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A Science Agenda  
From An African  
Perspective

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One of the objectives of the network is to disseminate research results to policy makers, legislators, the organized private sector, civil society, mass media and farmers' groups through publications, dialogue and advocacy. Among its range of publications are the Working Paper Series (WPS), Research Paper Series (RPS), Special Paper Series (SPS) and the Technopolicy Briefs.

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## List of Abbreviations

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AAS	The African Academy of Sciences
AU	African Union
ICIPE	The International Centre for Insect Physiology and Ecology
ICTs	Information and Communication Technologies
IITA	The International Institute for Tropical Agriculture
ILRI	The International Livestock Research Institute
IPRs	Intellectual Property Rights
IRRI	The International Rice Research Institute
IT	Information Technology
NEPAD	New Partnership for African Development
NGOs	Non-governmental Organizations
NNPC	The Nigerian National Petroleum Company
NYC	New York City
SMEs	Small and Medium Size Enterprises
S&T	Science and Technology

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## **1. Introduction**

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There is no doubt that there is a need to consider in an integrated way, economic, social and environmental issues in addressing the daunting task of laying the foundations for sustainable development, and that this will require massive and diverse inputs from science and technology (S&T). At the same time, we in Africa know that S&T has contributed to some of our global as well as regional and local problems (e.g. global warming, pollution and land and water degradation by the oil and gas industry; and replacing traditional food crops and farming methods with export products, for example, have significantly degraded the environment and depleted food resources).

These negative effects of S&T are due partly to the fact that our Science and Technology agenda has often been ad hoc, and 'provincial' -more like 'fire-fighting' -or it has been non-existent. A new Science and Technology agenda for Africa must be comprehensive, geographically, as well as integrated sectorally with sustainability objectives introduced consciously to maximize the benefits of S&T, and avoid introducing further economic, social and environmental problems for future generations. This introductory presentation will suggest broad outlines of such an S&T agenda through which Africa can address the sustainability issues facing us. Other presentations in these sessions will elaborate on specific elements of the proposed agenda.

## **2. S&T in Africa: Context and Challenges**

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### **Historical**

The constraints to development in the past and to enabling sustainable development in the future have been analysed adequately elsewhere -and generally include the colonisation and oppression from outside and within the continent, slavery, and some perceived cultural and environmental constraints. The history of the world, not only Africa, is replete with examples of reactionary and oppressive greedy political systems, regimes and demagogues. Let us not be detained by such lamentations!

### **Recent**

In recent times, Africa's adoption of S&T has been constrained by the fact that science has been practiced and implemented by a select club. Even in Europe and America S&T is the preserve of 5% or less of their people- while the others are users. Africa has been almost entirely a consumer of the products of S&T rather than a participant in creating knowledge, services and products.

Africa's leaders have been constrained by their pre-occupation with the management of security, defence, and poverty. There appears to be a broad acceptance of the insidious though false belief that we are handicapped, and without the capacity to solve our own development problems. While Indians who studied at home and outside, have been a major contributor to the San Francisco and Bangalore Silicon valleys, our governments cannot find a way to get the African students who studied alongside the Indians to use their cutting edge capacity to do the same for us.

### **3. The Current Landscape**

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There has been some acquisition of S&T for solving the problems of Africa through the establishment of educational and other research and development (R&D) institutions, but these successes have been limited in effectiveness and sustainability.

#### **S&T in Education**

During the colonial period, there were some secondary schools and universities that produced African graduates who provided leadership in their fields of endeavour (Okrika Grammar School and Kings College, Lagos; and the University of Ibadan and Makerere University, for example, produced small numbers of highly selected well-trained graduates, mainly in the arts and social sciences). With independence and recognition of the need for manpower in hard sciences, medicine and technology, most countries expanded educational opportunities at the tertiary level; however:

- Congo Brazzaville became independent when it had only 4 graduates- 40 years ago and
- Other countries gained independence with just over 1,000 graduates

Nigeria now has 40 universities, and over 40 polytechnics. The number of graduates is now impressive but their education does not give the required skills and capacity to solve the problems of development. At the University of Ibadan and Okrika Grammar School mentioned earlier, for example, there are now 10 times as many students enrolled as there were 40 years ago, but the standards have fallen to unacceptable levels. Yet, poor quality secondary and first degree African graduates, are being exported; Nigerians, like Asians, fill the graduate schools in the USA and subsequently make contributions at the highest levels of academia and industry -while the majority of American nationals leave universities after their first degrees, to join the workforce to make money as soon as possible!

