Content

Executive summary:
Direction Plan for US-EU-African—Asia- Pacific and Caribbean Nanotechnology Initiative (USEACANI)

US-EU-Africa-Asia-Asia Pacific and Caribbean Nanotechnology Initiative (USEACANI) covers 158 countries (Africa 53, EU 27, US, Canada, Caribbean and Pacific 30, Asia 46) with a focus on US, Africa and the Caribbean. USEACANI is one of the programs of Focus Nanotechnology Africa Inc. (FONAI); non-profit US 501c3 for educational and scientific purposes. Under the US tax code; we are classified to receive financial and other supports from the government and such institutions in the academia and private sector. The initiative hopes to use diaspora nano-experts and their allies from these regions to bring meaningful sustainable development to the regions of Africa, Caribbean and Pacific through nanoscience and nanotechnology to combat technological poverty (the root cause of other forms of poverty) and brain drain. Nanotechnology and nanoscience is defined as the creation and utilization of materials, devices, and systems through the control of matter on the nanometer-length scale, that is, at the level of atoms, molecules, and supramolecular structures. These nanostructures made with building blocks understood from the first principle are the smallest human made objects, and they exhibit novel physical, chemical, and biological properties and phenomena. The aim of nanotechnology is to learn to exploit these properties and efficiently manufacture the structures and employ them for various applications.

Nanoscale fabrication already plays a crucial role in chemistry, physics, biology, materials science, medicine, and engineering and computer science. It has been shown that nanoparticles can target and kill cancer cells and carbon nanotubes are 10 times as strong as steel with one sixth of the weight. Nanoscale materials have potential of making the computer smaller to perform more complex task and make supersonic transport cost effective. Fundamental studies at nanoscale will unveil many mysteries of nature and make these wonderful materials available to man, the thinker, through manufacturing.

Nanoscale is the foundation by which all natural materials are established. Studies at nanoscale mean tailoring the fundamental properties, phenomena, and processes exactly at the scale where the basic properties are determined. This determination of novel properties at nanoscale will lead to the production of virtually every human-made object-everything from automobiles, tiles, and computer circuits to advanced medicines and tissue replacements and lead to the invention of objects yet to be imagined. Nanotechnolgy is therefore the next industrial revolution; one that would restructure the technologies currently used for manufacturing, medicine, defense, energy production, environmental management, transportation, communication, computation, and education.

This draft plan represents the views of steering committee members of USEACANI (the team) who are leading authorities in the field of nanoscience and nanotechnology and other related fields. The committee proposes a National Nanotechnology Initiative for each of the 83 countries of Africa, Caribbean and Pacific (ACP). The team emphasizes three crucial areas: Developing a balanced research and development infrastructure, advancing critical research areas and nurturing the scientific and technical workforce of the present and next century. The team proposes doubling African and Caribbean governments investment in nanoscience and nanotechnology and founding a cooperative grand alliance of government, academia, and the private sector to promote these region's leadership in this emerging field. The steering committee recognizes the effect of technology poverty and brain drain in Africa and the Caribbean and believes that a project of this kind can combat this. The team identified some key areas of focus: Nanoenergy (Solar and fuel cell for cleaner environment), nanomedicine (drug delivery systems and vaccines for prevention and cures of HIV/AIDS, tuberculosis, cancer, tumor, cholera, malaria, etc), nanofiltration (affordable clean water), nanoeducation, nanoagriculture (disease resistant plants or crops through molecular synthesis) and nanosensors. The scientific, social and economic benefits of this kind of project cannot be quantified especially in US,Africa and the Caribbean.

Rational and benefit

A few millennia ago, Africa was at the forefront of technology; was the first to enter into the agricultural and stone age. The first civil society came from Africa; the Egyptian civilization, originating subjects like chemistry which is the basis for nanoscience and nanotechnology today; the Africans originated nanoscience and nanotechnology. Today the story is different, Africa is actively at the bottom in technological development, and so she has been termed as the "poorest nations" despite her rich natural resources.

Every year more than 20,000 talented African and Caribbean scientists and researchers leave their homeland for better research especially in North America, Europe and Japan. If this brain drain continues in a decade; Africa and the Caribbean will be left without any core scientists, the effect of which is more than tsunami in Asia and HIV/AIDS combined. In the US, there is a shift from sciences to subjects like management, accounting, etc., which is another form of brain drain. Poverty will continue to invade the black world. Poverty is the worst form of violent and worst than any diseases here on earth. It is the major root cause of HIV/AIDS and other diseases, terrorism, illiteracy, malnutrition, human, money and narcotics trafficking, tyranny, illegal immigration, ideological intolerance, genocide, debt slavery, etc. We will continue to have a very unstable and diseased system. Africa and the Caribbean continue to be given aids that in most cases ends up in the pockets of corrupt leaderships, rich mafias, and their allies who foment and institutionalize poverty. These aids also fall into hands of people who are adventurers and tourists to Africa and Caribbean without any meaningful interest and knowledge to the survival of this region. These emergency aids have in most cases caused more harm than good because they leave the recipients in stranded situation, as they are neither developmental nor sustainable. If these aids solve any problems at all, they are short-term and not sustainable. They are in most situations not geared toward creating jobs, setting up schools or small businesses for the majority poor, thereby empowering them. The center of all these problems is the lack of a good science and technological vision and breakthrough. On June 12, 2006 after a talk delivered in the UN; the African Union community in the United Nation encouraged FONAI to champion nanosciencetech activities in Africa with their support. The endeavor is also consistent and complimentary with the US science and technology policy and the US national nanotechnology initiative and US policy to fight against global poverty especially in Africa and the Caribbean. USEACANI also receives supports from the Caribbean scientists especially from Universities of West Indies. The project is consistent with EU, Asia, NATO, ACP and G8 to combat global poverty especially in Africa and the Caribbean: To fulfill this assignment and make it benefit other regions especially US, Africa and the Caribbean, the US-African and Caribbean Nanotechnology Initiative (USACANI) was founded in April 4, 2008 now changed to US-EU-Africa-Asia-Pacific and Caribbean Nanotechnology Initiative (USEACANI). Science and technology is the bedrock to any meaningful development in Africa, US, Caribbean and globally to combat poverty. The steering committee recognizes the effect of science and technological poverty and brain drain especially in Africa and the Caribbean and believes that a project of this kind is crucial to combating these problems. The team identified some 6 key areas of focus: Nanoenergy (Solar cell and fuel cell for cleaner environment), nanomedicine (drug delivery systems and vaccines for prevention and cures of HIV/AIDS, tuberculosis, cancer, tumor, cholera, malaria, etc), nanofiltration (affordable clean water), nanoeducation, nanoagriculture (disease resistant plants or crops through molecular synthesis) and nanosensors. The scientific, social and economic benefits of this endeavor cannot be quantified especially in Africa and the Caribbean.

