 | 0.16% |
| | Central African Republic | 67 | 0.10% | 35 | 0.12% | 382 | 0.14% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Eritrea | 91 | 0.14% | 33 | 0.12% | 370 | 0.14% |
| Guinea | 97 | 0.15% | 40 | 0.14% | 367 | 0.14% |
| Mauritania | 95 | 0.15% | 29 | 0.10% | 340 | 0.13% |
| Democratic Republic of Congo | 71 | 0.11% | 25 | 0.09% | 331 | 0.12% |
| Sierra Leone | 80 | 0.12% | 24 | 0.08% | 329 | 0.12% |
| Seychelles | 142 | 0.22% | 32 | 0.11% | 321 | 0.12% |
| Guinea-Bissau | 33 | 0.05% | 35 | 0.12% | 316 | 0.12% |
| Lesotho | 58 | 0.09% | 21 | 0.07% | 309 | 0.12% |
| Chad | 56 | 0.09% | 24 | 0.08% | 273 | 0.10% |
| Burundi | 77 | 0.12% | 20 | 0.07% | 259 | 0.10% |
| Djibouti | 14 | 0.02% | 7 | 0.02% | 127 | 0.05% |
| Liberia | 16 | 0.02% | 6 | 0.02% | 115 | 0.04% |
| Equatorial Guinea | 29 | 0.04% | 7 | 0.02% | 107 | 0.04% |
| Cape Verde | 31 | 0.05% | 6 | 0.02% | 93 | 0.03% |
| Mayotte | 21 | 0.03% | 4 | 0.01% | 61 | 0.02% |
| Somalia | 5 | 0.01% | 2 | 0.01% | 57 | 0.02% |
| Comoros | 17 | 0.03% | 6 | 0.02% | 56 | 0.02% |
| Sao Tome and Principe | 9 | 0.01% | 4 | 0.01% | 35 | 0.01% |
| **SSA Total:** | **64748** | **1** | **28679** | **1** | **266876** | **1** |

**Appendix 1A: Bibliometric Analysis of Internationally High-Producing Countries for Comparison**

| Country | Agricultural and Biological Sciences (AGRI) | Biochemistry, Genetics and Molecular Biology (BIOC) | Total Citations per Country |
|---|---|---|---|
| United States | 487,109 | 1,076,075 | 6,740,167 |
| Canada | 92,990 | 140,885 | 955,321 |
| China | 138,848 | 243,098 | 2,666,044 |
| India | 83,585 | 90,666 | 726,207 |

**Appendix 2: Bibliometric Analysis of AGRI and Total Citations in SSA, by Institution**

| Top AGRI Citation Counts by Affiliation 2010-2013 (Present) | | | | |
|---|---|---|---|---|
| Country | Affiliation | Total Affiliation AGRI Citations | Pct of Total Country AGRI Citations | Pct of SSA AGRI Citations |
| South Africa | Universiteit Stellenbosch | 1073 | 15.81% | 5.25% |
| South Africa | Universiteit van Pretoria | 1059 | 15.60% | 5.18% |
| South Africa | University of KwaZulu-Natal | 973 | 14.33% | 4.76% |
| South Africa | University of Cape Town | 897 | 13.21% | 4.39% |
| Nigeria | University of Ibadan | 466 | 12.82% | 2.28% |
| South Africa | University of Witwatersrand | 431 | 6.35% | 2.11% |
| Uganda | Makerere University | 322 | 55.23% | 1.57% |
| Kenya | University of Nairobi | 293 | 16.31% | 1.43% |
| Nigeria | University of Agriculture, Abeokuta | 269 | 7.40% | 1.32% |
| Nigeria | Ahmadu Bello University | 225 | 6.19% | 1.10% |
| Cameroon | Universite de Yaounde I | 223 | 23.13% | 1.09% |
| Ethiopia | Addis Ababa University | 221 | 33.90% | 1.08% |
| Nigeria | University of Nigeria | 212 | 5.83% | 1.04% |
| Nigeria | Federal University of Technology, Akure | 208 | 5.72% | 1.02% |
| Nigeria | Obafemi Awolowo University | 184 | 5.06% | 0.90% |
| Kenya | International Center of Insect Physiology and Ecology Nairobi | 183 | 10.19% | 0.90% |
| Ghana | University of Ghana | 175 | 30.02% | 0.86% |
| Tanzania | Sokoine University of Agriculture | 169 | 26.45% | 0.83% |
| Kenya | Kenya Agricultural Research Institute | 168 | 9.35% | 0.82% |
| Kenya | International Livestock Research Institue Nairobi | 125 | 6.96% | 0.61% |
| Kenya | World Agroforestry Centre Nairobi | 125 | 6.96% | 0.61% |
| Zimbabwe | University of Zimbabwe | 123 | 28.67% | 0.60% |
| Ghana | Kwame Nkrumah University of Science & Technology | 117 | 20.07% | 0.57% |
| Ethiopia | Jimma University | 111 | 17.02% | 0.54% |
| Senegal | Universite Cheikh Anta Diop | 102 | 29.31% | 0.50% |
| Ethiopia | Haramaya University | 98 | 15.03% | 0.48% |
| Tanzania | University of Dar Es Salaam | 86 | 13.46% | 0.42% |
| Cameroon | University of Dschang | 78 | 11.98% | 0.38% |
| Ethiopia | Hawassa University | 71 | 10.89% | 0.35% |
| Cameroon | University of Buea | 68 | 10.45% | 0.33% |
| Senegal | Institut de Recherche pour le Development Dakar | 67 | 19.25% | 0.33% |
| Ethiopia | Ethiopian Institute of Agricultural Research | 66 | 10.12% | 0.32% |