#### **S&T and R&D Institutions**

Like the examples of the colonial universities, some of the colonial research institutes also operated at high levels of research output and competence, and contributed significantly to R&D. The International Centre for Insect Physiology and Ecology (ICIPE), an African research institute, has had sustainability problems, but has been an important landmark. In the past 40 years most of the national institutions have lost excellence and output, and now function at unacceptable levels. At the same time, some international institutes sited in Africa, for example, the International Livestock Research Institute (ILRI) and the International Institute for Tropical Agriculture (IITA) have continued to do well,



but they employ their own people and spend their own money -providing no less than 10 times the level of funding of African national research institutes.

The R&D exposure given to Africans in all of these institutions has not spilled over for the most part; it has not ensured the existence of a sustainable critical mass of research scientists or research managers that is needed to serve the scientific community in Africa. The few experts that were trained were not replicated -expertise in many fields (taxonomy and forestry for example) is as endangered as our biodiversity and ecosystems!

### **Scientific Academies**

Senior scientists, policy makers and managers have formed the membership of scientific academies across the African continent, but there are still only 10 academies of science in Africa's 55 countries, and the pan-African African Academy of Sciences (AAS) has been in existence for only 10 years. These academies have for the most part, had little influence on government policy and academic productivity, due to a large extent to a lack of adequate support from governments and the private sector.

## **4. A Science Agenda From An African Perspective**

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### **Objective of the Agenda**

The objective of Africa's agenda for S&T is to be designed to ensure economic, social and environmental sustainability. It is to enable Africa to use S&T for capacity building, to improve economic production, and thus improve the quality of life of its people -today and tomorrow.

The countries of Africa have a diversity of cultures tempered by different modern histories, and a diversity of physical/ecological characteristics; they all have desperately poor rural and urban populations lacking in skills, in organised lives and in security for their futures; most have little to offer and less to lose. How do we channel the energy, oppose the chaos and anger, and get individuals to pursue individual visions and also collective goals -how do we focus their energy into implementing the science agenda for development? A science agenda for Africa must focus on bringing the means for participation in productive self-employment to the greatest number of our people in the shortest possible time.

### **Tools for Implementing the Agenda**

The science agenda must include elements that will empower Africa to use the tools at the global frontiers of S&T to address the complex problems of integrated sustainable development. We must invest in the tools of information technology, biotechnology, nuclear physics, and space science, and get them to serve as the foundation for the strong R&D programmes, which will enable the development of essential industries and a thriving small to medium sized enterprise (SME) sector.

#### **➤ *Information and Communication Technologies (ICTs)***

ICTs will be the entry point for many African countries to putting a science agenda into action. ICTs have the potential to enhance the ability of even the most disadvantaged countries and individuals of all levels of literacy to access and utilize information and knowledge for self-development so that they can benefit from the world's knowledge, and also contribute to it. These technologies offer a unique opportunity for a large percentage of the world's pool – of knowledge to be available to all equitably.

#### **➤ *Biotechnology***

Another likely common entry point for putting a science agenda into action is biotechnology. Biotechnology provides technological methods for enhancing African history and endowment- for improving

and sustaining bio-resources, including indigenous plants used for medicinal purposes, for food and for other products of economic and social value. Biotechnology contributes to food security through increased and food crop production (improved seeds, bio-pesticides) and food processing and storage (e.g. gamma irradiation).

➤ *Nuclear Physics*

Nuclear irradiation methods are used in food preservation (e.g. sterilisation, delayed ripening), materials sterilisation (e.g. medical practice) and in industrial materials irradiation (e.g. 'doping' and cross-linking of plastics to improve their performance). Investment in a gamma radiation programme provides the opportunity for a country to train high level people who can make contributions to the applications of particle physics, electron guns, cobalt sources and solid state physics for immediate benefit and for benefits yet not known or anticipated.

➤ *Space science*

Space science in a science agenda for Africa is anchored in areas of (1) communication (satellite, V SAT, wireless) systems and (2) remote sensing and earth observation. Information from remote sensing provides a means to access reliable data on forest cover, oceans and other natural resources, and on land use dynamics, to serve as the basis for planning for exploitation and management of those resources in sustainable ways. Research and development on the application of these high-tech and other traditional tools of S&T as well as of industry and engineering, is not intended primarily to repeat what has been done by others, but to provide dedicated solutions to our specific needs and environment. Such R&D should be a source of training of critically needed highly skilled manpower and provide the opportunity for use of their acquired knowledge. Effective R&D will importantly, enable innovation, and also reduce the high costs of building infrastructure and providing equipment and applications inherent in importing packaged technologies and foreign expertise.

➤ *Small and Medium Size Enterprises (SMEs)*

Most large-scale industries on ground in Africa today are multinational and African countries that participate are most often disadvantaged partners; furthermore, most large industries in the world today do their R&D in their home countries (preventing genuine technology transfer) and do not employ the large numbers of people required to make an impact on local economies. While it is important to introduce some large scale industries that are critical or strategic and to train manpower for them to ensure our ability to be in control of the technology, it would be unrealistic to think that every country in Africa will undergo a comprehensive industrial revolution.