Africa is the second largest and second most populous continent in the world with a population of 1 billion people making up 14.8% of the world population (http://en.wikipedia.org/wiki/Africa). The benefit of a scientifically rich Africa and the Caribbean cannot be quantified globally: The President of European commission summarized this benefit recently; "We need to be ready to front-load our assistance. We need to provide that aid more effectively and efficiently and we need to make sure every euro counts. Just from greater efficiency alone among all 27 Member states, we know that we can gain approximately 7 billion euro per year," said president Barroso during a joint press conference with Commissioner for development Louis Michel. "Offering our assistance is not only the right thing to do – it makes good economic sense too. Our promise to help developing countries integrate into the global economy so they can enjoy greater prosperity is a cornerstone of our founding values and will prove a foundation to global recovery, a green recovery"(European commission; April 8, 2009). If Europe, which makes up 11% of the world population http://en.wikipedia.org/wiki/Europe), projects to gain 7 billion euro or 9.8 billion dollar (1 euro = $1.4) per year from a project like this according to President Barroso, then the whole world will gain 63.6 (7 divide by 11% multiplied by 100%) billion euro or 89.1 billion dollar ($1.4 multiply by 63.6) per year. America, which contains 13.5%(http://en.wikipedia.org/wiki/Americas) of the world population will gain 12 billion dollar. US, which forms 36% (http://en.wikipedia.org/wiki/Americas) of the population of America will gain or benefit $4.32 billion per year and more. Further benefits are summarized below:

1. Support US, North America, EU, Africa, Asia and Caribbean institutions; private sector, academia and government to foster and nurture development especially in the science to enable Africa and Caribbean leadership in nanoscience and technology.
2. Support US, North America, EU, Africa, Asia and Caribbean institutions long-term nanoscience and engineering leading to fundamental discoveries in energy and environment, medicine, agriculture and food supply, home security, sciences, materials and engineering.
3. Encourage multinational, multi-institutional, multi-disciplinary research and education, which is an important vision of the US, North America, EU, Africa, Asia and Caribbean institutions nanoscience program. The focused areas are

nanomedicine, nanofiltration, nanoenergy (solar cell), nanoagriculture, nanosensors and nanoeducation.

4. Provision of a platform for training of future US, North America, Africa, EU, Asia and Caribbean researchers and entrepreneurs especially in international collaboration in the area of nanomedicine, nanofiltration, nanoenergy (solar cell), nanoagriculture, nanosensors and nanoeducation.
5. Creation of first class basic research environment in the US, North America, EU, Africa, Asia and Caribbean institutions leading to explosion of discoveries in these regions focused on nanomedicine, nanofiltration, nanoenergy (solar cell), nanoagriculture, nanosensors and nanoeducation.
6. Creation of first class applied research environment in the US, North America, EU, Africa, Asia and Caribbean institutions leading to explosion of industries in these regions for all round economic development in the area of nanomedicine, nanofiltration, nanoenergy (solar cell), nanoagriculture, nanosensors and nanoeducation.
7. The whole initiative including workshops and collaborative research involves Africa, US, North America, Asia, Asia Pacific and EU scientists that are world leaders exposed in international collaboration in the area of nanomedicine, nanofiltration, nanoenergy (solar cell), nanoagriculture, nanosensors and nanoeducation.
8. It will strengthen US, North America, EU, Africa, Asia and Caribbean and engineering in the world of nanoscience and engineering.
9. Broad participation of all citizens especially the under-represented leading to a healthy US, North America, EU, Africa, Asia and Caribbean and engineering.
10. The broad distribution of results leading to better understanding of nanoscience and engineering in the US, North America, EU, Africa, Asia and Caribbean. It will generally lead to great advancement of knowledge in the US especially in nanotechnology
11. The results and application of the discoveries will produce a better US, North America, EU, Africa, Asia and Caribbean society in the focused area of nanomedicine, nanofiltration, nanoenergy (solar cell), nanoagriculture, nanosensors and nanoeducation.

Generally, this project will have great impact in the Africa, US, North America, EU, Asia, Asia-Pacific and Caribbean. Specifically it will strengthen these regions science and engineering.

To ripe these benefits, President Obama promised to invest about $50 billion per year to fight against global poverty (Campaign speech, Desmoines Iowa, October 30, 2007) .The European commission through the African, Caribbean and Pacific countries has already allocated 2.7 billion euro ($3.7 billion; 1 euro = $1.4) to combat poverty in these countries (news published in Brussel in March 19, 2009). On the other side; the effect of a scientifically poor Africa and Caribbean is more than the effect of HIV/AIDS, Tsunami in Asia, 1st and 2nd world wars combined.

Overview of Recommendation

The steering committee of USEACANI recognizes that the benefits of nanoscience and nanotechnology could best be realized through a cooperative national program involving universities, government agencies at all levels, industry and governmental/national laboratories. To fully reap the benefits of nanoscience and nanotechnology, the team recommends a National Nanosciencetech Initiative in all these countries led by this team with the following objectives:

- Improve institutional structures so they foster and nurture development
- Support long-term nanoscience and engineering research leading to fundamental discoveries of novel phenomena, processes and tools;
- Encourage inter-disciplinary, multi-disciplinary and multi-institutional cooperation required in nanotechnology;
- Provide new types of education to train the experts in nanotechnology and entrepreneurs of the future;
- Create the physical infrastructure to enable first-class basic research, exploration of applications, development of new industries, and rapid commercialization of innovations in the field of nanotechnology.

In addition, FONAI through USEACANI stand for zero tolerance to corruption. We believe in accountability, integrity, honesty and hardwork. We believe that these missions among others can provide definite solutions to the problem of technological poverty and brain drain leading to unstable and deceased Africa and the Caribbean. FONAI, as a non-governmental organization and non-profit institution, is well positioned to accomplish this onerous task. In addition to emphasizing their vision of a grand coalition and contribution to a National Nanotechnology Initiative, the team also proposes specific objectives for academia, private industry, government laboratories, government funding agencies, professional science and engineering, as follows:

1. **Academia**

    - Promote interdisciplinary activities/studies involving many departments
    - Foster on-campus nanotechnology centers for greater interaction
    - Introduce nanoscience and engineering in existing and new curricula
    - Establish graduate programmes to encourage interdisciplinary and multinational studies whereby the candidate does his/her research abroad and come back to defend the thesis at home university to combat brain drain
    - Establish aggressive programs to encourage mobility of nanoscience and technology experts from developed countries to the South especially Africa and the Caribbean
    - Establish first class research institutions for applied and basic research
    - Establish Universities of nanoscience and nanotechnology
    - Establish international nanoscience and nanotechnology institutes

2. **Private Sector**

- Build up investment by maintaining in-house research activities in nanoscience and nanotechnology
- Join, contribute to, or lead regional coalitions for nanotechnology research and information dissemination
- Sponsor nanotechnology startups/spin-offs jointly with the academia and other research labs especially in nanomedicine for cures of HIV/AIDS, cancer, tumor;nanofiltration, nanoeducation, nanosensor, nanoenergy-solar cell in these regions to encourage job creation and all round development

3. **Government Laboratories**

- Support and pursue respective agency missions
- Provide standards for the nanotechnology field.
- Establish multi-national first class research lab to encourage multinational approach to solving challenging scientific poverty

4. **Policy makers of countries and sub-regional groupings**

To work with USEACANI steering committee members to pass a congressional bill with a budget of $4.16 million (125 million divided by 30 countries of Caribbean and Pacific) for 10 years for the case of the Caribbean countries and $9.4 million ($500 million divided by 53 countries of Africa) for next ten years for the case of African countries for their respective National Nanotechnology Initiative and for the US $4 billion.

Important contacts are the Presidency/Prime Ministers, S and T Ministers and house leaders. The same process will be with EU, NATO and ACP parliaments. The G8 fund will be obtained through each of the G8 countries parliament.

Government funding

- Establish a National Nanotechnology Initiative
- The NNI will be set up for the relevant framework for human capacity and policy capacity for nanotechnology in these regions.
- Emphasize small, inter-disciplinary research groups in academia within and among universities, and promote policies that foster collaboration between academia, private sector and government laboratories
- Support nanoscience and engineering scholarship.
- Maintain a good information and database for nanotechnology to serve rapid development of research and education in the field.
- Sponsor regional university and Government labs in partnership with industry to cultivate exploratory research, shared research in crucial areas, education and information flow
- Establish 'vertical centers' where fundamental research, applied research, technology development, and prototype construction or clinical evaluation can be pursued concurrently

- Promote international collaborations for cost-sharing and joint centers/networks of excellence.