| | | | | |
|---|---|---|---|---|
| Cameroon | Ministry of Scientific Research and Innovation | 60 | 9.22% | 0.29% |
| Uganda | International Institute of Tropical Agriculture Uganda | 49 | 8.40% | 0.24% |
| Ghana | University of Cape Coast Ghana | 43 | 7.38% | 0.21% |
| Ghana | University for Development Studies Ghana | 37 | 6.35% | 0.18% |
| Tanzania | Muhimbili University of Health and Allied Sciences | 31 | 4.85% | 0.15% |
| Zimbabwe | International Maize and Wheat Improvement Center Harare | 31 | 7.23% | 0.15% |
| Uganda | Mbarara University of Science and Technology | 30 | 5.15% | 0.15% |
| Zimbabwe | National University of Science and Technology Bulawayo | 29 | 6.76% | 0.14% |
| Tanzania | Tanzania Wildlife Research Institute | 27 | 4.23% | 0.13% |
| Ghana | Cocoa Research Institute of Ghana | 27 | 4.63% | 0.13% |
| Ghana | Crops Research Institute of Ghana | 27 | 4.63% | 0.13% |
| Zimbabwe | Bindura University of Science Education | 18 | 4.20% | 0.09% |

**Appendix 3: Sub-Saharan High-Producing Universities**

| Top Citation Counts by Affiliation 2010-present (February 2013) | | | | |
|---|---|---|---|---|
| Country | Affiliation | Total Affiliate Citations | Pct of Country Citations | Pct of SSA Citations |
| South Africa | University of Cape Town | 5,635 | 14.90% | 6.40% |
| South Africa | University of Witwatersrand | 4,301 | 11.38% | 4.89% |
| South Africa | Universitieit Stellenbosch | 4,179 | 11.05% | 4.75% |
| South Africa | Universiteit van Pretoria | 3,652 | 9.66% | 4.15% |
| South Africa | University of KwaZulu-Natal | 3,394 | 8.98% | 3.86% |
| South Africa | University of Johannesburg | 1,996 | 5.28% | 2.27% |
| Nigeria | University of Ibadan | 1,761 | 12.03% | 2.00% |
| Uganda | Makerere University | 1,505 | 58.36% | 1.71% |
| South Africa | North-West University | 1,377 | 3.64% | 1.57% |
| Nigeria | University of Nigeria | 1,143 | 7.81% | 1.30% |
| Cameroon | Universite de Yaounde I | 1,078 | 44.42% | 1.23% |
| Ethiopia | Addis Ababa University | 1,020 | 35.71% | 1.16% |
| Ghana | University of Ghana | 882 | 34.20% | 1.00% |
| Nigeria | Obafemi | 877 | 5.99% | 1.00% |
| Nigeria | Ahmadu Bello University | 867 | 5.92% | 0.99% |
| Kenya | University of Nairobi | 834 | 16.38% | 0.95% |
| Nigeria | University of Benin | 747 | 5.10% | 0.85% |
| Nigeria | University of Ilorin | 673 | 4.60% | 0.76% |
| Nigeria | University of Lagos | 571 | 3.90% | 0.65% |
| Kenya | Kenya Medical Research Institute | 548 | 10.76% | 0.62% |
| Ghana | Kwame Nkrumah University of Science & Technology | 516 | 20.01% | 0.59% |
| Senegal | Universite Cheikh Anta Diop | 504 | 33.67% | 0.57% |
| Nigeria | University of Agriculture, Abeokuta | 489 | 3.34% | 0.56% |
| Zimbabwe | University of Zimbabwe | 443 | 27.90% | 0.50% |
| Tanzania | Muhimbili University of Health and Allied Sciences | 359 | 13.77% | 0.41% |
| Ethiopia | Jimma University | 339 | 11.87% | 0.39% |
| Tanzania | University of Dar Es Salaam | 329 | 12.62% | 0.37% |
| Tanzania | Sokoine University of Agriculture | 311 | 11.93% | 0.35% |
| Cameroon | University of Dschang | 291 | 11.99% | 0.33% |
| Kenya | International Livestock Research Institute | 278 | 5.46% | 0.32% |
| Kenya | Moi University | 270 | 5.30% | 0.31% |
| Kenya | Kenyatta University | 260 | 5.11% | 0.30% |
| Cameroon | University of Buea | 258 | 10.63% | 0.29% |
| Cameroon | University of Douala | 243 | 10.01% | 0.28% |
| Ethiopia | Hawassa University | 215 | 7.53% | 0.24% |