There is no doubt that it will be more effective to start with production and service technologies that will create jobs in large numbers, quickly. We need to focus on providing information from R&D and an enabling environment for SMEs to get more people into the productive sector- a robust SMEs sector can demand and pay for more R&D, and services and thereby build infrastructure and institutions.

## **5. Essential Elements For An African Science Agenda**

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There are elements that are essential to an African science agenda, if it is to be effective in achieving its objectives. These include political will and vision, definition of policies, concerted, integrated capacity building, massive support for education at all levels, critical strategic partnerships, enthusiastic support for R&D, and for small and medium scale enterprises.

### ➤ *Political will and vision*

The most fundamental element of a science agenda for Africa is a genuine political will and vision, consistent with the objectives of the agenda, which acknowledges that S&T are credible tools for solving our problems. African countries must have politicians and other social leaders who share this vision with the scientists, engineers, and entrepreneurs. From that common shared vision, there will be a political commitment to deploying resources to implement that vision not just today, but for putting in place structures for sustaining the commitment to resource allocation to implement the shared vision.

If this vision is truly shared within individual countries, we welcome the new pan-African institutions that are being formed, such as the African Union (AU) and New Partnership for African Development (NEPAD), because without these visions, these institutions will be as ineffective as others that have been formed in the past.

NEPAD is a pledge by African leaders, based on a common or shared vision -to accept it as a collective duty to create jobs, generate wealth and reduce poverty and to fix the vision through actions to put in place regulatory (liberalisation) and legal (de-regulation) frameworks. These regulatory and legal frameworks are to promote peace, transparency, accountability, rule of law, security of life and investments, respect for human rights, gender equality and sensibility, public-private sector partnerships and popular participation.

There have been too few leaders in developing nations with the necessary vision to have the political will to support S&T as a tool for positive good. Nehru and Ataturk had no problem with sharing their political vision with academics and scientists -African civil society led by its elders, academic, professional and religious leaders and entrepreneurs, must let the highest levels of power know that they *expect a higher level of consciousness* from their leaders to enable them have this shared vision.

➤ *Define Policies for S&T*

Policies are basically road-maps, or frameworks. When embarking on any journey, it is good to have a roadmap to assist in arriving at the intended destination. It is important that African countries have a planned route, in the form of a policy in major development sectors. In Nigeria for example under the current administration, the Ministry of Science and Technology has put in place 11 policies ranging from information technology (IT), biotechnology, space, industrial materials, and intellectual property rights (IPRs), to energy.

Policies provide a framework, but can be disregarded or remain ineffective if not put into law. Governments must confirm a policy by fixing it through establishing it in law, through executive and legislative approval. Once a policy is fixed, it is most likely to withstand the vagaries of changes in political leadership, administrative personnel and even economic support.

It is not for every African country to follow the trajectory of Nigeria -but every country must identify areas based on their particular environment and resources, through which it can get involved at a significant level in S&T for development. That said, it is also true that most countries will find it necessary to have a biotechnology policy and that all countries must have a policy on ICTs. ICTs are essential for capacity building and in data and institutional management in all sectors of development.

➤ *Embrace Integrated Capacity Building*

When we talk of capacity building for individuals, for institutions or in infrastructure, it is clear that building in capacity in one cannot be done in isolation from building capacity in the others.

- Of what use is it to send Nigerian engineers to the UK to learn space science if they come back to Nigeria without an institution to absorb them or infrastructure to support the institutions in which they want to use their skills and knowledge? We have banks that use high-tech IT systems and train personnel in banking skills, but if a stable and sound financial (infrastructure) system is not in place, banks will continue to fail us.
- Africans in the diaspora are increasingly interested in coming back to participate in the new visions being incorporated into policies which are to enable new production and services, but if the infrastructure and institutions to support policy implementation are not in place, these people may have no choice but to give up the dream.
- We have been supporting capacity building of doctors and nurses in our educational system, but our medical services are collapsing because of poor support for infrastructure and institutions; our doctors and nurses are leaving daily for countries that have this capacity.
- Clearly, there must be a concerted effort to address capacity building in an integrated way, with each capacity need influencing the development of the others.

➤ *Provide Education, Education, and More Education*

Basic to enabling integrated capacity building is the broad range of human capacity, which is underpinned by good education. There has been a lot of education in Africa, but much of it has not been

effective and functional- and clearly the educational systems we have, have not prepared us for the S&T world of the 21st century.