5. **Professional science and engineering societies**

- Establish inter-disciplinary forums that accelerate progress in research and development in nanoscience, engineering and technology, and facilitate its transition into other technologies
- Convene group of scientists and engineers who have not collaborated traditionally
- Reach out to the international community to ensure US, Africa, Caribbean and Pacific awareness of the latest invention
- Develop educational symposia to explore educational opportunities at kindergarten, primary, secondary and degree levels
- Invite industrial players to participate in interdisciplinary job fairs and interview prospective scientists and engineers for nanotech jobs.

6. **Non-governmental organization (NGO)**
   - To provide educational awareness on nanoscience and nanotechnology
   - Make funds available through their foundations
   - Be part of the nanoscience and naotechnology national initiative

7. **USEACANI team role**

- Visit countries and sub-regional groupings to see what is on the ground. This visit will include all concerned government agencies, government labs, universities and industry
- Organize a workshop on USEACANI sub-regionally. The workshop will further explain to all government agencies, universities and industry the meaning, role and benefits of Nanotechnology
- Develop a direction plan for nanotechnology in these countries
- Liaise with the Government in all aspects of this plan towards the establishment of the National Nanotechnology Initiative and be members of it.
- The team will work with the Advisory Board, G8, EU, ACP to pull out the other $4.25 billion (EU: $0.5 billion; NATO $0.5 billion, World bank $0.5 billion; G8: $2.625 billion; ACP: $0.125 billion)
- The team will work with African Union and CARICOM to pull out $0.5 billion and $0.125 respectively

7.Timelines:

April-December, 2009: Formation of Networks (Academia, government or policy makers and private sector; US, EU, AU, G8, ACP), visits, workshops and drafting of direction papers for congressional bill with budget. Drafting of congressional bill with budget in US and each of the 83 countries in Africa and the Caribbean, EU, ACP and G8. Drafting of proposals to ICI and other private donors and the receipt of such fundings

January 2010-December 2010: Bill Passage with Budget and funding; workshops and other nanoeducation in each of the countries and sub-regional workshops including literature search engines. Funding from EU, G8 and ACP.

January 2011-December 2019: Building and opening of International Nanoscience and Nanotechnology Research Institutes and universities.

January 2011-December 2019: Single Investigator seed money program

Nanosciencetech Industrial Development Program 2011-2019.

8. Budget
Total budget for the next ten years $10 billion

Source:

Contributors	US dollar	Contributor[1]	US dollar[1]	Contributor	US dollar
US	4 billion	Bill Gate	500 million	Japan	438 million
G8	2.625 billion	Ford	140 million	UK	438 million
Foundations	1.0 billion	Hewlett	90 million	Italy	438 million
EU	0.5 billion	Mellon	80 million	Germany	438 million
African Union	0.5 billion	MacArthur	70 million	Canada	438 million
World bank	0.5 billion	Rockefeller	46 million	Russia	438 million
ACP	0.25 billion	Carnegie	30 million		
CARICOM	0.125 billion	Calculation based on 2007 Net worth [1]			

Table 1: Budget distribution by proposed institutional contributors

1. http://foundationcenter.org/findfunders/topfunders/top100assets.html)

Use of funds:

Project	US dollar
Nanoeducation	2.2 billion
Individual Investigator	1 billion
International institute	2 billion
International Universities	2 billion
Industrial development	2.5 billion
Overhead with benefits	1.5 billion

Table 2: Use of funds

9. Summary steering committee
1.Work with your members from Africa, Pacific and the Caribbean along with your Advisory Board to connect with all nanotech programs in each country.
2.Get each country nanoexperts to have a meeting and discuss the elements in this paper on national nanotechnology initiative. Always try to build on what is on the ground and work together to expand on what is there.
3.Use this network and meeting to connect Science and Technology ministers/house leaders/President, professional organizations and the private sector in each of the 84

countries, present this paper along with others I will send, discuss about the nanotechnology initiative and the passage of a congressional bill with a budget of at least $4 billion for the case of US, AU: $9.4 million ($500 million divided by 53 countries of Africa) for the next 10 years in the case of each country in Africa. For the Caribbean and Pacific, $4.17 million ($125 million divided by 30 countries of the Caribbean and Pacific) for the next ten years in each country.
Work with European Union, NATO and ACP parliaments to get a bill passed with the budget of $0.5, $0.5 and $0. 25 billion respectively.
Discuss with World Bank and send in proposal for $0.5 billion. Work with ICI to obtain the $1.2 billion
4.Present a report every first week of the month through eonah@fonai.org.

Dr. Ejembi John Onah
Founder and Chair, USEACANI Steering Committee

Other members of the Steering Committee are:

1. Dr. Samuel Ugbolue, Professor, University of Massachusetts Dartmouth
2. Dr. Stanley Moffatt, Professor, Reagent University of Science and Technology, Accra-Co-Chair
3. Dr. Mauricio Terrones, Professor, Advance Material Lab, Mexico
4. Dr. Charles Esimone, Professor, University of Nigeria, Nsukka
5. Dr. Harinder Missan, Professor, University of West Indies, Trinidad
6. Dr. Nelson Ochekpe, Professor, University of Jos

Research working groups
Principal Investigator: Dr. Ejembi John Onah

1. Nanoenergy
Dr.Harry Atwater (Professor,CALTECH), Dr.Sossina Haile (Professor,CALTECH), Dr.David Hui (Professor, UNO), Dr.Malik Maaza (Professor, Ithemba Lab), Dr.Samy El-Shall (Professor,VCU), Dr.Fabian Ezema (Professor, UNN), Dr.Mauricio Terrone (Professor, AMLM), Dr.Ishenkumba Kahwa (Professor,UWI), Dr.Missan Harinder (Professor, UWI), Onyanobi Anyebe (Professor, BenPoly), Dr. Izzedine Zorkani, Professor Dhar Mehraz University Morocco

2. Nanomedicine
Dr.Michael Adikwu (Professor, UNN), Dr.Stanley Moffatt (Professor, Reagent University), Dr.David Wilson (Professor, Cornell), Dr.Charles Esimone (Professor, UNN), Dr.Benjamin Ezekoye (Professor, UNN), Dr.Mansoori (Professor, UIC), Dr. Anthony Attama (Professor, UNN), Dr.Nelson Ochekpe (Professor, UniJos), Dr. Helen Asemota (Professor, UWI),

3. Nanoagriculture
Dr.Igbekele Ajibefun (Professor, FUTA)

4. Nanoeducation
Dr.Aldrin Sweeney (Professor, UCF)

5. Nanofiltration
Dr.Samuel Ugbolue (Professor, UMASSD), Dr.Yong Lak Jo(Professor, Cornell), Dr.Margaret Frey (Professor, Cornell),

