

Africa-U.S. Network of Centers of Excellence in Water and Environmental Science & Technology



Strategic Plan 2010 – 2020

“Science & Technology for Sustainable Development in Africa”



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Introduction – Context of Tertiary Education in Africa

In 2006, the African continent as a whole had a little more than 9.3 million students in tertiary institutions as compared to 6 million in 2000. This number is expected to double by 2015, reaching between 18 and 20 million.¹ In the past, numerous world-class universities had been created in Africa, but most have not been properly maintained due to severe resource constraints leading to inadequate government response to a growing demand. As a consequence, poor study conditions and quality of tertiary education compelled Africa's best and brightest to seek their education abroad, with only a few returning to Africa, especially in science and technology.

The current estimate is that more than 50,000 African professionals with post-graduate degrees work outside their mother country. In the meantime, the emerging global knowledge economy demands high level of skills that can only be provided by tertiary institutions. Sub-Saharan Africa has just one scientist or engineer for every 10,000 people while industrialized countries have anywhere from 50 - 200 for every 10,000 people. Development aid in the 1990's created an imbalance in the education sector that favored primary education over tertiary education with a lack of holistic or systems approach to education. It is now clear to the international community that tertiary institutions should certainly be an important part, if not at the center of a country's education network and capacity building strategy. Universities are the source of trained teachers, nurses, doctors, engineers, scientists, managers, etc. Excellence in these areas is necessary to keep the best and brightest in their home countries. Also, science and engineering curricula need to refocus on local challenges in order to solve local problems.

For rapid capacity building, universities need community outreach initiatives with both students and faculty engaging with communities in order to understand local challenges and provide technical solutions. Priority must also be placed on practical orientation to education and problem-solving. Science and Technology should be the key focus areas for tertiary institutions in contributing to cutting edge solutions to development challenges. Collaborative approaches with other regional and international tertiary institutions and the private sector are needed to foster sub-Saharan Africa's economic growth and development through the promotion of excellence in science and engineering. Training networks will also help in complementing and strengthening national institutions and leading research must be conducted in the areas of science and technology that are most relevant to the African continent.

¹ THEMATIC STUDIES SYNTHESIS Realized in the context of the Task Force for Higher Education in Africa (UNESCO-2009)

Students' exchange and mobility between countries within the continent remains very low. For example, in 2006, only about 309 000 students out of 9.3 million were studying outside their home country, which represents 3.3% of the total number of students. Of the mobile students it is estimated that only 1/5 of Sub-Saharan students choose another country in Sub-Saharan Africa². A majority of the mobile students go outside of Africa for tertiary education as shown in Table 1. This situation contributes significantly to the African brain drain. African students are some of the more mobile in the world and a reorientation of a part of this mobility back to Africa has become necessary.

Year	2000	2006	2015
Students Number	6 millions	9,3 millions	18 to 20 millions
% growth		55%	100%
Students/ /1000 inhabitants	6	10	15
# Students in school outside of home country (Mobile Students)		309 000	
Mobile Students/Total students		3,3 (5% S. Africa)	
Mobile students in other African Countries		62,000 (20%)	
Mobile Students Outside Africa		147 000	

Table 1: Evolution of Students population in Higher Education in Africa

Such a reorientation needs: (i) the promotion of a world-class higher education throughout the continent, (ii) the harmonization of curricula and diplomas, and (iii) the promotion of mobility scholarship programs for African students not only outside Africa but also to higher education institutions within Africa.

While the average unemployment rate of college graduates (25 to 35 years old) is estimated at more than 25% over the past several years, the needs of African economy for high skilled human resources are yet not met. This explains the employment of expatriate staff from the North in many African industries and public services. This poor correlation of higher education

² Source: Hendrik van der Pol Director, UNESCO Institute for Statistics, July 6, 2009

with the skill-set needs of African economies is as a result of many factors: (i) the poor standard and quality of higher education delivery, (ii) the lack of preparation of graduates on innovation, entrepreneurship and self-employment, and (iii) the lack of adequate infrastructure to support the courses of studies.³

In this context, it is clear that a rapid growth of students as anticipated and shown in Table 1 above, without structural changes (in training contents and in directing students to fields of high priority for economical growth and development), will further increase the difficulties in proper human capacity development in Africa.

Partnership Strategic Mission:

The mission of the “Africa-US Network of Centers of Excellence in Water & Environmental Science and Technology” project is to build a partnership aimed at making significant contributions to science and technology capacity building in Africa, through collaborative research, education, community service, and outreach activities together with our United States counterparts with a focus in the specific areas of water resources and environmental science and technology. This is in response to the critical societal needs to resolve pressing problems in sustainable development, global change adaptation, health and welfare, entrepreneurship, and poverty eradication in Africa.

An important aspect of this strategic mission is African capacity building involving the training of a critical mass of Africans, particularly females and underrepresented populations, with the capacity to use science and technology to find solutions to problems in water and environmental resource management. The United States partners will also benefit immensely through the internationalization of American education for leadership and competitive advantage in global science and technology.

Partnership Vision:

The Africa-US Network of Centers of Excellence aspires to become a world-renowned teaching, research, and capacity development partnership between a select team of African and United States institutions that address the present and future needs of society in water

³ THEMATIC STUDIES SYNTHESIS Realized in the context of the Task Force for Higher Education in Africa (UNESCO-2009)

and environmental science and technology in order to foster sustainable development, good health, innovation, entrepreneurship and wealth creation.

The partnership will harness existing capacities in the participating African and American universities to build the network of Centers of Excellence. In order to fulfill the strategic mission and vision outlined above, three strategic goals are identified. The strategic goals, together with activities or measures, and measurable performance parameters are defined below.

Strategic Goal #1

Establish a cluster of 3 Sub-Saharan African (SSA) universities (2IE, UMaT and UNIBEN) as world-class Centers of Excellence in water and environmental science and technology, in partnership with United States' counterparts, to engage in research, education, and outreach activities.

Numerous high quality universities and institutions of higher education have been created in Africa over the past 50 - 100 years. However, most of these institutions have not been properly maintained as centers of excellence due to severe resource constraints leading to inadequate government and private sector response to a growing higher education demand in Africa. As a consequence, poor conditions and quality of tertiary education has compelled *"the best and the brightest"* to seek their education abroad, with few returning to Africa, especially in science and technology.

Recent estimates are that more than **50,000** African professionals with post-graduate degrees (Professional, MS, & PhD) work outside their mother country. In the meantime, the current global knowledge economy demands high levels of skills that can only be provided by tertiary institutions. As stated earlier, the number of scientists and engineers per 10,000 population in Africa is insufficient to create a critical mass of technical human capacity for effective and sustainable development. This is partly due to the lack of a systems approach to education. To achieve the needed critical mass of scientists and engineers, African tertiary institutions equipped with world-class centers of excellence should be at the center of any developing country's education network and capacity building strategy with the following attributes:

- Motivation to study in Africa → Excellence at the tertiary level should inspire the best minds to stay in school and subsequently work for Africa to solve African problems.

- Local population access to education → Opportunities and learning centers for science education and in-service training are needed. For example, Monterrey Tech in Mexico for instance, has developed a distance education network with 800 learning centers providing training to the poorest and in the most rural areas.
- Quality → Tertiary institutions should lead the way for quality educational resources and teaching practices. Research and dissemination of knowledge is critical to sustainable development and innovation.

In order to achieve our Strategic Goal #1, the activities and measures outlined below will be pursued.

Measures & activities in Support of Strategic Goal #1:

- a. ***Adopting a “focused investment model” where initial emphasis is on developing 2iE, the lead African institution, into a world-class Center of Excellence and employing lessons learned to develop the other two institutional centers.***

In line with the recommended “***focused investment model***”, our initial focus is to develop and rapidly grow the first network center of excellence at the primary African partner institution (2iE in Burkina Faso), in the first two years, before scaling up to the other two partner institutions in Ghana and Nigeria. Consequently, the lion share of the budget for the first two years of our project is concentrated on developing and building the center at 2iE to a world-class education and research center for capacity building. Subsequently, in Years 3, 4, & 5, the lessons learned at 2iE will be applied to the development of the centers at UMaT in Ghana, and UNIBEN in Nigeria.

The strategy is for this project to have a major impact, in terms of capacity building, in the West African sub-region. It should be noted that this consideration drove the selection of the institutional partners in this network project. The lead institution, 2iE, is located in the water-limited Sahel region of West Africa, UMaT is located in the heart of the mineral mining region of Ghana, while UNIBEN is located in the oil rich Niger Delta region of Nigeria. In addition to partnership with United States institutions of higher education, the 3 African institutional partners were also chosen to encourage and foster science and technology capacity building collaborations between ***Anglophone*** and ***Francophone*** Africa. The 3 institutions are critically placed to lead the capacity building effort in the water and environmental science and technology areas in West Africa.