| | | | | |
|---|---|---|---|---|
| Tanzania | National Institute for Medical Research Tanga | 214 | 8.21% | 0.24% |
| Ghana | University of Cape Coast Ghana | 197 | 7.64% | 0.22% |
| Ethiopia | Haramaya University | 166 | 5.81% | 0.19% |
| Uganda | Mbarara University of Science and Technology | 149 | 5.78% | 0.17% |
| Uganda | Uganda Ministry of Health | 142 | 5.51% | 0.16% |
| Ethiopia | University of Gondar | 138 | 4.83% | 0.16% |
| Senegal | Institut de Recherche pour le Development Dakar | 130 | 8.68% | 0.15% |
| Ghana | Ghana Atomic Energy Commission | 120 | 4.65% | 0.14% |
| Uganda | Uganda Virus Research Institute | 117 | 4.54% | 0.13% |
| Senegal | Centre Hospitalier Universitaire Dakar | 115 | 7.68% | 0.13% |
| Cameroon | University of Ngaoundere | 108 | 4.45% | 0.12% |
| Ghana | University for Development Studies Ghana | 82 | 3.18% | 0.09% |
| Senegal | Institut Pasteur de Dakar | 79 | 5.28% | 0.09% |
| Senegal | Universite Gaston Berger de Saint-Louis | 65 | 4.34% | 0.07% |
| Zimbabwe | National Universityof Science and Technology Bulawayo | 61 | 3.84% | 0.07% |

**Appendix 4: Webometric Ranking of Sub-Saharan Universities**

| Ranking | World Rank | University | Country | Presence Rank | Impact rank | Openess Rank | Excellence Rank |
|---|---|---|---|---|---|---|---|
| 1 | 400 | Stellenbosch University | South Africa | 639 | 639 | 212 | 473 |
| 2 | 456 | University of Cape Town | South Africa | 604 | 801 | 682 | 288 |
| 3 | 526 | University of Pretoria | South Africa | 737 | 1234 | 148 | 618 |
| 4 | 529 | University of the Witwatersand | South Africa | 1,900 | 877 | 359 | 449 |
| 5 | 686 | University of Kwazulu Natal | South Africa | 1,163 | 1,001 | 1,378 | 580 |
| 6 | 862 | University of South Africa | South Africa | 668 | 1,177 | 340 | 2,004 |
| 7 | 1035 | Rhodes University | South Africa | 1,422 | 1,934 | 930 | 1,106 |
| 8 | 1073 | University of the Western Cape | South Africa | 2,787 | 1,280 | 1,372 | 1,271 |
| 9 | 1080 | Makerere University | Uganda | 564 | 3,301 | 731 | 883 |
| 10 | 1326 | University of Nairobi | Kenya | 1,528 | 2,981 | 950 | 1,346 |