6. Nanosensor
Dr.Omowunmi Sadik(Professor, UB)

Advisory Board Members-USEACANI

1.Dr.Ejembi Onah, Founding Presidents FONAI and Advance NanoFocus, Co-Chair, USA
2. Dr. Mauricio Terrones, Professor, National Laboratory for Nanoscience and Nanotechnology, Co-Chair, Mexico
3. Dr. Malik Maaza, Professor, Ithemba Lab, Co-Chair, Africa
4.Dr.David Hui, University of New Orleans, Co-Chair, USA
5.Dr. Aldrin Sweeney, Professor, University of Central Florida, Co-Chair, USA
6.Dr. El-Shall Samy, Professor, Virginia Commonwealth University, Co-Chair USA
7.Dr. Stanley Moffatt, Professor, Reagent University Accra, Co-Chair, Africa
8.Dr.Ishenkumba Kahwa, Professor, University of West Indies, Co-Chair, Caribbean,
9.Dr. Sogah D.Y. Professor, Cornell, Co-Chair, USA
10.Dr. Helen Asemota, Professor, University of West Indies Jamaica and Shaw University Co-Chair, USA and Caribbean
11.Dr. Sossina Haile,Professor, CALTECH, USA
12. Paul Iwezulu, UK
13.Dr. Mansoori, Professor University of Illinois Chicago, USA
14.Dr.Lubomir Lapcik, Professor, Thomas Bata University,Czech-Co-Chair
15.Dr.Ajibefun; Professor,Federal University of Agriculture Akure, Africa
16.Dr.G. Egharevba, Professor, Obafemi Awolowo University, Ife, Africa
17.Dr.Anil Chaudhary, Professor, University of Hyderabad, India
18.Dr.Nelson Ochekpe, Professor, University of Jos, Africa
19.Jim Winkelman , Advance NanoFocus Inc. USA
20.Dr.José Vega Baudrit, Professor, National Laboratory of Nanotechnology,Costa Rica
21.Dr.Jean Ebothe, Professor, University of Reims, France-Co-Chair
22. Dr. Samuel Ugbolue, Professor, University of Massachusetts Dartmouth, USA
23.Dr.Yong Lak Jo, Professor, Cornell University, USA
24.Ex-Seantor President, Ameh Ebutte, Africa
25.Dr.Michael Adikwu, Professor UNN, Africa
26.Ex-Congressman, Sherwood Boehlert, USA
27.Dr. David Wilson, Professor, Cornell University, USA
28.Dr. Omowunmi Sadik, Professor, University of Binghamton, USA
29. Dr. Eden Manut, Professor, Ovidius University, Constanza Romania

US-EU-Africa-Asia-Pacific and Caribbean Nanotechnology Initiative (USEACANI)
USEACANI covers 158 countries with a focus on US, Africa and the Caribbean. It is an initiative that believes the crucial role of Diaspora nano-experts and other scientists to bring sustainable development to Africa and the Caribbean and hopes to use them along with their allies in North America-US, Asia and Europe.

Background and objective

A few millennia ago, Africa was playing a leading role in science and technology: Africa was the first to enter into the agricultural and stone age. The first civil society came from Africa: The Egyptian civilization; originating subjects like chemistry thought to be the origin of nanoscience and nanotechnology. Today the story is different: We are actively at the bottom in technological development, so we have been termed as the 'poorest nation' despite our rich natural resources. Every year more than 20,000 talented and well educated Africans and Caribbean leave their homeland for better research in developed countries like Europe, North America, and Japan. Consequently, in about another decade, Africa and the Caribbean will be void of any core scientific researchers. This continual brain drain and technological poverty spells disaster worst than, 1st and 2nd world wars, HIV/AID epidemic and Tsunami in Asia. We will continue to have a very unstable, dependent and diseased system in Africa and the Caribbean. The center of all these problems is the lack of a good technological vision and breakthrough. Nanotechnology and nanoscience is the industrial and scientific revolution taking place now. The projected nanotechnology funding 2006-2010 are**:** US, $5.6 billion; Japan, $5.915 billion, Germany, $2.1 billion;South Korea, $1.015 billion; EU, $4.415 billion and China, $3.115 billion (technology transfer center 2007, converted to dollar at $1.4 = 1 euro). The whole of African continent is larger than United States, Europe, India, China, Argentina and New Zealand put together with an estimated current population of 1 billion. The whole of Africa and the Caribbean with 68 countries has nothing yet in concrete terms of initiating Nanotechnology or budgetary allocation.

The whole of African continent and the Caribbean with 68 countries have nothing yet in concrete terms of initiating Nanotechnology or budgetary allocation. Therefore, our missions include:

- Improve institutional structures so they foster and nurture development;
- Support long-term nanoscience and engineering research leading to fundamental; discoveries in medicine, energy and environment, agriculture and food supply, home security, sciences, materials and engineering.
- Encourage inter-disciplinary, multidisciplinary, multi-institutional and multi-national cooperation required in nanotechnology;
- Provide a platform for new paradigm of education for training the experts in nanotechnology and entrepreneurs of the future;
- Create the physical infrastructure to enable first-class basic research, exploration application, development of new industries, and rapid commercialization of innovations in the field of nanotechnology

We believe that these missions among others can provide definite solutions to the problem of technological poverty leading to stable and healthy Africa and the Caribbean. USEACANI is well positioned to this.

Critical issues
"Initiative" connotes the mission and intent rather than the specific approach. Launching an initiative is like starting a business as an entrepreneur. Many of the challenges are the same. First, time must be taken to develop a vision for the organization and bring together stakeholders around it. Secondly, one must develop an organizational plan to guide activities and attract funding. Third, one should establish an organization to carry out the vision without flaws for enabling exponential growth.

Apart from these important factors mentioned above, there should be awareness that economic development efforts are multiparty, collaborative undertakings; success depends not only on the principals within the organization, but also upon the engagement of all the key stakeholders. The meeting together brings healthy rivalry, which should not be overplayed since national development is the uppermost importance.

Finally it involves a lot of money: Millions of dollar even billions. Whatever is worth doing is worth doing well. It is a serious business and government plays a significant role in the accomplishment of the realization of the national technology enterprise.

Design consideration

Two phases were involved in the designing process: A. Pre-initiative and planning stage. B. Launch.

A. Pre-initiative State

The pre-initiative stage involves the leadership team or steering committee in the planning process. During this planning stage it was important to involve a broad range of professionals: Leaders from the industry, academia, government, non-profit and financial sectors. Since this stage was very crucial, it was good to get the right people involved at this stage. Top level participation from institutions including those mentioned in the executive summary was very crucial.

The next key step in this phase was the strategic road map with goals and milestones to facilitate planning and to evaluate progress. It should be clearly thought that all initiatives are positioned to enhance economic development and create regional or international leadership. The strategic roadmap is aimed at defining what the initiative seeks to achieve and the ways of achieving it.

Proper development of strategic roadmap can be very valuable to further develop a robust plan for the organization and mobilize stakeholders. The strategic roadmap should involve both 'inside out' (what can the region do by involving the capabilities within) and 'outside in' (where would the region like to be) perceptive. This necessitates that the planners take an inventory of the region's capabilities to provide a fact base on the current situation. A large number of qualitative interviews with key stakeholders can provide valuable information to initiative planners. By examining the gaps between the 'outside in' view of where the region would want to play and 'inside out' view of where it is well positioned to play, the steering committee can develop a good strategic roadmap with rough estimates of the cost of what it is required to do. To do this USEACANI involved all parties especially from Africa, US and the Caribbean in an alliance of academia, private sector and policy makers. This exercise is ongoing and we have received supports from the African Union (AU), academia and policy makers in these regions.

Strategic plan

What the initiative seeks to achieve and ways to achieve it

Nanotechnology is defined as the creation and utilization of materials, devices, and systems through the control of matter on the nanometer-length scale, that is, at the level of atoms, molecules, and supramolecular structures. These nanostructures made with building blocks understood from the first principle are the smallest human made objects, and they exhibit novel physical, chemical, and biological properties and phenomena. The aim of nanotechnology is to learn to exploit these properties and efficiently manufacture the structures and employ them for various applications.