As will be presented in detail in a later section of this document on “institutional capacity and experience”, following major institutional reforms over the past 5 years, the lead African institution, 2iE, is now an international Private-Public Partnership (PPP) institution focusing on the needs of African development. 2iE is currently officially recognized as a centre of excellence for water and environmental science and engineering by the Economic Community of West African States (ECOWAS), West African Economic and Monetary Union (WAEMU) and the New Partnership for Africa’s Development (NEPAD), an African Union organ that was formed to foster sustainable development throughout Africa. These recognitions are a testament to 2iE’s institutional preparedness to lead capacity building efforts for science and engineering education and research in Africa. The institution demonstrates excellence in academic culture and quality, administrative policies, management responsiveness, transparency, and capacity to successfully execute internationally funded projects while employing internationally accepted accounting standards. 2iE also has a strong regional and international dimension as it welcomed students of 21 nationalities in 2009/2010, and a cadre of permanent faculty from 14 different countries.

However, despite the above progress so far, additional investments are still critically needed in personnel development, scientific infrastructure modernization, academic curricula, and training capacity in order to attain international or world-class standards. Without such additional investments, the significant progress made so far by some African institutions such as 2iE may be gradually eroded to the detriment of the larger African science and engineering educational capacity. We therefore feel very confident that the lessons learned by concentrating initial investments at 2iE will be invaluable to the effective development of the needed institutional capacities in the other African partner institutions.

b. *Development of world-class graduate curricula & research programs on water resources and environmental science and engineering, and the impact of climate change → (Developing & Retaining Human Capacity).*

An increasingly serious problem in SSA, within the broader science and technology field, is the dearth of human and technical capacity in water resources management, climate change adaptation, and environmental sciences and technology sub-specialties. The threats that current and future climate change impacts pose to Africa’s development is well known and documented. Although Africa contributes approximately 3.8% of total greenhouse gas emissions globally, the continent is bracing to bear the brunt of impacts

from climate change. Africa's vulnerability is worsened by multiple factors which include biophysical and developmental stresses that are coupled with low adaptive capacity. In most African countries, the economies are heavily reliant on climate-sensitive sectors such as (a) rain-fed agriculture, (b) fisheries, (c) natural resources, and (d) tourism.

The climate change impacts can be seen all across Africa and have had tremendous negative economic and social effects on a population that is least able to adapt. The large-scale poverty in most of Africa also limits human development. According to UNDP report the 22 countries listed as '**low development**' countries in the UNDP's 2007-2008 Human Development Report (HDR) on Climate Change are all in Africa. Furthermore, despite the commitment of their governments, African countries are struggling to meet the Millennium Development Goals (MDGs) – and climate change is increasing their risk of falling short of these goals. Therefore, it is clear that integrated and comprehensive approaches to climate change adaptation research and capacity building are needed to meet the scale of the challenge. The network will aim to jointly develop world-class graduate level curricula and research programs on climate change impact on water resources and environment.

c. *Development of sustainable solutions to the problems of water quality and wastewater treatment.*

Water is one of the most important resources affecting Africa's socio-economic development and ecosystem integrity. With only 9% of global freshwater resources (4,050 km³/yr) water supply & availability in Africa is naturally limited. Poor water quality is a key cause of poverty and about 3.1 million people died in 2002 as a result of diarrheal diseases and malaria, 90% of who were children. Water scarcity and poor quality is further exacerbated by climate variability and climate change.

It is estimated that over 300 million Africans currently will face water scarcity conditions. Of the 48 countries that are expected to experience chronic water shortages by the year 2025, **20** are in the Middle East and North Africa and another **20** are in **sub-Saharan Africa**. In just 20 years, countries such as **Niger** have lost more than 80 percent of their freshwater wetlands. Climate-Change is expected to make this worse throughout sub-Saharan Africa (SSA). In 1998, 72% of all reported cholera cases in the world were in Africa. Water quality is declining in most regions of Africa, affecting public health, industry, the diversity of freshwater species and ecosystems. At the same time the proportion of wastewater treated in Africa is zero as shown in Figure 1 below.

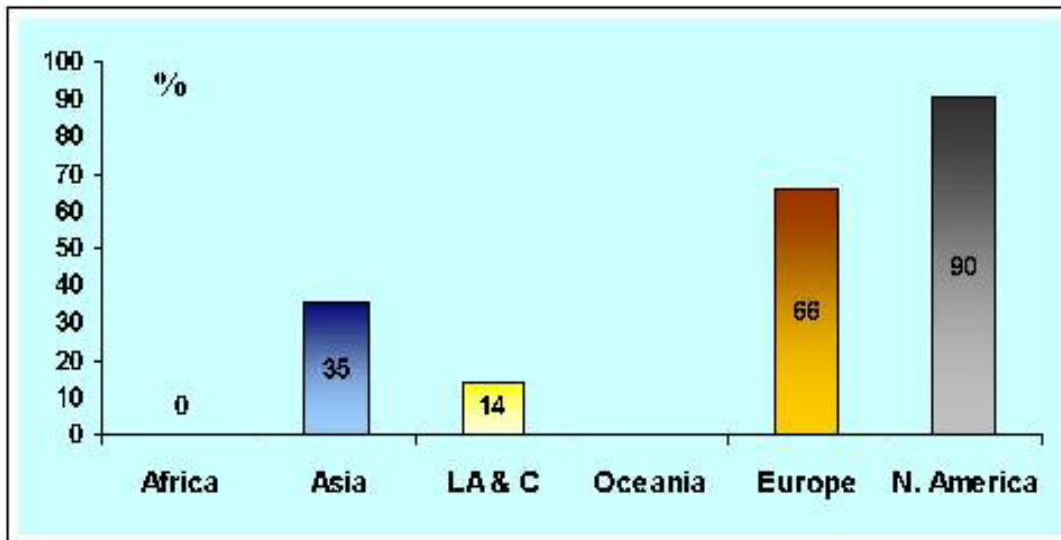


Figure 1. Percentage (%) of wastewater treated in various regions of the world
Source: WHO/UNICEF 2000

This partnership will engage in the development of innovative & cost-effective technologies to address uniquely African water quality and wastewater problems. Entrepreneurial scientists & engineers will be trained to develop effective & profitable business models for providing water services to urban and rural poor in Africa. Research & human capacity development in water resources management, water storage & treatment, and climate change.

- d. Procurement and development of shared state-of-the-art laboratory facilities and infrastructure for education and research, with special emphasis on educating the female population → (Developing & Retaining Human Capacity).**

A New York Times article of May 20, 2007 titled “Africa’s Storied Colleges, Jammed and Crumbling” showed the poor state of the science and technology educational infrastructure in most SSA universities that were once world-class educational institutions in the 1960s and 1970s. The state of the educational science and technology infrastructure was illustrated with a picture shown in Figure 2 below. The figure epitomizes the poor state of science and technology education and research infrastructure in SSA.



Figure 2: A chemistry lab student at Anta Diop University in Senegal measuring Liquid with a broken graduated cylinder.

Given this precarious state of science and engineering infrastructure in most African tertiary institutions, this network partnership intends to develop and procure state-of-the-art laboratory facilities and infrastructure for education and research that will be shared by the partners. In developing these world-class facilities, the network will be mindful of gender bias in African higher education by placing special emphasis on the recruitment and **education of girls and females** from the local population.

- e. ***Collectively raise funds for research, education and outreach for long-term sustainability from funding agencies globally, while developing collaborations with existing local industries for financial and programmatic support i.e. adopt an entrepreneurial approach → (Entrepreneurial Approach).***

The partnership network will collectively develop the capacity to successfully solicit for research, education and outreach funding from international funding agencies in order to ensure long-term sustainability. In this fund-raising area of partnership activity, the lead African institution, 2iE, has developed a robust and transparent capacity to source funds internationally. The lessons learned from 2iE will be applied to develop similar capacity for funding solicitation and proposal writing in the other two African partner institutions. As an illustration, the table below shows the breakdown of 2iE sources of incomes between 2007 and 2009 (excluding funding for new infrastructures and in program quality):

Table 2. Change in 2iE Sources of Income from 2007 to 2009

Year	2007	2008	2009
Budget Support	37%	18%	10%
Tuition Fees	24%	24%	36%
Provision of services	19%	13%	14%
Donors funded activities contract	21%	45%	40%

Table 2 shows that the budgeted government support for 2iE as a proportion of operating cost declined from 37% in 2007 to about 10% in 2009, while funding from sponsored activities as a percentage of total funding doubled in the same period. The incomes coming from donor funded activities and contracts reflect the growing capacity of 2iE to finance research and development projects through responding to request-for-proposals (RFPs) from international sponsor agencies and donors. Below are some on-going internationally funded projects at 2iE:

EU Water Facility:	2007	€1,987 500	Duration: 36 months
EU Energy Facility:	2007	€865,827	Duration: 36 months
IDRC Canada :	2007	Can\$489,200	Duration : 36 months
Danida (Denmark)	2008	DKK1,946,267	Duration: 11 months
African Water Facility	2009	€1,990,000	Duration : 60 months
EU, Energy-Biofuels	2009	€980,000	Duration: 24 months

- f. ***Develop a critical mass of graduate students, with at least 30% female, in water and environmental science and technology, and also train junior faculty members, with special consideration for women trainees, to PhD/Post Doctoral levels for careers in academia → (Developing & Retaining Human Capacity).***

The strategic plan is for the network partnership to graduate between 30 and 50 PhD and 90 – 150 MS level African students, and numerous postdoctoral fellows and junior faculty within the first five years of operation. This will require that each institution will have at least 20 graduate students registered in the network programs annually for the first five years.

g. *Develop distance learning capacity for increased access to higher science and technology education → (Developing & Retaining Human Capacity).*

One of the most significant capacity building activities to be engaged upon in the partnership network is the development of an outreach program based on enhanced distance learning capacity for increased access. Since a majority of Africa's population live in rural areas, access to higher education, particularly for the female population is limited. This network will develop a distance learning program in each of the participating African institutions in order to increase access and reduce cost of training. 2iE, the lead African institution already has a viable and robust distance learning program from which the other two institutions can learn important lessons in terms of development, implementation, and associated program delivery problems.

h. *Develop student, faculty and staff exchanges between partner institutions.*

This activity area will be developed into 3 programmatic activities as follows:

1. Study-abroad student exchange program between the US institutions and the African partner institutions.
2. African study-abroad program for student exchange between the 3 African institutions who are partners in the project.
3. Faculty and staff exchange programs between the US and African partner institutions.