Source: http://www.webometrics.info/en/Ranking_africa/Sub_saharan_Africa

**Appendix 5: Facilitated Network Hubs**

| Institution/Network | Region, Characteristics, & Programs |
|---|---|
| **African Union (AU) Organizations** | |
| **African Union (AU)** | Union of 54 African countries to achieve greater solidarity between the African countries and people. Currently implementing the Second Decade of Education for Africa (2006-2015) Plan of Action with partners. Key goals include promoting research, quality assurance through Regional and Continental Qualification Frameworks (such as the Arusha Convention), and an increased role in mobilizing funding for the higher education sector (African Union, 2006). |
| **New Partnership for African Development (NEPAD)** | Implementing agency of the **AU** responsible for driving economic integration in Africa. Human Development program area creating *regional networks of centres of excellence* focusing on specific themes. Facilitates collaboration among universities and research centers across disciplines and across organizations on long-term R&D programs and projects (Mugabe, 2003). Examples include:<br>• *The Southern Africa Network for Biosciences (SANBio),*<br>• *The Southern Africa Water Sciences and Technology Network,* and<br>• *The African Mathematical Institutes Network (AMI-Net).* |
| **Comprehensive Africa Agriculture Development Program (CAADP)** | Agricultural program of **NEPAD** focused on food security, nutrition, and increasing farming incomes. Aims to increase agricultural productivity by 6% each year and encourage member countries to pledge 10% of national budgets to public investment in agriculture. |
| **Forum for Agricultural Research in Africa (FARA)** | Technical arm of **CAADP** focused on agricultural R&D in Africa. Programs include:<br>• *Framework for African Agricultural Productivity (FAAP):* brings together stakeholders with political, financial, and technical resources to address problems;<br>• *TEAM-Africa* (with ANAFE and RUFORUM): aims to transform tertiary agricultural education systems to produce quality graduates<br>• *CAADP Country Core Groups for Education (3C Edu)*: ensures country-level investment plans include tertiary agricultural education planning<br>• *UniBRAIN (in combination with PanAAC, etc.)*: advances agribusiness incubation and improved agribusiness education |
| **Pan African University** | Five thematic university hubs across the five regions of Africa created by the **AU**. Smaller universities can connect to these regional hubs. Also offers Masters and PhD level education. In West Africa, the University of Ibadan in Nigeria specializes in Life and Earth Sciences, including agriculture (African Union, 2011). |
| **AU Regional Economic Communities (RECs)** | |
| **Regional Economic Communities (RECs)** | Eight regional inter-governmental organizations of African countries to align economic development policies. These groups are important to the **AU** development strategy and work closely with **CAADP**. The following lists two RECs and their corresponding university associations (United Nations Economic Commission for Africa, 2012). |
| **Southern Africa Development Community (SADC)** | Inter-governmental organization in 15 southern African countries. Promotes development and cooperation among member countries. The SADC Protocol on Education & Training (2000) outlines objectives for cooperation, including higher education. |
| **Southern African Regional University Association (SARUA)** | Organization of 57 members including universities from the **SADC** countries. Strengthens the leadership and institutions of Higher Education in the Southern African region, thereby consolidating a southern African agenda for higher education. |