Nanoscale fabrication already plays a crucial role in chemistry, physics, biology, materials science, medicine, and engineering and computer science. It has been shown that nanoparticles can target and kill cancer cells and carbon nanotubes are 10 times as strong as steel with one sixth of the weight. Nanoscale materials have potential of making the computer smaller to perform more complex task and make supersonic transport cost effective. Fundamental studies at nanoscale will unveil many mysteries of nature and make these wonderful materials available to man, the thinker, through manufacturing.

Nanoscale is the foundation by which all natural materials are established. Studies at nanoscale mean tailoring the fundamental properties, phenomena, and processes exactly at the scale where the basic properties are determined. This determination of novel properties at nanoscale will lead to the production of virtually every human-made object-everything from automobiles, tiles, and computer circuits to advanced medicines and tissue replacements and lead to the invention of objects yet to be imagined. Nanotechnolgy is therefore the next industrial revolution; one that would restructure the technologies currently used for manufacturing, medicine, defense, energy production, environmental management, transportation, communication, computation, and education.

This draft plan represents the views of steering committee that are leading authorities in the field of Nanotechnology and other related fields. The team proposes a National Nanotechnology Initiative for each of 83 countries of Africa, Caribbean and Pacific. The team emphasizes three crucial areas: Developing a balanced research and development infrastructure, advancing critical research areas and nurturing the scientific and technical workforce of the present and next century. The team proposes doubling government investment in nanoscience and nanotechnology and founding a cooperative grand alliance of government, academia, and the private sector to promote these region's leadership in nanoscience and nanotechnology.

Overview of Recommendation

The team agrees that the benefits of nanotechnology could best be realized through a cooperative national program involving universities, government agencies at all levels, industry and governmental/national laboratories. To fully reap the benefits of nanotechnology, the team recommends a National Nanotechnology Initiative led by this team with the following objectives or visions:

- Maintain a first class research and development program competitive with anywhere in the world to fully realize the potentials of Nanotechnology
- Provide educational resources, skilled workforce, and physical infrastructure to enable first-class basic research, exploration of applications, development of new industries, and rapid commercialization of Nanotechnology discoveries
- Facilitate transfer of technology into new products for economic developments, jobs and other public benefit
- Creating a responsive environment required in nanotechnology.

Vision 1: **Maintain a first class research and development program competitive with anywhere in the world to fully realize the potentials of nanotechnology and nanoscience**

Federal research and developments lead to the growth of knowledge, discoveries and develop technologies that address national needs. To fully accomplish the vision of nanotechnology initiative; federal government funding is required at intersection and frontiers of many disciplines, chemistry, physics, biology, engineering and materials. Activities of government to achieve this vision are for high funding of basic and applied research, development of technologies and transfer of such technologies for economic development. Application areas by government and industries include medicine, agriculture, energy, information, defense, transportation, etc. USEACANI research activities will be focused in these areas: Nanoenergy (solar cell), nanofiltration, nanomedicine (drug delivery vehicles and vaccines for cures and prevention of HIV/AIDS, tumor, cancer, malaria, cholera, etc), nanosensors, nanoagriculture and nanoeducation.

Proposed activities:

The USEACANI will fund R & D within and across boundaries of science and engineering disciplines in order to advance discovery innovation in nanoscience and nanotechnology. USEACANI intends to spend $4 billion to built specialized institutes around themes of nanoenergy, nanofiltration, nanomedicine, nanaosensors, nanoagriculture and nanoeducation. Nanoscience and nanotechnology universities will be built along the same themes to masters and PHD with faculties recruited from Diasporas and other scientists globally. Such faculties can hold two positions in their home countries or developed countries and in Africa and the Caribbean. All these institutions will have the state of art equipments and other infrastructures. Universities and other research institutions will perform most of the federally funded researches. This funding can be in form of grants, contracts cooperative agreement. Government laboratories should perform about 25% of the R&D of federally funded research; 10% should be small business and private sectors including non-government organizations. R & D and development activities can be in the following ways:

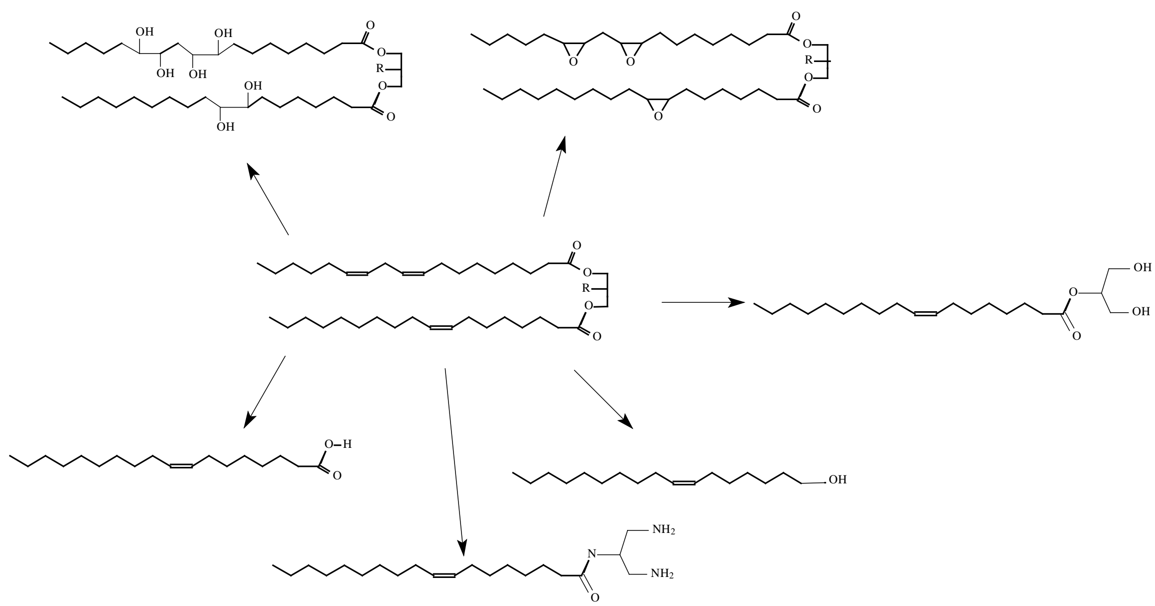
1. **Research themes**

These are themes of USEACANI research and development: Nanoenergy, nanofiltration, nanomedicine, nanoagriculture and nanosensor.

A. Nanonergy

Advanced functional nanopicochemical as solar cell

In 2005, total worldwide energy consumption was 500 Exajoules (= 5×10^{20} J) with 80-90% derived from the combustion of fossil fuels. This is equivalent to an average energy consumption rate of 16 TW (= 1.6×10^{13} W) (http://en.wikipedia.org/wiki/World_energy_resources_and_consumption). The total world energy cost is estimated at $1.00 trillion per year (http://earthfirst.com/world-energy-outlook-patently-unsustainable/). The demand will grow to 45% by 2030 according to this reference. The greatest consumer is North America especially US. The present petroleum source of energy cannot withstand this high demand in the foreseeable future. In Africa, majority of people don't have electricity. Consequently, one of the greatest crises facing the world now is an energy problem. USA is a leading producer of soybean. Soybean or other plant oil sources can easily be produced in Africa and the Caribbean. Producing chemical feedstocks from soybean oil using novel biochemical and chemical methods without solvent is key in the USA search for alternative energy. Dyes of various forms like the black dye can easily be synthesized from these feedstocks. These dyes can be used for synthesis of solar cells as nanocomposites using self assembly monolayers (SAMS), surface living polymerization and Langmuir-Blodgett (LB) technique either singly or in dual forms. Harvesting energy directly from the sun using photovoltaic cells without detrimental environmental pollution through emission has a great potential in addressing US and world energy problems. Titanium dioxide (TiO_2) is the most widely used particle because of its photocatalytic, brightness and opaque properties. As a result, TiO_2 finds applications in paints, sunblocker, antifogging, toothpastes, skin care, air and water purification, etc. Another emerging area where TiO_2 as components of polymer (composites) will be greatly used is solar cell. This technology is cheaper and could, in theory, be more efficient than now available silicon based technology, which are not flexible and lightweight also expensive.