The logistics for the above activities, particularly items 1 & 2, will be handled by our African NGO partner, GEIFON. The academic content for these exchange activities will be negotiated between partner institutions under the auspices of the African Renaissance Institute of Science & Technology (ARIST), a US African Diaspora partner organization.

i. *Engage students in experiential learning activities that involve application of science and technology for the solution of water quality and environmental problems.*

The network partnership will implement **Service-Learning** programs in each of the African partner institutions that will engage the students and faculty in solving identified

community water and environmental problems through the application of science and engineering principles. Emphasis will be placed on service to small communities and rural populations in the participating African countries. A second aspect of the experiential learning activities will involve the development and implementation of research experience for undergraduate (REU) students in order to encourage critical thinking skills, and at the same time facilitate the recruitment of future graduate students.

j. *Train students in entrepreneurial approaches and promote innovation activities in new business incubation → (Entrepreneurial Approach).*

The academic programs and curricula in all partner institutions and centers of excellence will be infused with classes in innovation and entrepreneurship to be taught by entrepreneurship experts and industry partners. The network also plans to institute an annual Business Development Competition where students will develop locally implementable business plans, and present such plans to experts and industry captains for evaluation. Such plans must be borne out of their academic training at the 3 African centers of excellence. The industrial partners will be engaged for a major role in this endeavor, and entrepreneurship awards will be given on the basis of merit to deserving student competitors. This is aimed at encouraging innovation, entrepreneurship, and wealth creation through the application of the science and technology knowledge and skills learned.

k. *Assess African partner institutional constraints and develop strategies to strengthen institutional capacities to develop world-class research, education, and outreach activities to address local water and environmental problems → (Monitoring & Evaluation).*

A detailed assessment and evaluation of institutional constraints will be conducted for each of the 3 African partner institutions in order to achieve the following objectives:

1. Identify the problem areas in their capacity to deliver world-class academic programs and management policies in each African institution.
2. Prioritize the identified constraints for a gradual resolution of the issues over time. The prioritization of the identified institutional and policy constraints will be done by the individual African institutions for the constraints identified in their institution.

3. Develop team-based collaborative solutions to the identified constraints according to priorities.

Preliminary assessments of institutional and policy constraints for each of the 3 African institutions were conducted during the planning grant period. The following are the initial identified constraints, as well as the observed areas of strengths, found with each of the institutions:

- i. 2iE → The lead African institution's main constraints and areas of relative weaknesses included (a) limited faculty capacity in the chemical sciences, particularly English speaking faculty to support an international bi-lingual (French & English) programs; (b) state-of-the-art research equipment in the laboratories; (c) inadequate research and scholarly productivity by way of publications of articles in journals, proceedings, etc. 2iE faculty is eager to engage in research but are limited by the teaching loads at this time. However, 2iE clearly demonstrated strength and excellence in academic and financial management, institutional policies, academic quality, distance learning, community outreach activities, ability to secure external funding, project implementation capacity, and management of externally sponsored programs.
- ii. UMaT → The University of Mines and Technology showed weaknesses and constraints in the areas of (a) availability of buildings for laboratory, office, and classroom spaces (b) limited faculty capacity, (c) research equipment (d) low levels of research output, and (e) internationally acceptable research and sponsored programs management, (f) capacity to attract external funding for research and teaching activities. UMaT showed strength and excellence in academic program delivery, academic quality, outreach and community service activities.
- iii. UNIBEN → The University of Benin demonstrated weaknesses in (a) limited faculty capacity, (b) lack of research equipment and low research productivity, (c) internationally acceptable sponsored programs management and administrative policies, (d) excessive classroom sizes for science and engineering course delivery, (e) poorly equipped teaching laboratories (f) poor community service and outreach, (g) low capacity to attract external funding. UNIBEN however, demonstrated strength and excellence in faculty quality, academic program delivery, availability of building for laboratories, classrooms, and offices.

Complete institutional assessments and development of strategies to address the identified problems will be conducted when the network partnership is implemented.

l. Publish and disseminate knowledge to the scientific community and the general public.

The network will engage in first class research activities geared towards scientific projects that are developed to address local African water and environment problems. The results of such research and knowledge discovery will be widely disseminated through publications in scientific scholarly journals, conferences, community short courses, seminars, workshops, and advisory work with local, national, and regional governments, etc.

m. Establish a robust continuous monitoring and evaluation program for the African network partners in order to ensure transparency and continuous improvement . → (Monitoring & Evaluation)

The project implementation and management plan will adopt the strategy illustrated in Figure 3 below.

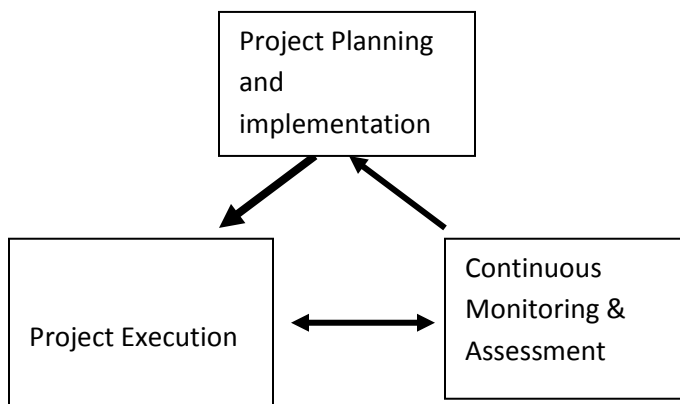


Figure 3: Project Implementation Approach

The project **Planning and Implementation** stage will involve the definition and identification of the sponsors' requirements and conditions in relation to the project strategic mission, goals, and objectives. Additional efforts will involve meeting with collaborating institutions to get buy-in, developing institutional ownership of project, and defining the major project milestones for the first 5 years. In addition, the planning

stage will define the needed implementation personnel and administrative support for each activity, the equipment needs and availability at the various project sites (network partners), and other project needs. At the end of the planning stage which should occur within the first 3 - 6 months, the **Implementation** phase follows. This phase will consist of the implementation of steps, processes, procedures and policies that are necessary to fulfill the project goals, mission and objectives, and also to develop and implement the network management plan. The **Continuous Monitoring and Assessment** phase will establish the basic processes and criteria for monitoring, observing, and assessing the project and evaluating outcomes, outputs and deliverables on a continuous basis. The assessment results are then evaluated and solutions to the identified constraints and problems are developed and adopted for execution of corrections and problem solutions. This monitoring and assessment process will ensure that potential problems are identified in a timely manner such that corrective actions can be continuously taken. This will ensure a continuous improvement process for the project.

- n. ***Provide science based advice to governments, national, regional and international organizations for the formulation of evidence-based public policies in the areas of water and environmental resource management.***

This project activity will be developed in partnership with the national “Ministries of Water Resources & Environment” in the host countries, as well as the regional authorities such as the Economic Community of West African States (ECOWAS), to develop evidence based policies for water resources management, protection of the environment, development of adaptation strategies to problems arising climate change, and public outreach campaigns.

Measurable Performance indicators for Strategic Goal #1:

- Publish 10-20 scholarly articles in journals, books and conference proceedings during the initial 5 years.
- Train at least 30 PhDs and 90 MS graduates over 5 years.
- Engage 15 post doctoral Research Fellows over 5 years.
- Number of applied practical solutions developed over 5-10 years.