| | |
|---|---|
| **East African Community (EAC)** | Regional intergovernmental organization of Burundi, Kenya, Rwanda, Tanzania, and Uganda. Created a five year operational development plan and resource mobilization strategy and is working to harmonize education systems. |
| **Inter-University Council of East Africa (IUCEA)** | Inter-governmental organization to foster collaboration between universities in **EAC.** Provides a forum for discussing academic matters related to higher education and facilitates the maintenance of internationally comparable education standards in East Africa. Facilitates a partnership between University of Dar es Salaam (TZ) and Makere Univeristy (UG) to promote student study abroad. |
| **USAID Organizations** | |
| **The United States Agency for International Development (USAID)** | Devotes substantial funding to education in Africa ($354 million in 2010). One of USAID's three education strategy goals is to improve the ability of tertiary and workforce development programs to generate workforce skills relevant to a country's development goals (Peterson, 2011). The following are all USAID efforts related to higher education. |
| **Higher Education for Development (HED)** | Partners universities in developing countries with universities in the US to engage universities in development issues. Total of 13 partnerships with Sub-Saharan African Universities related to agriculture. An example of a successful past project is Partnership for Enhancing Agriculture in Rwanda through Linkages (PEARL) (2001-2006). The University of Michigan and Texas A&M University worked to rebuild the National University of Rwanda through faculty orientation, the school of agriculture curriculum reform, outreach center establishment, and creating links with ISAR (the agricultural research institute), OCIR (coffee marketing organization), and ACDI/VOCA (a non-governmental organization) (O'Sullivan, 2004). PEARL is credited with sparking the specialty coffee industry in Rwanda (Doucleff, 2012). The three current projects are:<br>• *Managing Agricultural Development to Protect the Environment* (Senegal),<br>• *Addressing Food Security Needs in South Sudan Through University Rebuilding* (South Sudan), and<br>• *Rwanda: Women's Leadership Program in Agriculture* (Rwanda). |
| **Modernizing Extension and Advisory Services (MEAS)** | A consortium led by the University of Illinois to define and disseminate best practice strategies and approaches to providing effective rural extension. Produces country case studies which include a description of the local university's role and recommendations to improve rural extension provision (MEAS, 2013). |
| **Partnerships for Enhanced Engagement in Research (PEER)** | A competitive grants program to support research in USAID's focus areas of development. Annually accepts research proposals from scientists and students from 87 eligible countries (26 African countries) with an National Science Foundation (NSF) sponsored research university counterpart in the US. PEER awarded five grants in Africa related to agriculture in Cycle 1, 2012. Results of Cycle 2 will be announced May 2013. |
| **Higher Education Solutions Network (HESN)** | Aims to discover better solutions to global development challenges through university networks. Composed of a constellation of seven Development Labs in six US universities one Ugandan University. Makerere University serves as the ResilientAfrica Development Lab which coordinates 20 universities in 16 African countries. |
| **Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)** | USAID/East Africa's regional African partner for agricultural technology development with 11 African member countries (USAID, 2013). Coordinates with **CAADP** country teams to contribute to the **AU/NEPAD** vision and strategies of increasing regional agricultural production. Works with country NARS, CGIAR, universities, and research centers. Their Partnership and Capacity Development Program projects include:<br>• *UniBRAIN* (coordinated by FARA) and<br>• *Eastern Africa Agricultural Productivity Program* (EAAPP). EAAPP is upgrading four national research centers into *four regional centers of excellence* (RCoEs) in four countries each specializing in a priority crop. They aim to include universities and businesses to improve agricultural research and training as well as national and regional policy coordination. |

| University Associations | |
|---|---|
| **International Association of Universities (IAU)** | UNESCO-based worldwide association of higher education institutions. Brings together institutions and organizations from 120 countries for reflection and action on common concerns and collaborations. |
| **Agence Universitaire de la Francophonie (AUF)** | Global organization which promotes the development of French-speaking universities and research communities in 98 countries. Disseminates information in French and provides access to trainings on technologies of information and communication within its network. Their network consists of universities, research centers, and institutions. Their partners include UNESCO, the European Union, and the World Bank. |
| **Association of African Universities (AAU)** | International non-governmental organization with 199 members in 45 African countries to strengthen higher education in Africa through member collaboration. UNESCO recommended the formation of the AAU. Provides a forum for higher education institution leadership and policy-makers to discuss emerging issues and create policy recommendations. The AAU also has several ongoing programs:<br>• Study Program on Higher Education Management in Africa;<br>• International Fellowships Program (West Africa Region);<br>• Staff Exchange;<br>• AAI/AAU First Data Western Union Fellowship;<br>• Association for the Development of Education in Africa's Working Group on Higher Education (ADEA/WGHE); and<br>• the Roster of African Professionals (ROAP). |
| **South African Universities of Technology (SATN)** | Network of seven South African universities of technology. Provides a forum of discussing higher education issues for universities of technology, promotes the university of technology sector, and networks with European universities with a similar focus and related government agencies (SATN, 2011). |
| **Post-Graduate Training Networks** | |
| **Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)** | A non-profit consortium of 29 universities in Eastern, Central and Southern Africa united to train Masters and PhD graduates across multiple universities and to increase the capacity of the member universities. Supporting activities include:<br>• Coordinating biennial regional conferences,<br>• Producing case studies and policy briefs, and<br>• Setting up National Forums for each country which meets at least twice a year to coordinate activities, analyze interventions, and mobilize resources and advocacy. |
| **African Economic Research Consortium (AERC)** | Not-for-profit organization focused on policy research and training in economics. Brings together a network of 27 universities in 20 countries in a collaborative approach to post-graduate training in economics to leverage limited teaching capacity, attain a critical mass of students, offer a larger menu of electives and jointly enforce high standards. At the master's level similar initiatives in the francophone countries and in Nigeria, both originating from AERC studies, are based on the same concept. One of the postgraduate programs offered is the Collaborative MS in Agricultural & Applied Economics (CMAAE). |
| **University Science, Humanities, and Engineering Partnerships in Africa (USHEPiA)** | A network of eight universities in seven Sub-Saharan African countries to build university staff capacity facilitated by the University of Cape Town (UCT) and with initial support from AAU. USHEPiA administers post-graduate programs at UCT to train university staff as well as facilitates long-term research coordination among its network members. |
| **Regional Initiative in Science and Education (RISE)** | Coordinated by the Science Initiative Group (SIG) which aims to facilitate the Millennium Science Initiative. Prepares PhD and MS-level scientists and engineers in Sub-Saharan Africa through university-based research and teaching networks in selected disciplines. RISE supports five thematic regional networks in ten countries: AMSEN, RISE-AFNET, SABINA, SSAWRN, and WIO-RISE. |