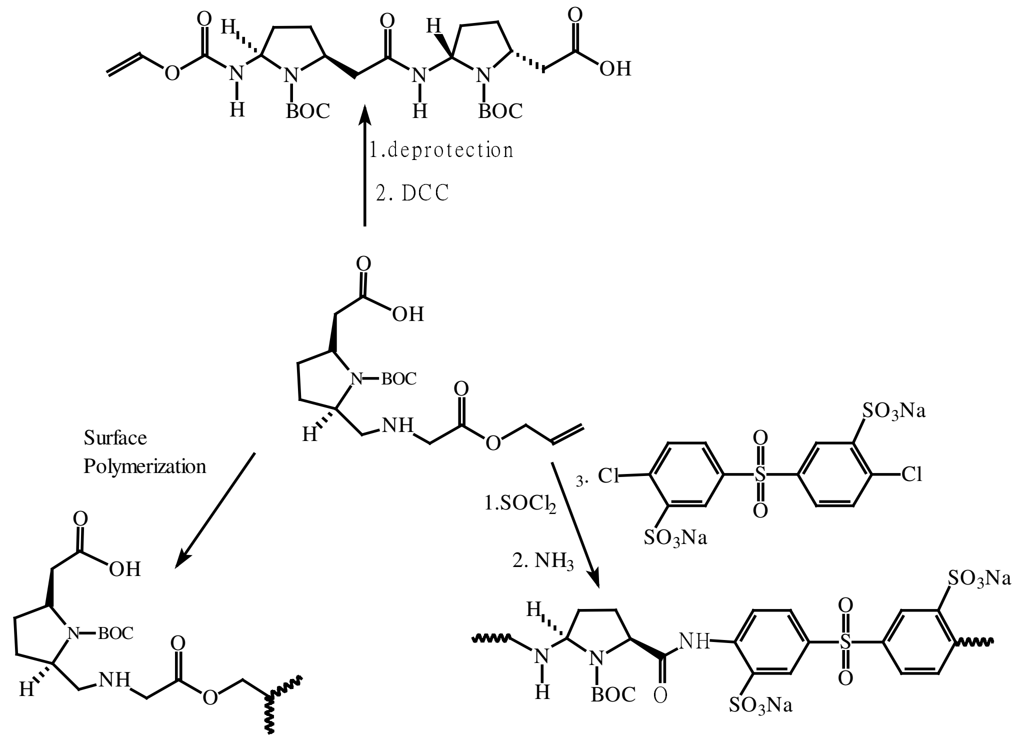


Scheme 1. Pathway to the synthesis of functional nanochemical from renewable energy source

The silicon based technology, although has been used for solar, needs more efficiency and further improvements. Synthesizing solar cells using a combination of np-Si and TiO_2 can enable such solar cell to have increasing mobile charges; donor/acceptor, light weight, flexible and photochemically stable; making such solar cells more efficient and cheaper than the commonly available silicon based solar cell. It has the potential of producing energy cost of 2 cents per watt at 30% conversion of solar energy compared to silicon based conversion of 20% costing $4 - $5 per watt and fossil energy source costing $1.00 per watt. This application uses the property of the compound as a photocatalyst. The goal of this project is to build nanosolar cells in houses, vehicles and other applications by US, African and Caribbean federal, state and private sectors involving partnership across disciplines and institutions especially involving the minority scientists. The solar cell industry is a multi-billion and will continue to grow in the years to come because of the emphasis on clean environment using alternative energy.

B. Nanomedicine

HIV/AIDS, cholera, tuberculosis, malaria, Cancer, tumors and brain diseases are the leading causes of death in Africa, Caribbean, Pacific and United States (US). Cancer affects nearly half of men and over one-third of all women in the US (Cancer guide, American Cancer Society, 2004). Some 50 million people in this country (1 out 5) suffer from brain damage (Mediplus, 2004). According to statistics published in 2008, 33 million people were living with HIV/AIDS globally in 2007; out of this, 22 million (67%) came from Sub-Saharan Africa. According to this report, out of 2 million deaths globally, 1.5 million (75%) (http://www.avert.org/worldstats.htm) came from sub-Saharan Africa.



Scheme 1. Reaction pathway to synthesis of novel organic functional nanochemical

A few vaccines at testing stage and drugs are available for HIV/AIDS. Some of these drugs or vaccines are too costly for the average people especially in Africa and the Caribbean, which are the greatest victims of HIV/AIDS. Such drugs and vaccines can be made cheaper when produced from renewable source like soybean oil products.

Further, functional organic materials like spermine, spermidine and putreshine analogues hold great promise in stabilizing DNA, which may mitigate the affect of these diseases. Binding of these polyamines analogues to duplex and triplex DNA is an approach to suppress the transcription of gene related diseases like cancer and tumors. These analogues can also potentially be applied in neurological disease therapy and AIDS related diarrhea.

Under physiological ionic and pH conditions, polyamines are positively charged and hence the negative phosphate groups of DNA are their prime targets of action. Thus polyamine comes under the category of ligands that stabilize DNA. This is the case, at least in part because of their ability to neutralize the high negative charge density imposed by the association of DNA strands. Molecular modeling, X-ray crystallography, florescence spectroscopy, solution structural studies using techniques like the Langmuir-Blodgett method can be used to provide evidence for polyamine-DNA interactions.

Firstly, we will synthesize novel polyamines analogues from precursors that are readily available and cheap. Since many of the polyamine receptor sites (nucleic acids, membranes) are chiral in nature, it is reasonable that the introduction of asymmetry into the polyamine backbone may be beneficial to their activities. This makes the chiral analogues become more potent than the natural polyamines. The synthesis of these analogues is accomplished by novel approaches including protection and deprotection chemistry.

In the second part of the project, we will use these analogues to carry out studies with DNA. The analogues can be dissolved in organic solvent and self assembly monolayer (SAMS) or Langmiur-Blodgett films of them can be formed to study the mechanism of DNA stabilization at nanoscale. These studies will be carried out under various conditions. Other structural studies can be obtained using X-ray crystallography, florescence spectroscopy, gas phase NMR and surface plasmon resonance for anticancer and antitumor applications.

Third, we will investigate brain activity using these novel functional materials with the SO_3Na group to detect dopamine and other neurotransmitters. As these transmitters are amines, they are protonated at physiological pH values and so can be ion exchanged with Na in the functional material. The other principal components in the brain environment are anions at physiological pH and should be rejected by the functional film. The functional materials can be further modified to be used for surface initiated reactions for molecular recognition.

The long term goal of this project is the production of drugs and vaccines for cures and prevention of HIV/AIDS, cancer, tumor, malaria, cholera, etc and to study the mechanism of DNA stabilization as an approach to prevention and cure of cancer, tumors HIV/AIDS and to detect dopamine or neurotransmitters in order to investigate brain activity. The medium and short term goal is the synthesis of novel functional materials, especially natural polyamine analogues, epoxy and polyols.

C.Nanosensors

Novel functional nanomaterial holds great promise in the emerging nanotechnology. The uses of biomaterials to produce functional nanomaterials hold better promise to contribute reduce dependency on hazardous petroleum product. Further, the formation of well organized and controlled very thin films achieved only by Langmuir-Blodgett (LB) technique has potentials, especially in nanomedicine and environment as sensors.