- Adoption of practical solutions developed over 5-10 years
- Develop 3 functional interdisciplinary state of the art laboratories in water and environmental engineering at the partner institutions
- Number of center and non-center participants that use the facilities
- Five additional non-USAID sponsored projects over 5-year period
- Development of 2 new distance learning programs
- 500 distance learning graduates and 500 participants in short and professional development courses
- Sixty faculty/staff and students on exchange programs within the network over a 5-year period
- Sixty visiting professors to deliver lectures in partner institutions
- Seventy five students will be involved in experiential learning activities in selected communities over 5 years
- Seventy five partner institution affiliated students recruited for graduate studies in water and environmental science over a 5-year period
- 250 students participate in business development competition in partner institutions over a 5-year period
- 35 students participants receive entrepreneurship award over a 5-year period
- 15 industrial partnership over the 5-year period
- Support and promote 3 network journals
- Create virtual journal and newsletter to disseminate network information globally
- Organize 5 international conferences over a 5-year period
- Six joint proposals will be developed over a 5-year period
- 5 short courses for African/American students and professionals over the 5-year period
- Create a network-based advisory council to provide information and consultation to governments, national, regional and international organizations in West Africa.

Strategic Goal #2

Leverage partnership with African Diaspora scientists and United States institutional partners including universities, such as Tuskegee University and Princeton University, in securing external funding for partnership programs and for development of a critical mass of African scientists and engineers.

Measures & activities in Support of Strategic Goal #2:

- a. ***Engage the African Diaspora scientists and engineers in partnership with American partner universities to support education and research collaborations with African partner institutions → (Developing & Retaining Human Capacity).***

With few exceptions, the academic curricula in African universities are outmoded, offering little subject matter of relevance to relevant industries or ideas for the marketplace, or even to adding value to existing export raw materials and products. Further, leaders of technically based private firms, such as those in the agricultural, mining, financial, and food technology sectors see little advantage in forging partnerships with African university professors, who in turn have little confidence in contributing ideas to the private sector.

As part of our strategic project plan, we intend for the members of the African Diaspora to play a significant role in helping the partner African institutions develop teaching and research capacity. This corps of African talents living abroad is by now enormous. Diaspora scientists from Nigeria, for example, number in the tens of thousands in the U.S. alone. Many of them have succeeded in academia, in business, as entrepreneurs in bringing new technologies to the marketplace, managing large programs, and founding their own companies. At the same time, many of the African Diaspora scientists and engineers are highly motivated and eager to apply their skills for the benefit of their home countries and regions, given the appropriate platform and mechanisms to do so.

To date, such Diaspora focused platforms and mechanisms have been non-existent, and few assistance programs have been able to harness the potentials of the African

Diaspora effectively. The *African Renaissance Institute of Science and Technology* (ARIST), a United States based partner in this project, has the potential not only to circumvent these difficulties, but to convert them into strengths. ARIST was created by a partnership of scientific leaders from both the Diaspora and from African institutions who are united in their desire to work together on behalf of African higher educational institutions and people.⁴ The sole focus and purpose of ARIST is to improve the quality of educational and research programs throughout Africa for capacity building and poverty reduction. Higher educational advanced research and teaching capacity is the essential precursor to developing and retaining the next generation of African academics, researchers and innovators. ARIST will lead the coordination of the African Diaspora and the U.S. institutional partners in the collaborative efforts with the African partner institutions.

- b. *Develop partnership with USAID missions in Burkina Faso, Ghana, and Nigeria in fostering higher education partnerships between American and African institutions, while improving educational opportunities for girls, women and other underserved and disadvantaged populations → (Building Relationship with USAID).***

USAID’s assistance to Africa works to help African governments, institutions, and organizations incorporate good governance principles and innovative approaches to health, **education**, economic growth, agriculture, and the **environment**. For example, within the USAID Education & Universities programmatic areas in Nigeria, U.S. assistance fosters higher education partnerships between American and Nigerian universities, especially those in the north and the volatile Delta regions. This is replicated throughout Africa as evidenced by the USAID sponsored conference on “Africa Regional Higher Education Summit” held from October 21 – 24 of 2008 in Kigali, Rwanda. This Africa-U.S. partnership project intends to liaise with the relevant USAID country representatives to build relationships with USAID missions in order to align some of our activities with USAID missions.

One identified area of common interest between USAID missions in Africa and our network is in placing special emphasis on improving educational opportunities for girls, women and other underserved and disadvantaged populations, as outlined above. According to USAID *“Competitive economies require workers to be able to learn*

⁴ The African Renaissance Institute of Science and Technology is a registered non-profit educational organization based in Princeton, New Jersey, USA.

advanced and changing concepts of science and technology, law and governance, and business and on a continuous basis. Without sound conceptual and technical skills acquired in secondary schools, workforce development programs, community colleges, and universities, youth in developing countries will be unable to be as productive and as innovative as they could – and should be. Therefore, in collaboration with American universities and colleges, USAID supports a wide variety of training, workforce development, and higher education programs that strengthen faculties and administrations in both developing countries and the United States”. This clearly defines a major area of our potential partnership with USAID mission in Africa.

- c. *Engage African students, scientists, and engineers in American higher education and research through study-abroad and faculty exchange programs with US partner institutions; and also develop students, faculty, and staff exchanges between the African partner institutions → (Developing & Retaining Human Capacity).***

As earlier outlined under Strategic Goal #1 above, this activity area will be developed into 3 programmatic activities as follows:

1. Study-abroad student exchange program between the US institutions and the African partner institutions.
2. African study-abroad program for student exchange between the 3 African institutions who are partners in the project.
3. Faculty and staff exchange programs between the US and African partner institutions.

The logistics for the above activities, particularly items 1 & 2, will be handled by our African NGO partner, GEIFON. The academic content for these exchange activities will be negotiated between partner institutions under the auspices of the African Renaissance Institute of Science & Technology (ARIST), a US African Diaspora partner organization.

- d. *Engage in joint curriculum development, research, and solicitation for funding.***

The partnership will endeavor to develop joint curricula at the graduate level (MS & PhD) in order to take advantage of the collective expertise of partner institutions for capacity building in the African institutions. The joint effort will include the development of interdisciplinary research projects in water and environmental engineering, as well as joint solicitation for external funding of programs as a means of leveraging the initial USAID sponsorship.

Some efforts among the partners have already been made in this strategic activity area. As an illustration, based on initial information provided by Higher Education for Development (HED) and as a part of our planning grant activities, this partnership team has submitted a joint proposal titled “*African Network of Centers of Excellence in Climate Change Adaptation (ANCECCA)*” to the Open Society Institute (OSI) & Soros Foundation Network in response to a recent request for proposals (RFP).

- e. Support academic and research exchanges and collaboration between Anglophone and Francophone West-African institutions in order to harmonize training and leverage human and material resources in support of capacity building → (Demonstrating capacity & Potential for impact).***

The division of West-African higher educational institutions along linguistic lines of their respective national colonial governments (English & French) has contributed immensely to the lack of collaboration and partnership among West-African institutions that would leverage human and materials resources for regional capacity building in science and technology. A major strategic objective of this project is to contribute to bridging the Anglophone-Francophone divide by bringing institutions from the two linguistic groups together in West Africa for regional capacity development. Consequently, the partnering of two Anglophone institutions (UMaT and UNIBEN) with a Francophone lead African institution in this partnership project is deliberate.

Measurable Performance indicators for Strategic Goal #2:

- Conduct 25 visits by American scientists and engineers, including African Diaspora scientists and engineers in the United States to deliver courses and participate in research in the partner institutions over the next 5 years.
- At least 10 Scientists and Engineers from African partner institutions to deliver courses and/or participate in research in the US partner institutions on an annual basis.
- Engage at least 10 exchange students and 10 exchange faculty members annually between 2iE, the Francophone lead African institution and the other two institutional partners, UMaT and UNIBEN, both of which are Anglo-phones.

- Develop common graduate degrees (MS & PhD) curricula for all three African partner institutions, and secure funding for at least 5 research and development projects over a 5-year period.
- Ensure that at least 30% of the student intake into the centers of excellence are female and underrepresented minorities within 5 years of commencement of activities.
- Identify at least one common specific subject area of collaboration with the USAID country missions in West Africa.

Strategic Goal #3

Engage US students and Faculty in unique research, educational, and outreach activities that will make them more competitive global scientists and engineers:

Measures & activities in Support of Strategic Goal #3:

- a. ***Develop a unique research experience program for undergraduate US students to be conducted in African partner institutions.***

A number of community-based research projects that can serve for service-learning experiences for undergraduate US exchange students will be developed in each of the 3 African partner institutions. The NGO partner, GEIFON, will be responsible for assisting in the development of the service-learning projects, as well as coordinating the student activities during the exchange visits.

- b. ***Develop Faculty exchange between US and African partner institutions.***

As described earlier (Strategic Goal #1, Activity “g”), these exchanges will involve participation by both African and United States institutions.

- c. ***Encourage graduate student and post-doctoral research experiences in partner African institutions → (Developing & Retaining Human Capacity).***

This is aimed at enhancing the collaboration between the African partner institutions in order to leverage resources for regional capacity building.

- d. *Engage visiting US students and scholars in interactions with local USAID mission activities related to water, sanitation, and the environment → (Building Relationship with USAID Missions).*

The visiting US students and scholars will be engaged in the USAID mission activities that are relevant to the water and environmental science and technology focus area of this partnership. Details of the USAID mission activities in Africa are presented in Strategic Goal #2 and Activity-b above.