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| **Virtual University Networks** | |
| **Learning International Networks Consortium (LINC)** | International community of individuals and organizations that focuses on the role of technology in expanding educational reach coordinated by MIT. Their activities include:<br>• Connecting their participants to share best practices,<br>• Creating virtual distance learning communities in each participating country,<br>• Holding annual symposia to bring participants together, and<br>• Supporting modestly priced distance-learning initiatives. |
| **African Virtual University (AVU)** | Initially created as a project by the World Bank, the AVU is now an independent intergovernmental organization formed by 15 governments to expand affordable distance learning. Their expanding network of partner institutions spans francophone, anglophone, and lusophone countries. Currently, there are 27 partner institutions with *AVU Learning Centers* to disseminate classes and programs. There are ten *Open Distance and eLearning Centers* to act as physical hubs for the creation of knowledge, the development and management of programs for partner institutions, and delivery points of programs such as the Teacher Education Program (African Virtual University, 2012). |
| **AfDB Organizations** | |
| **African Development Bank Group (AfDB)** | A multilateral development finance institution focused on developing infrastructure, strengthening research capacity and promoting innovation and creativity through reinforced public-private partnerships. The AfDB is working with **NEPAD** to collect information to identify potential *Regional Centers of Excellence*. They also fund The AfDB also supports the African Virtual University (AVU) and higher education science and technology (HEST) projects in several countries (AfDB, 2013). |
| **Association for the Development of Education in Africa (ADEA)** | Originally an initiative of the World Bank and is now based at the African Development Bank. International non-governmental composed of all 54 Ministers of Education in Africa and 16 development partners to create a forum for policy dialogue. Coordinates efforts among members to create successful education policies. |
| **Private Sector Network** | |
| **Pan African Agribusiness & Agroindustry Consortium (PanAAC)** | A private sector driven platform bringing together agribusiness and agro industry value chains and support services to enable them access information, knowledge, strategic partnerships and financial remediation. Their programs include:<br>• *UniBRAIN* (coordinated by FARA) and<br>• *PanACC Student Intern Programe (PSIP)*. PSIP is a student internship program which matches agribusiness students to a private sector mentor. |
| **Regional Research and Education Network (RREN) Alliances** | |
| **UbuntuNet Alliance** | RREN alliance in eastern and southern Africa. UbuntuNet and WACREN interconnect their regional networks to each other, to major research and education networks, and commodity Internet exchange points in and outside Africa. They promote information and communication technology (ICT) access and usage among national RENs. They aim to secure affordable high speed international connectivity and efficient ICT access and usage for African national RENs. |
| **West and Central African Research and Education Network (WACREN)** | RREN alliance in western and central Africa (see above). |
| **Arab States Research and Education Network (ASREN)** | RREN in north Africa and Middle East. Aims to implement, manage and extend sustainable Pan-Arab digital infrastructures dedicated for the research and education communities and to boost scientific research and cooperation in member countries through the provision of world-class digital infrastructures and E-services. |

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| **Network of Foundations** | |
| **Partnership for Higher Education in Africa (PHEA)** | Seven Foundations collaborated to fund education projects in nine African countries totaling $440 million in the decade of 2000 through 2010. Grants funded country wide projects (63%) as well as multi-country projects (37%). Universities were the primary grantees ($243 million) and regional networks for postgraduate training and research were second ($60.5 million). |
| **National Alignment of Research and Education** | |
| **India's National Agricultural Research System** | The Indian Council of Agricultural Research (ICAR) directs the National Agricultural Research System which coordinates 53 state agricultural universities (SAUs). ICAR has also adopted the National Agricultural Technology Program (NATP) to improve coordination between institutes to organize and increase accessibility of information. The NATP is associated with an increase in published research, and the SAUs are an important component of ICAR's research capability.<br>There have, however, been recent calls to improve this system's quality assurance, align it with state research centers, and get rid of political influence in the management of the university (Maguire, 2011). |

Source: Information found on program website unless otherwise noted.