Novel functional materials from soybean are very good in the immobilization of biomolecules because they are biocompatible and biodegradable and therefore can be used for *in vivo* studies. The problem has been this area of using functional biomaterials from soybean oil for immobilization of biomolecules has not been explored if at all to a little extent. More concentration has been given to the use of materials from petroleum source because of the myth that they have better property. This is a myth because petroleum products are more expensive with lower biodegradability and biocompatibility. According to my knowledge, there has been no published work on the immobilization of biomolecule using functional materials from soybean oil and fabricating their films using the Langmuir-Blodgett technique. Even when this system is fabricated as sensors, the detection limit is very low. I will produce novel Nafion type of materials from these oils and use them for the detection of dopamine and other neurotransmitters to investigate brain activity. As these transmitters are amines, they are protonated at physiological pH values and so can be ion-exchanged with SO_3Na group in the functional soy bean oil, while the other principal components in the brain environment are anions at physiological pH, should be rejected by the functional film. It has been shown that Nafion–coated carbon electrodes show very little anion interference, giving an improved detection limit. We will use stereoselective synthesis to modify soybean oil thereby enhancing their use for molecular recognition, where specificity and sensitivity are key issues. Further, we will produce precursors from soybean oils to be used for controlled living polymerization. We will also modify these precursors with fluorine containing functional monomers, forming polymers with unique characteristics. These materials will be used as materials for nanocomposites.

The long term goal of this project is to create a sensor, controlled drug delivery and nanocomposite. The medium and short term goal is production of functional nanomaterials from soybean oil. Sensor industry is a multi-million dollar industry in the USA alone. In Africa and the Caribbean it will enjoy robust growth.

D. Single molecule

Studies of enzyme mechanism have been commonly carried out at ensemble or microscale. Studies at microscale has led to some important discoveries but recently it has been discovered that such studies provide a lot of disadvantages: Micro or ensemble methods provide information about average state of a large number of molecules which can be masked by dynamic fluctuation as can micro-heterogeneity. At this scale sychronization is a problem; that is at a given point; each molecule is at different stage of reaction due to multiple turnovers. Studies at single molecule or nanoscale allow distribution functions of behavior to be developed. This allows observation of transition states that may have been lost at ensemble measurements. It can obtain reactions in the single molecule as distinguished from irrelevant bulk reactions. Information about dynamic coupling between protein in motion and catalysis within a single molecule can be observed. At single molecular level; molecular sequence of each molecule can be observed; that is sychronization is not a problem. This is very crucial in DNA synthesis and other enzyme reactions. The research discoveries will find application in nanomedicine and nanoagriculture which is a multi-billion dollar industry in Africa, USA and the Caribbean

E. Multi-functional nanofibers

This project involves the development of nanofibers from melts by utilizing recently developed melt electrospinning facilities in our laboratories. One important aspect of nanofibers from melt is that dissolution of polymers in organic solvents and their removal/ recycling are not required. Thus, it is of technological importance to tailor the properties of melt-electrospun nanofibers (100 nm – 1 μm) for their commercial applications. To this end, continuous production of submicron-scale fibers directly from polymer melts such as PLA, PET, fluoro-polymers and their nanocomposites via multiple nozzle systems will be developed. The proposed research would greatly diminish the potential environmental hazard of nanoscale materials and processing. The project will also provide fundamental understanding of the structure - property relationships of melt electrospun nanofibers. In addition, titanium oxide nanoparticles will be incorporated during the electrospinning process to improve the antimicrobial functionality of the electrospun substrate. Furthermore, including molecular biohazard sensors into the melt electrospun fibers and ultimately forming these fibers into fabrics will form sensor assemblies. Fabric structure and properties will be optimized to maximize transport of target biohazards to sensing sites. Wipes or swabs containing the sensor fibers will provide a disposable and easy method for detecting contaminants on surfaces by simply wiping the surface. Sensor fabrics developed in the proposed research will combine the high sensitivity and selectivity of molecular biological sensors with the large specific surface area and absorption capacity of electrospun nonwoven fabrics for smart sampling of pathogens. The materials developed could be used to detect pathogens in food preparation areas, on surfaces of meats or vegetables, on surfaces in medical facilities, or within drops of liquids including water, juices, saliva or blood. The materials will be sensitive, selective and inexpensive. Nonwoven fabrics for sensing will be prepared by electrospinning and attachment sites for sensors will be incorporated during the spinning process. These fabrics can be used directly, or incorporated into other textile structures. This also a multi-million dollar industry in the USA, Africa and the Caribbean

1. **Single investigators**

Single investigator directed research is a key component of USEACANI R&D program and it is very crucial to the genesis of innovation leading to discovery and breakthroughs in nanoscience and nanotechnology. Funding of individual investigators allows USEACANI to support a broad range of ideas, as well as high risk proposal that if successful will lead to critical breakthrough and advances envisioned in nanoscience and nanotechnology.

2. **Multi-investigator/team efforts**

Research at intersections between traditional subjects is a requirement for rapid progress in both understanding nanoscale phenomena and developing nanoscience and nanotechnology applications. Funding of team project that addresses specific problems of technology looked from different discipline is the hallmark of nanotechnology initiative. A big amount of research funding can be spent by USEACANI for inter-disciplinary research teams.

Institutes

Multi-disciplinary research institutes is a requirement of nanotechnology and nanoscience initiative. Compared to the multi-investigator research team, these centers have a broader scope and bring together a larger group of researchers with greater breadth of expertise.

Multi-investigators and centers build scientists who have an understanding and appreciation of many converging disciplines. Such individuals are needed to fully understand the opportunities and benefits of nanoscale phenomena and processes. One of the critical benefits of nanoscience and nanotechnology today is multi-disciplinary approach to R & D. It creates a conscious environment, which were lacking before, around a decade ago.

Nanoscience and nanotechnology initiatives stimulate interactions among stake holders in the science community through various means, including setting up joint research directions, collaborative activities, multi-agency program funding and grantees workshops. Such initiatives encourage R & D in partnership with industries and the international community.

Plans

Since nanoscience and nanotechnology is still at early stages, sustained effort should be devoted to sensitization through publications, workshops and conferences at national and other agency levels. Targeted investments and shared commitment among stakeholders are essential to accelerate social and economic benefits based on advancement and commercialization of nanoscience and nanotechnology.

Some strategies are important to achieving our goal of creating a first class R & D to fully realize the benefits of nanoscience and nanotechnology:

- Funding of fundamental research leading to the discovery and development of novel ideas. Such research includes the investigation of nanoscale phenomena, properties, processes, structures, architectures, as well as development experimental and stimulation tools with high spatial and temporal resolution
- Research investment in the enabling disciplines and synergistic research at intersection of disciplines encompassing nanotechnology through all the three aspects described above: Single investigator, multi-investigator/team efforts and centers.
- Within a constrained budget, continue to make nanotechnology funding a priority.
- Focus on specific R & D in nanotechnology and capacity building based on inputs from nanotechnology workshops. Examples include:

  -fundamental scientific issues on nanotechnology
  -investigative tools; theory, modeling and simulations
  - investigative tools; experimental methods and probes
  -synthesis, assembling and processing of nanostuctures
  -applications; coating, dispersion and other surface area structures
  -applications; nanodevice, nanosensors and nanoelectronics
  -applications; biology, medicine and health
  -applications; energy and chemicals
  -nanoscale processes and the environment
  -infrastructure needs for research and development education
  -nanomanufacturing
  - government and other agency funding strategy

  - Establish focused research and development program within each component area. Develop inter-agency and industrial partnerships to meet this objective.
  - Create scientific and engineering platforms to encourage competitive applications of nanotechnology. Such platforms include carbon nanotubes,

nanoparticles and surface engineered polymers for different applications including modular nanomanufacturing techniques

- Promote awareness of, and engagement in international R & D by USEACANI based researchers. Focus includes training of international scholars especially from Africa and the Caribbean, sponsoring international conferences, etc.