Performance indicators for Strategic Goal #3:

- Forty US undergraduate students in summer research for the 5-year period
 - Forty US graduate and postdoctoral fellows in research in African partner institutions over the 5-year period
 - Five community-based outreach activities for visiting US students and scholars
-

Additional Strategic Plan Considerations:

A. Institutional Capacity & Experience (*Lead African Institution*)

The lead African institution - International Institute for Water and Environmental Engineering (2iE) - is a 40 years old world-class international institute for higher education and research in the fields of water, energy, environment and civil engineering based in Ouagadougou, the capital city of Burkina Faso, West Africa. 2iE was created in 1970 as an interstate school of engineers by 14 African countries (Benin, Burkina Faso, Cameroun, Centre Africa, Chad, Congo, Côte d'Ivoire, Gabon, Guinea, Mali, Mauritania, Niger, Senegal, Togo). Following major institutional reform over the past 5 years, 2iE is now an international Private-Public Partnership (PPP) institution focusing on the needs of African development.

2iE is officially recognized as a Centre of Excellence for Water and Environmental science and engineering by the Economic Community of West African States (ECOWAS), West African Economic and Monetary Union (WAEMU) and the New Partnership for Africa's Development (NEPAD), an African Union organ that was formed to foster sustainable development throughout Africa. These recognitions are a testament to 2iE's institutional capacity for science and engineering education and research. About 5000 Africans have been educated at 2iE and about 15 000 engineers and technicians have benefited from one or several short courses offered by 2iE.

In 2010, 2iE welcomed 850 on-site students of 21 nationalities and another 450 students of 32 nationalities on distance-learning for the Bachelor's, Master's and a PhD degree programs. In addition, more than 1500 attendees are trained each year through the 2iE short course and outreach program. 2iE regards employability of its students as being its first priority, and it has been very successful in placing its graduates in gainful employment throughout Africa. The success of 2iE is partly attributable to the inclusion of management into the curricula, partnership agreements with the private sector, participation of private sector in its governance and scientific committee, participation of professionals in delivering courses, organization of annual enterprise days, creation of a business incubator and a business nursery program, and the transparency of management. According to the annual survey of the employment of its alumnae, more than 90 % of 2iE graduates get a job 6 months after they graduate. 12% of 2iE graduates have created their own businesses in Africa, thus playing a major role in the development of the African countries.

On the research front, over the past 3 decades, 2iE students, faculty and researchers have run large basic and applied research programs in water, environment, renewable energy, and

material sciences and technology. Research is conducted in partnership with renowned international universities from the north and the south, and in association with industry. The main research topics in the domain of Water/sanitation and environment are the following:

- Water pollution control and water resources assessment and management in urban and rural areas.
- Drinking and waste water treatment and supply with focus on the urban poor, and small settlements and rural areas (innovative technologies were developed and implemented in partnership with the private sector, industry and local governments).
- Water harvesting, rain water banking, and waste water collection and reuse, with a specific focus on reuse for urban agriculture.
- Impact of climate change and entropic activities on soils and water resources and population health. 2iE is part of the international African Monsoon Multidisciplinary Analysis program (AMMA).
- Improvement of water use for agriculture (innovative technologies were developed and implemented in partnership with professionals).

On financial management and funding, the 2iE financial management system has been assessed and found to satisfy international standards by multilateral and bilateral donors such as the African Development Bank, the World Bank, the European Union and French AFD, Switzerland DDC, Danish DANIDA, Canadian IDRC. 2iE operating accounts and projects accounts are regularly subjected to auditing by external firms. As a result of the financial management capacity of 2iE, the institution has developed an excellent capacity to source funds for its operation and development. 2iE has successfully prepared and have been able to fully fund an ambitious **Strategic Development Plan**, for the period **2006-2010**, which aimed at increasing its training capacity and improving academic quality. This Business Plan with a budget of of USD 30 million, received support from the **Government of Burkina Faso** (donation of lands), the French Ministry of Foreign Affairs (EUR 6 millions), the Agence Française de Développement (EUR 4.7 millions), the World Bank (\$3.5 millions), the African Development Bank (EUR 4 millions), DDC Switzerland (CHF 4 millions) and the WAEMU (EUR 200 000). The business plan included:

- Investment on new infrastructures to reach a 2000 students capacity;
- Transformation of the governing system (from an Inter-States organization to a Private-Public partnership);
- Strengthening of training programs and improvement on quality of academic delivery;
- Development of distance learning;
- Development of research, innovation and entrepreneurship;
- The transformation of the financing model.

In this first phase of its multi-year development plan, 2iE has largely increased its capacity to finance its running costs on its own resources without depending on government funding, thus demonstrating self-reliance and sustainability.

With the first strategic development plan phase (2007-2010 Plan) almost complete, the International Institute for Water and Environmental Engineering (2iE) has become an international scientific and technological education, research, and outreach platform that is able to train world-class technicians, engineers and scientists who work in Africa and for the economic development of the continent. The quality of education programs at 2iE is now internationally recognized, with 2iE being the only engineering school in Africa to be **accredited in Europe** (EUR-ACE accreditation obtained in January 2009 for 6 years). By the end of 2010, with the development and addition of new academic and scientific infrastructure, 2iE scientific platform will have a large capacity to increase student capacity to 2000 on campus from its current 1200.

To facilitate this expansion, 2iE has prepared a new Strategic Plan for the period 2011-2015 with the intention to increase student enrollment and access to between 2000 and 2500 students on-site, and another 2000 students in distance learning programs with:

- A better social, **gender**, and nationalities diversity;
- A larger world-class faculty with a specific focus on the African Diaspora in North America;
- A multiplying impacts on the African Higher Education system in a whole through expertise and student mobility;
- A focus on innovation and entrepreneurship in the Green Business;
- A world-class access to ICT and distance learning technologies;
- Making 2iE a model for social and environmental responsibility.

The proposed HED/USAID network of centers of excellence project will certainly contribute immensely to the achievement of 2iE Strategic Plan through the active collaboration with a network of scientists from other African and American universities. The partnership project will use 2iE's success as a model and platform for positively improving the institutional capacities and efficiencies of the other two African partners.

B. Potential Broader Impacts

In addition to the measurable performance parameters and specific outcomes and outputs that were detailed earlier, a number of additional and broader cross-cutting impacts resulting from the network partnership include:

1. Development of advanced education, research, community service and outreach infrastructure, equipment, and expertise that will be available to other local, national, and regional higher institutions of learning, governments, the private sector, grassroots groups, and non-governmental organizations (NGOs), thus providing a major long-term leverage to the initial investment and efforts.
2. The development of Africa-based and Africa-focused science and education networking competencies and best practices that could help leverage national investments in education, science, and technology capacities at all levels.
3. The centers will also help train the next generation of African scientists and engineers for academic and industry engagements. Once fully implemented, each center of excellence will be expected to produce numerous advanced level scientists and engineers annually at the MS and PhD levels in support of African capacity building in water and environmental science and engineering, and the broader science and technology disciplines. In addition, numerous undergraduate students, particularly those in related disciplines such as in engineering (environmental, chemical, civil, etc.) and natural sciences (chemistry, biology, physics, geology, etc.) will receive courses and training in various aspects of water and environmental science and engineering.
4. The partnership network model will provide a collaborative partnership of human and material resources to spawn better analytical approaches to complex and trans-disciplinary climate change adaptation challenges throughout Africa.
5. Collaborations with other non-network member institutions in research and capacity building to extend benefits into the larger African higher education sub-sector.

If successfully implemented, the potential impact of these centers of excellence on students, faculty, and national and regional developments in Africa will be huge. The provision of world-class science and technology facilities and infrastructure, together with the infusion of internationally renowned scientists in a collaborative effort will lead to the production of numerous highly trained local African scientists and engineers that are critically needed in Africa. The trained personnel in turn will not only be better prepared to solve serious societal problems, but will also be equipped to engage in innovative and entrepreneurial activities for wealth creation and economic growth of their nations and region. The engagement of the existing capacities and faculty members from the African partner institutions, and from other higher institutions in the region, will prepare the African academics for enhanced productivity, teaching effectiveness, professional development, and capacity building. New faculty from higher institutions in the region will also be trained to PhD levels. For the long-term, the leveraging effects of all these positive impacts would contribute to the transformation of the African countries into enhanced GDP growth economies.

The establishment of centers of excellence, where educational and research best practices are the norm, within existing African higher education institutions will not only represent a new

paradigm in African education, but will have the potential to introduce innovation and significant changes to the educational delivery practices in the partner institutions. This will occur through training of the local faculty and students in world-class teaching and research methods.

C. National & Regional Support for Higher Education

As mentioned earlier, the lead African institution – International Institute for Water and Environmental Engineering (2iE) was created in 1970 as an Inter-State school of engineering by 14 African countries (Benin, Burkina Faso, Cameroun, Centre Africa, Chad, Congo, Côte d’Ivoire, Gabon, Guinea, Mali, Mauritania, Niger, Senegal, Togo). Following major institutional reform over the past 5 years, 2iE is now an international Private-Public Partnership (PPP) institution focusing on the needs of African development. Over the years, 2iE has received strong support from the host country – Burkina Faso. For example, recently, the Government of Burkina Faso donated about 110 hectares of land to allow the development of new infrastructures. The Government of Burkina Faso also recently obtained a World Bank facility of about \$5.0 million to support infrastructure developments at 2iE. 2iE is also the beneficiary of a Head-Quarter Agreement which confers diplomatic status, tax exemption, and free movement of students and employees. However, support for 2iE is not only national but also regional and continental. 2iE has been designated as a Center of Excellence in Water and the Environment of the Economic Community of West African States (ECOWAS). In addition, many West and Central African countries provide support for 2iE through scholarships and academic program funding support.

The other African partner institutions, UMaT and UNIBEN, are both public owned institutions in their home countries of Ghana and Nigeria. Consequently, national support for higher education in each of the three African partner institutions in this project is guaranteed.

D. Alignment of Project with USAID Regional Mission in West-Africa

As discussed earlier under Strategic Goal #2, USAID’s assistance to Africa works to help African governments, institutions, and organizations incorporate good governance principles and innovative approaches to health, **education**, economic growth, agriculture, and the **environment**. For example, within the USAID Education & Universities programmatic areas in Nigeria, U.S. assistance fosters higher education partnerships between American and Nigerian universities, especially those in the north and the volatile Delta regions. This is replicated

throughout Africa as evidenced by the USAID sponsored conference on “Africa Regional Higher Education Summit” held from October 21 – 24 of 2008 in Kigali, Rwanda. This Africa-U.S. partnership project intends to liaise with the relevant USAID country representatives to build relationships with USAID missions in order to align some of our activities with USAID missions. Contacts have already been made and a meeting between USAID representatives at the U.S Embassy in Ouagadougou, Burkina Faso and the African lead institution (2iE) officials was held on March 29, 2010 to discuss areas of possible collaboration and alignment with the USAID West Africa mission.

One identified area of common interest between USAID missions in Africa and our network is in placing special emphasis on improving educational opportunities for girls, women and other underserved and disadvantaged populations, as outlined above. According to USAID *“Competitive economies require workers to be able to learn advanced and changing concepts of science and technology, law and governance, and business and on a continuous basis. Without sound conceptual and technical skills acquired in secondary schools, workforce development programs, community colleges, and universities, youth in developing countries will be unable to be as productive and as innovative as they could – and should be. Therefore, in collaboration with American universities and colleges, USAID supports a wide variety of training, workforce development, and higher education programs that strengthen faculties and administrations in both developing countries and the United States”*. This clearly defines a major area of our potential partnership with USAID mission in Africa.

Suggested Budget

The tables below present the suggested budget for the first two years of the project and also for the first 5 years. The tables also provide details of the share of each partner institution.

For the financial management of the allocated funds, it is proposed that 2iE will sign on behalf of and take responsibility for the funds for the African partners, while Tuskegee University will take responsibility of the funds for US partners. Based on an assessment of each partner institution’s administrative capacity, other African partner institutions will sign specific sub-grant agreements with 2iE, the lead African institution, in which procedures and financial management arrangements and standards will be stipulated.

BUDGET ITEM & DESCRIPTION YEAR 1 & 2					BUDGET PER PARTNER YEAR 1 & 2						
Description (In USD)	Unit	Nbre of Units	Unit Costs	TOTAL COSTS	2iE	Uni Ben	UMaT	GEIFON	Tuskegee	Princeton	ARIST
Strategic Goal 1: To establish a cluster of 3 sub-Saharan African (SSA) universities (2iE, UMaT and UNIBEN) as world-class centers of excellence in water and environmental science and technology to engage in research, education, and community outreach											
1.1 Development of world-class research on the impact of climate change on water and the African environment				1 005 000	616 000	194 500	194 500	0	0	0	0
Support to PhD Students (30 x 3 years)	Per PhD student per year	30	12 000	360 000	240 000	60 000	60 000				
Post Doctoral Research Fellows (15 x 2 years)	Per Research Fellows per year	15	15 000	225 000	135 000	45 000	45 000				
Travel and data collection costs	Per PhD students for 3 years	7	15 000	105 000	60 000	22 500	22 500				
Publication in Scientific Journals	Per publication	5	3 000	15 000	9 000	3 000	3 000				
Laboratory consumables	per year	2	40 000	80 000	40 000	20 000	20 000				
Subscription of scientific journals	Per year	2	100 000	200 000	120 000	40 000	40 000				
Computer Equipment	Per PhD students and Research Fellows	20	1 000	20 000	12 000	4 000	4 000				
1.2 Development of sustainable solutions to the problems of water quality and wastewater treatment				300 000	300 000	0	0	0	0	0	0
Development of prototypes	By prototypes	2	100 000	200 000	200 000	0	0				
Dissemination of results	By innovative solutions	2	25 000	50 000	50 000	0	0				
Support to the creation of Businesses on innovative solutions	By start up business	1	50 000	50 000	50 000	0	0				
1.3 Procurement and development of shared state-of-the-art laboratory facilities and infrastructure for education and research				2 000 000	1 500 000	250 000	250 000	0	0	0	0
Lab Equipment	Per Facilities	1	1 500 000	1 500 000	1 000 000	250 000	250 000				
Construction/rehabilitation of education and lab infrastructures	Per Partner	1	500 000	500 000	500 000	0	0				
1.4 Collective funds raising for research, education and outreach for long-term sustainability				66 000	38 000	0	0	28 000	0	0	0
Workshops	Per Workshops	2	15 000	30 000	15 000	0	0	15 000			
costs of missions to donors	Per Missions	4	4 000	16 000	8 000	0	0	8 000			
External expertise	Per Expertise	2	10 000	20 000	15 000	0	0	5 000			
1.5 Development of a critical mass of graduate students in water and environmental science and technology				385 000	275 000	55 000	55 000	0	0	0	0
Support to MSc Students (90 x 2 years)	Per MSc student per year	70	5 500	385 000	275 000	55 000	55 000				
1.6 Development of distance learning capacity for increased access to higher science and technology education				80 000	80 000	0	0	0	0	0	0
Development of New Distance Learning Programs	Per Program	1	80 000	80 000	80 000	0	0				
1.7 Development of student, faculty and staff exchanges between partner institutions				257 000	131 000	63 000	63 000	0	0	0	0
Exchanges of staff and faculty (short to medium duration)	Per exchange	7	5 000	35 000	20 000	7 500	7 500				
Exchange of Students (one year)	Per exchange	20	7 500	150 000	75 000	37 500	37 500				
Visiting Professors	Per Lecture	24	3 000	72 000	36 000	18 000	18 000				
1.8 Engagement of students in experiential learning activities that involves application of science and technology for the solution of water quality and environmental problems				20 000	7 200	6 400	6 400	0	0	0	0
Experiential learning activities in communities	Per students/per year	25	800	20 000	7 200	6 400	6 400				
1.9 Training of junior faculty members to PhD/post doctoral levels for careers in academia				250 000	150 000	50 000	50 000	0	0	0	0
PhD/post Doctoral training for junior faculty	Per junior faculty	5	50 000	250 000	150 000	50 000	50 000				
1.10 Coordination of research experience for undergraduate students to facilitate the recruitment of future graduate students				120 000	60 000	30 000	30 000	0	0	0	0
Research experiences for undergraduates	Per undergraduates	40	3 000	120 000	60 000	30 000	30 000				
1.11 Training of students in entrepreneurial approaches and promote innovation activities in new business incubation				400 000	400 000	0	0	0	0	0	0
Support to 2iE existing Business Incubator	Per Year	2	50 000	100 000	100 000						
Creation and support to a Business Nursery	Per Year	2	75 000	150 000	150 000						
Extension of 2iE Business Development competition to other members of the network	Per Competition	2	25 000	50 000	50 000						
Entrepreneurship awards (5 x 5 years)	Per awards	10	10 000	100 000	100 000						
1.12 Development of collaborations with existing industries				50 000	50 000	0	0	0	0	0	0
Partnership with industries	Per Partnership	2	25 000	50 000	50 000	0	0				
1.13 Publication and dissemination of knowledge to the scientific community and the general public				584 000	520 000	20 000	20 000	24 000	0	0	0
Virtual journal and Newsletter	Per year	2	12 000	24 000				24 000			
Promotion of network scientific journal (3 x 5 years)	Per journal per year	6	10 000	60 000	20 000	20 000	20 000				
Organization of International Conferences	Per Conference	2	250 000	500 000	500 000	0	0				