Vision 2: Provide educational resources, skilled workforce, and physical infrastructure to enable first-class basic research, exploration of applications, development of new industries, and rapid commercialization of nanoscience and nanotechnology discoveries

A well educated citizenry, a skilled workforce, and supporting infrastructures of instrument, equipment, facilities are very essential in the initiative. Nanoscale science, engineering and technology education can help to;

1. Produce the next generations of researchers, innovators and teachers,
2. Provide the workforce of the future with maths and science, and technological skills required to succeed with nanoscience and nanotechnology
3. Insure a well educated citizenry and manpower that are equipped to make good decisions in a technology driven society. Here, an adequate arrangement should be to educate people of all levels and every age.

Equally important in supporting education and human resources development; it is important to support physical infrastructure development. Examples are universities, government labs and other research institutions. Building of other physical infrastructures to support nanotechnology is very critical in accomplishing this goal. The cost of this can be more than a university or government lab or businesses can bear but federal funding can take care of such state-of-the-arts physical infrastructures based on needs, to be available to all researchers/investigators etc nationally.

Activities

Focused education of kindergarten to universities, and the public on nanoscience. Special emphasis should be placed on building nanoscience and nanotechnology the-state-of-the-arts universities geographically distributed in zones for the public use. Specifically, education and provision of infrastructures should include:

a) Training of undergraduates, graduates and postdocs at such universities and research labs through the broad research program as in vision 1.
b) Via training agencies, award fellowship to students to participate in nanotechnology and nanoscience program to allow flexibility in choosing training programs especially those that cross disciplines. Such award should be conditioned upon the fact that such a student is registered in his/her home country and will do research in a developed country to return home to defend the thesis. This will combat brain drain.

c) Support the training of technicians as nanotechnology moves into product and services to meet the growing demand in industry.
d) Bring nanoscience concept into education for students of all ages. This program will include: Research experience for teachers and students, nanoscience education programs supporting nanotechnology courses, free lectures for all people at specific institutions or government labs on a periodic basis, support the development of science centers and museum exhibits, video productions, and other approaches to learning outside of formal educational institutions.

Infrastructure

- Establish geographically distributed user facilities to provide all researchers access to advanced instrumentations for fabrication, characterization, modeling and stimulation of nanoscale and nanostructures devices, materials, systems and processes. The infrastructures will include:
  Those by government ministries like nanoscale science and research centers available to every user based on merit. Nanoscience and nanotechnology users network to provide instrumentations for characterizations, properties and expertise and the network for computational nanotechnology consisting of groups of universities that together support computational research, as well as education, modeling and stimulation tools that can be accessed via the web.
- Support additional facilities within the federal laboratory enterprise dedicated to nanotechnology R & D.

Plans

Education

The initiative will create an environment that allows for multi-disciplinary education, teacher training and development of curricula and instructional materials. The initiative will further be involved in the training for advanced R&D in nanoscience and nanotechnology and support nanotechnology industrial needs. The component of this will involve:

a) Taking advantage of existing programs and forming new partnerships to bring students and teachers into the research lab. Bringing nanotechnology and nanoscience researchers together with teachers and education researchers will provide mutual benefits by strengthening educational programs and providing fresh research perceptives.
b) The creation of first rate university facilities for learning and teaching of nanoscience with federal funding as with any full fledged university. Such a university will train scientists-teachers for the secondary schools and undergraduate levels who can introduce nanoscience and nanoengineering concepts into schools and undergraduate classrooms. It will serve as a clearinghouse for curricula materials, instructional methods and activities in nanotechnology education.

c) Promoting partnerships between industry, education and training to ensure that nanotechnology firms have access to highly skilled workforce they need, and workers have access to the training needed for careers in the industry.

Vision 3: Facilitate transfer of technology into new products for economic developments, jobs and other public benefit

USEACANI can only come to a full realization when funded R&Ds are transformed to product. Patenting discoveries of nanoscience and nanotechnology R&D and interaction of academia, government labs, ventures and investors with the industries can do this. Policy approaches can be very critical in this transfer pathway.

Activities

1)USEACANI should have a liaison group with industry to enable the flow of research results to the industry and other commercial institution.
2) Support information exchange meeting between industries, academia and government labs. Such meetings will look at results with possible application
3)The universities and other USEACANI research inlet can have industrial partners to foster such interactions.
4) Encourage meetings with the Standards Organization, academia, industry and government labs to establish some standards for nanoscience and nanotechnology.

Plans

Focusing on the activities as enumerated and executing them to the letter for the benefit of the various sectors or players in the initiative and where appropriate expand on them.

Strategies

Some strategies as enumerated below are important to accomplish this vision 3

Industrial outreach

- Encourage industries to research using government state-of-the-arts facility provided by USEACANI funds, thereby encouraging interactions. It should be a policy to protect the privacy of industries in case of any discoveries to be in their total control if they can pay for the cost.
- Expand on the liaison activities with the industries and even encourage other new partnership of such a kind.
- Funding of USEACANI researches in academia, government labs and small businesses including non-governmental organization
- Encourage researchers in academia and government to spend time in the industry and vice versa
- Encourage industries to focus some of their researches on nanoscience and nanotechnology. The government policy should make it high priority.

Nanomanufacturing

USEACANI shall:

- Establish one or more centers focused on nanomanufacturing
- Establish scale-up program for a smooth transfer to commercialization
- Establish an inter-agency nanomanufacturing group to co-ordinate all nanomanufacturing issues.

Vision 4: Creating a responsive environment required in nanotechnology

For nanoscience and nanotechnology to grow, Government through the USEACANI should not only take care of the above 3 visions but should consider the societal implications of nanotechnology namely, environmental safety, ethics and law.

Plans

Environmental safety and health implications

As necessary, support and expand research into health or safety implications of nanotechnology. Increase fundamental understanding to study the interaction of nanomaterials with the cell through invivo and invitro experiments and models.
Increase study on fundamental understanding of interaction of nanomaterials and the environment. Increase understanding of fate, transport and transformation of nanoscale materials in the environment and their life cycles and identify and characterize potential exposure, determine possible human effect or impact and develop appropriate methods of controlling exposure when working with nanoscale materials. Communicate such findings with the appropriate agency on health and safety methods of handling nanomaterials. Creation of a sub-committee on environmental safety and health hazard of nanomaterials.

Ethical, legal and other societal issues

Foster and encourage forums for dialogue with other stakeholders to clearly understand nanoscience and nanotechnology

Provide information materials for the public to better understand nanoscience and nanotechnology. Periodic checks by USEACANI are very important to understand the reaction of the public and address issues.

Support research on societal implications of nanoscience and nanotechnology: Important areas will include cultural, ethical and legal implications including impacts on science and education, quality of life and national security. Funding research should include: Ethical and legal issues on nanoscience and nanotechnology development. Problems to adoption of nanoscience and nanotechnology in commerce, healthcare and environmental protection.

Establish centers on cultural, ethical and legal issues of nanoscience and nanotechnology. This should be through competitive proposals. Such a proposal should include all the stakeholders in nansocience and nanotechnology

Dr. Ejembi John Onah
Founder and Chair, USEACANI Steering Committee

Other members of the Steering Committee are:

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3. Dr. Mauricio Terrones, Professor, Advance Material Lab, Mexico
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