BUDGET ITEM & DESCRIPTION YEAR 1 & 2

BUDGET PER PARTNER YEAR 1 & 2

Description (In USD)	Unit	Nbre of Units	Unit Costs	TOTAL COSTS	2iE	Uni Ben	UMaT	GEIFON	Tuskegee	Princeton	ARIST
1.14 Development of joint research projects between partners				0	0	0	0	0	0	0	0
<i>Already in 1.4 and 1.1</i>											
1.15 Organization of short courses for African/American students and professionals in water and environmental sciences/technology and related disciplines				160 000	160 000	0	0	0	0	0	0
African/American students and professionals short courses	Per short courses	2	80 000	160 000	160 000	0	0				
1.16 Provision of science based advice to governments, national, regional and international organizations for the formulation of evidence based public policies in the areas of water and environmental resource management				40 000	0	0	0	40 000	0	0	0
Development of a network based advisory council	per year	2	20 000	40 000				40 000			
Sub Total Strategic Goal 1				5 717 000	4 287 200	668 900	668 900	92 000	0	0	0
Strategic Goal 2: To leverage partnership with African Diaspora (ARIST) and US universities, such as Tuskegee University and Princeton University, in the development of a critical mass of African scientists and engineer											
2.1 Engagement of the Diaspora scientists and engineers in education and research in the African partner institutions				1 780 000	0	0	0	0	500 000	500 000	780 000
Fees and transport costs for Diaspora lecturers in Africa	Per lectures	10	10 000	100 000							100 000
Fees and transport costs for Diaspora Researchers in Africa	Per mission	8	10 000	80 000							80 000
Research costs in the US	Per Partner University	1	1 000 000	1 000 000					500 000	500 000	
Support to ARIST (Secretariat, coordination and meetings)	Per Year	2	300 000	600 000							600 000
2.2 Engagement of African scientists and engineers in American education and research				120 000	120 000	0	0	0	0	0	0
African faculties and Researchers to the US (short visits)	Per mission	3	10 000	30 000	30 000	0	0				
African Young Researchers to the US (1 year)	Per Young Researcher per year	3	30 000	90 000	90 000	0	0				
2.3 Engagement of American Universities and Research Institutes in collaborative education and research				500 000	0	0	0	0	250 000	250 000	0
Collaborative Research Project (USA-Africa)	Per project	2	250 000	500 000					250 000	250 000	
2.4 Development of student, faculty and staff exchanges between partner institutions				0	0	0	0	0	0	0	0
<i>Already stated in SG1 et SG3</i>											
2.5 Engagement in joint research and solicitation for funding				150 000	0	0	0	0	150 000	0	0
Cost of proposal development and fund raising activities	Per Year	2	75 000	150 000					150 000		
Sub Total Specific Objective 2				2 550 000	120 000	0	0	0	900 000	750 000	780 000
Strategic Goal 3: To engage US students and Faculty in unique research, educational, and outreach activities that will make them more competitive global scientists and engineers											
3.1 Development of research experience for undergraduate US students in African partner institutions				150 000	0	0	0	0	80 000	70 000	0
US Undergraduates research experience in African partner institutions (2 months)	Per Student per Year	15	10 000	150 000					80 000	70 000	
3.2 Development of Faculty exchange between US and African partner institutions				100 000	0	0	0	0	50 000	50 000	0
Fees and transport costs for US Lecturers in Africa	Per lectures	10	10 000	100 000					50 000	50 000	
3.3 Encourage graduate student and post-doctoral research experiences in partner African institutions				750 000	0	0	0	0	400 000	350 000	0
US graduates and post-doctoral research experience in African partner institutions (1 year)		15	50 000	750 000					400 000	350 000	
3.4 Development of unique community-based outreach activities for visiting US students and scholars				300 000	0	0	0	0	150 000	150 000	0
Community outreach activities	per community	2	150 000	300 000					150 000	150 000	
3.5 Engagement of visiting US students and scholars in interactions with local USAID mission activities related to water, sanitation, and the				0	0	0	0	0	0	0	0
In kind				0							
Sub Total Specific Objective 3				1 300 000	0	0	0	0	680 000	620 000	0
PROJECT COORDINATION											
Administration of the project (Accountant, Procurement Officer, Coordinator)	Per Year	2	300 000	600 000	200 000	80 000	80 000		200 000	40 000	
Computer Equipment and ICT (purchase and running costs)	Per Year	2	55 000	110 000	20 000	20 000	20 000	10 000	20 000	20 000	
External Expertise	Per Year	2	50 000	100 000	40 000	20 000	20 000	5 000	10 000	5 000	
Staff Training	Per Year	2	100 000	200 000	80 000	40 000	40 000		20 000	20 000	
Communication costs	Per Year	2	20 000	40 000	10 000	5 000	5 000	5 000	10 000	5 000	
Publicity/Visibility	Per Year	2	20 000	40 000	20 000				20 000		
Evaluation and auditing	Per Year	2	60 000	120 000	60 000				60 000		
Sub Total Project Coordination				1 210 000	430 000	165 000	165 000	20 000	340 000	90 000	0
SUB TOTAL BUDGET				10 777 000	4 837 200	833 900	833 900	112 000	1 920 000	1 460 000	780 000
Overhead (20%)				2 155 400	967 440	166 780	166 780	22 400	384 000	292 000	156 000
TOTAL BUDGET				12 932 400	5 804 640	1 000 680	1 000 680	134 400	2 304 000	1 752 000	936 000

BUDGET ITEM & Description 5 Years						BUDGET PER PARTNER							
Description (In USD)	Unit	Nbre of Units	Unit Costs	TOTAL COSTS	Year 1 & 2	Year 3, 4 & 5	2iE	Uni Ben	UMaT	GEIFON	Tuskegee	Princeton	ARIST
Strategic Goal 1: To establish a cluster of 3 sub-Saharan African (SSA) universities (2iE, UMaT and UNIBEN) as world-class centers of excellence in water and environmental science and technology to engage in research, education, and community outreach													
1.1 Development of world-class research on the impact of climate change on water and the African environment				2 560 000	1 005 000	1 555 000	1 590 000	485 000	485 000	0	0	0	0
Support to PhD Students (30 x 3 years)	Per PhD student per year	90	12 000	1 080 000	360 000	720 000	720 000	180 000	180 000				
Post Doctoral Research Fellows (15 x 2 years)	Per Research Fellows per year	30	15 000	450 000	225 000	225 000	270 000	90 000	90 000				
Travel and data collection costs	Per PhD students for 3 years	15	15 000	225 000	105 000	120 000	135 000	45 000	45 000				
Publication in Scientific Journals	Per publication	20	3 000	60 000	15 000	45 000	36 000	12 000	12 000				
Laboratory consumables	per year	5	40 000	200 000	80 000	120 000	100 000	50 000	50 000				
Subscription of scientific journals	Per year	5	100 000	500 000	200 000	300 000	300 000	100 000	100 000				
Computer Equipment	Per PhD students and Research Fellows	45	1 000	45 000	20 000	25 000	29 000	8 000	8 000				
1.2 Development of sustainable solutions to the problems of water quality and wastewater treatment				1 000 000	300 000	700 000	600 000	200 000	200 000	0	0	0	0
Development of prototypes	By prototypes	5	100 000	500 000	200 000	300 000	300 000	100 000	100 000				
Dissemination of results	By innovative solutions	10	25 000	250 000	50 000	200 000	150 000	50 000	50 000				
Support to the creation of Businesses on innovative solutions	By start up business	5	50 000	250 000	50 000	200 000	150 000	50 000	50 000				
1.3 Procurement and development of shared state-of-the-art laboratory facilities and infrastructure for education and research				6 000 000	2 000 000	4 000 000	2 000 000	2 000 000	2 000 000	0	0	0	0
Lab Equipment	Per Facilities	3	1 500 000	4 500 000	1 500 000	3 000 000	1 500 000	1 500 000	1 500 000				
Construction/rehabilitation of education and lab infrastructures	Per Partner	3	500 000	1 500 000	500 000	1 000 000	500 000	500 000	500 000				
1.4 Collective funds raising for research, education and outreach for long-term sustainability				165 000	66 000	99 000	55 000	29 000	29 000	52 000	0	0	0
Workshops	Per Workshops	5	15 000	75 000	30 000	45 000	15 000	15 000	15 000			30 000	
costs of missions to donors	Per Missions	10	4 000	40 000	16 000	24 000	20 000	4 000	4 000			12 000	
External expertise	Per Expertise	5	10 000	50 000	20 000	30 000	20 000	10 000	10 000			10 000	
1.5 Development of a critical mass of graduate students in water and environmental science and technology				990 000	385 000	605 000	660 000	165 000	165 000	0	0	0	0
Support to MSc Students (90 x 2 years)	Per MSc student per year	180	5 500	990 000	385 000	605 000	660 000	165 000	165 000				
1.6 Development of distance learning capacity for increased access to higher science and technology education				160 000	80 000	80 000	160 000	0	0	0	0	0	0
Development of New Distance Learning Programs	Per Program	2	80 000	160 000	80 000	80 000	160 000						
1.7 Development of student, faculty and staff exchanges between partner institutions				580 000	257 000	323 000	290 000	145 000	145 000	0	0	0	0
Exchanges of staff and faculty (short to medium duration)	Per exchange	20	5 000	100 000	35 000	65 000	50 000	25 000	25 000				
Exchange of Students (one year)	Per exchange	40	7 500	300 000	150 000	150 000	150 000	75 000	75 000				
Visiting Professors	Per Lecture	60	3 000	180 000	72 000	108 000	90 000	45 000	45 000				
1.8 Engagement of students in experiential learning activities that involves application of science and technology for the solution of water quality and environmental problems				60 000	20 000	40 000	20 000	20 000	20 000	0	0	0	0
Experiential learning activities in communities	Per students/per year	75	800	60 000	20 000	40 000	20 000	20 000	20 000				
1.9 Training of junior faculty members to PhD/post doctoral levels for careers in academia				500 000	250 000	250 000	300 000	100 000	100 000	0	0	0	0
PhD/post Doctoral training for junior faculty	Per junior faculty	10	50 000	500 000	250 000	250 000	300 000	100 000	100 000				
1.10 Coordination of research experience for undergraduate students to facilitate the recruitment of future graduate students				300 000	120 000	180 000	150 000	75 000	75 000	0	0	0	0
Research experiences for undergraduates	Per undergraduates	100	3 000	300 000	120 000	180 000	150 000	75 000	75 000				
1.11 Training of students in entrepreneurial approaches and promote innovation activities in new business incubation				1 000 000	400 000	600 000	1 000 000	0	0	0	0	0	0
Support to 2iE existing Business Incubator	Per Year	5	50 000	250 000	100 000	150 000	250 000						
Creation and support to a Business Nursery	Per Year	5	75 000	375 000	150 000	225 000	375 000						
Extension of 2iE Business Development competition to other members of the network	Per Competition	5	25 000	125 000	50 000	75 000	125 000						
Entrepreneurship awards (5 x 5 years)	Per awards	25	10 000	250 000	100 000	150 000	250 000						
1.12 Development of collaborations with existing industries				125 000	50 000	75 000	75 000	25 000	25 000	0	0	0	0
Partnership with industries	Per Partnership	5	25 000	125 000	50 000	75 000	75 000	25 000	25 000				
1.13 Publication and dissemination of knowledge to the scientific community and the general public				1 460 000	584 000	876 000	800 000	300 000	300 000	60 000	0	0	0
Virtual journal and Newsletter	Per year	5	12 000	60 000	24 000	36 000				60 000			
Promotion of network scientific journal (3 x 5 years)	Per journal per year	15	10 000	150 000	60 000	90 000	50 000	50 000	50 000				
Organization of International Conferences	Per Conference	5	250 000	1 250 000	500 000	750 000	750 000	250 000	250 000				

BUDGET ITEM & Description 5 Years						BUDGET PER PARTNER							
Description (In USD)	Unit	Nbre of Units	Unit Costs	TOTAL COSTS	Year 1 & 2	Year 3, 4 & 5	2iE	Uni Ben	UMaT	GEIFON	Tuskegee	Princeton	ARIST
1.14 Development of joint research projects between partners				0	0	0	0	0	0	0	0	0	0
Already in 1.4 and 1.1													
1.15 Organization of short courses for African/American students and professionals in water and environmental sciences/technology and related disciplines				400 000	160 000	240 000	240 000	80 000	80 000	0	0	0	0
African/American students and professionals short courses	Per short courses	5	80 000	400 000	160 000	240 000	240 000	80 000	80 000				
1.16 Provision of science based advice to governments, national, regional and international organizations for the formulation of evidence based public policies in the areas of water and environmental resource management				100 000	40 000	60 000	0	0	0	100 000	0	0	0
Development of a network based advisory council	per year	5	20 000	100 000	40 000	60 000				100 000			
Sub Total Strategic Goal 1				15 400 000	5 717 000	9 683 000	7 940 000	3 624 000	3 624 000	212 000	0	0	0
<i>Strategic Goal 2: To leverage partnership with African Diaspora (ARIST) and US universities, such as Tuskegee University and Princeton University, in the development of a critical mass of African scientists and engineer</i>													
2.1 Engagement of the Diaspora scientists and engineers in education and research in the African partner institutions				3 950 000	1 780 000	2 170 000	0	0	0	0	1 000 000	1 000 000	1 950 000
Fees and transport costs for Diaspora lecturers in Africa	Per lectures	25	10 000	250 000	100 000	150 000							250 000
Fees and transport costs for Diaspora Researchers in Africa	Per mission	20	10 000	200 000	80 000	120 000							200 000
Research costs in the US	Per Partner University	2	1 000 000	2 000 000	1 000 000	1 000 000					1 000 000	1 000 000	
Support to ARIST (Secretariat, coordination and meetings)	Per Year	5	300 000	1 500 000	600 000	900 000							1 500 000
2.2 Engagement of African scientists and engineers in American education and research				400 000	120 000	280 000	240 000	80 000	80 000	0	0	0	0
African faculties and Researchers to the US (short visits)	Per mission	10	10 000	100 000	30 000	70 000	60 000	20 000	20 000				
African Young Researchers to the US (1 year)	Per Young Researcher per year	10	30 000	300 000	90 000	210 000	180 000	60 000	60 000				
2.3 Engagement of American Universities and Research Institutes in collaborative education and research				1 250 000	500 000	750 000	0	0	0	0	750 000	500 000	0
Collaborative Research Project (USA Africa)	Per project	5	250 000	1 250 000	500 000	750 000					750 000	500 000	
2.4 Development of student, faculty and staff exchanges between partner institutions				0	0	0	0	0	0	0	0	0	0
Already stated in SGI et SGI3													
2.5 Engagement in joint research and solicitation for funding				375 000	150 000	225 000	0	0	0	0	225 000	150 000	0
Cost of proposal development and fund raising activities	Per Year	5	75 000	375 000	150 000	225 000					225 000	150 000	
Sub Total Specific Objective 2				5 975 000	2 550 000	3 425 000	240 000	80 000	80 000	0	1 975 000	1 650 000	1 950 000
<i>Strategic Goal 3: To engage US students and Faculty in unique research, educational, and outreach activities that will make them more competitive global scientists and engineers</i>													
3.1 Development of research experience for undergraduate US students in African partner institutions				400 000	150 000	250 000	0	0	0	0	200 000	200 000	0
US Undergraduates research experience in African partner institutions (2 months)	Per Student per Year	40	10 000	400 000	150 000	250 000					200 000	200 000	
3.2 Development of Faculty exchange between US and African partner institutions				250 000	100 000	150 000	0	0	0	0	125 000	125 000	0
Fees and transport costs for US Lecturers in Africa	Per lectures	25	10 000	250 000	100 000	150 000					125 000	125 000	
3.3 Encourage graduate student and post-doctoral research experiences in partner African institutions				2 000 000	750 000	1 250 000	0	0	0	0	1 000 000	1 000 000	0
US graduates and post-doctoral research experience in African partner institutions (1 year)	Per Year	40	50 000	2 000 000	750 000	1 250 000					1 000 000	1 000 000	
3.4 Development of unique community-based outreach activities for visiting US students and scholars				600 000	300 000	300 000	0	0	0	0	300 000	300 000	0
Community outreach activities	per community	4	150 000	600 000	300 000	300 000					300 000	300 000	
3.5 Engagement of visiting US students and scholars in interactions with local USAID mission activities related to water, sanitation, and the in kind				0	0	0	0	0	0	0	0	0	0
Sub Total Specific Objective 3				3 250 000	1 300 000	1 950 000	0	0	0	0	1 625 000	1 625 000	0
PROJECT COORDINATION													
Administration of the project (Accountant, Procurement Officer, Coordinator)	Per Year	5	300 000	1 500 000	600 000	900 000	500 000	200 000	200 000		500 000	100 000	
Computer Equipment and ICT (purchase and running costs)	Per Year	5	55 000	275 000	110 000	165 000	50 000	50 000	50 000	25 000	50 000	50 000	
External Expertise	Per Year	5	50 000	250 000	100 000	150 000	100 000	50 000	50 000	10 000	20 000	20 000	
Staff Training	Per Year	5	100 000	500 000	200 000	300 000	200 000	50 000	50 000		100 000	100 000	
Communication costs	Per Year	5	20 000	100 000	40 000	60 000	25 000	10 000	10 000	10 000	30 000	15 000	
Publicity/Visibility	Per Year	5	20 000	100 000	40 000	60 000	50 000				50 000		
Evaluation and auditing	Per Year	5	60 000	300 000	120 000	180 000	150 000				150 000		
Sub Total Project Coordination				3 025 000	1 210 000	1 815 000	1 075 000	360 000	360 000	45 000	900 000	285 000	0
SUB TOTAL BUDGET				27 650 000	10 777 000	16 873 000	9 255 000	4 064 000	4 064 000	257 000	4 500 000	3 560 000	1 950 000
Overhead (20%)				5 530 000	2 155 400	3 374 600	1 851 000	812 800	812 800	51 400	900 000	712 000	390 000
TOTAL BUDGET				33 180 000	12 932 400	20 247 600	11 106 000	4 876 800	4 876 800	308 400	5 400 000	4 272 000	2 340 000