### **Early education**

We need to look at education in a comprehensive way from family, to nursery to secondary to tertiary education; we need to provide the basic educational foundation upon which S&T education can be built. This means that African countries must ensure that children are literate in mother tongues in early education as the mother tongue is the foundation for basic concepts and values and imagination which provide for subsequent studies in math, physics and engineering which may be taught in any other language. Value systems, discipline, perseverance, objectivity and integrity, and appreciation for rational and logical thinking should characterise the educational process from childhood to adulthood.

### **Secondary, Technical and Informal Education**

In order to enable all levels and sectors of our citizenry benefit from the science agenda, African countries should be committed to providing literacy and numeric skills to the level of secondary school to 100% of their citizens. This can be achieved through the expansion of secondary, technical and informal education systems, which will produce the bulk of the users and implementers of the products of S&T and constitute a viable market for its products and services.

### **Tertiary Education**

African countries have invested in tertiary institutions for decades, but these institutions have not yielded the desired results. The few early universities were too elitist to provide the critical mass of graduates; the unmanaged expansion of universities in recent years has resulted in graduates without the skills and knowledge, attitudes and values required for the 21st century. Our universities need to be given support for integrated capacity building to improve the numbers and quality of their graduates. We need to use the new tools of technology to expand education, for example, virtual libraries and the Internet. We need to look at innovative approaches to 'add value' to the degrees of our graduates to enable them fit into the employment needs opened up by the African science agenda. There is a need for institutionalising 'mentoring' for young science graduates who have not grown up with a scientific culture, to expose them in positive and intense ways to become successful professionals and entrepreneurs.

However, in addition to these main-stream tertiary institutions, Africa must invest in high level (international and pan-African) centres for providing the specialist human capacity required for implementing the science agenda for Africa. We need to create oases or small and focused centres to sequester areas of excellence. These centres of excellence must deliberately protect merit, innovation, and creativity.

These centres of excellence as well as the mainstream universities need to be open -they need to be multinational; we must bring back the diversity and synergy of international cross fertilisation of academia which rarely exists today in African universities. We must send our best abroad for training in some frontier areas, but greater effort should be made to bring those in the frontiers of science outside Africa -whatever their nationality, to centres of excellence in Africa- this will only be possible if the required supporting institutions and infrastructure are in place.

➤ *Engage in Critical (strategic) Partnerships*

We need partnerships to create world-class universities, to create world class R&D institutions, to implement joint research projects, to enable transfer and exchange of research scientists and engineers, to open institutions to international staff, to jointly fund projects and to jointly create industries (e.g. Nigeria-Surrey Satellite Scheme).

### **International Partnerships**

With respect to capacity, implementation of policies, education, and institutional and infrastructural capacities, we cannot do it alone; Africa will need support from the international community in terms of capital and expertise.

We must wonder whether Africa is of enough strategic importance to Europe, USA, Russia or Japan to deploy resources and expertise for these partnerships to bring Africa into the global network of S&T and development. I would like to think the answer is yes and I give a reason why it is yes. Africa has strategic resources, land mass, and a population (700 million) which is a viable market. Yes, there is basis and leverage so that it can be a win-win situation for international partnerships.

For these joint partnerships Africa must have a defined agenda; and we must be in the driving seat and maintain our own agenda and not allow our agenda to be ambushed by other interest groups.

### **South-South Partnerships**

There must be best efforts at South-South cooperation in S&T development through exploiting complementary skills to build each other's capacity and create and share markets. We can establish coalitions as well as create the synergy for coalitions to have greater competitive capacity in the broader global theatre of competition. Such coalitions can exploit openings in a shifting global economy.

Particular countries may want to enlarge their major S&T programmes beyond national boundaries, especially in areas where those countries have commonalities. For this purpose it may be useful to have sub-regional groups based on existing growth points for driving African S&T, e.g. North Africa, West Africa, Central Africa, Southern Africa.

While such coalitions may be initiated by one or two countries, others will join as they see benefit and advantage to joining.

For this type of partnerships to work, Africans must invest heavily in the implementing institutions. The AU and NEPAD should be in a good position to invest in such partnering and institution building.

### **Support Research and Development (R&D)**

The African science agenda must include a strong policy support and funding for R&D. In addition, Africa has to build world class R&D institutions as centres of excellence; it is institutions of this quality that can meaningfully engage in international partnerships: in the exchange of scientists, in implementation of joint research projects; and in accessing local, regional and international R&D funds. For the past forty years or more, African countries have not been able to build, fund, and run such world-class research institutions. International research institutions, like IITA, the International Rice Research Institute (IRRI), among others, have much more liberal funding than national research institutes, and of course are better run and administered thus attracting and retaining first class research scientists with a high level of creative and innovative research outputs leading to patents, products and services. The AU and NEPAD have no choice but to invest in (3-4) world-class R&D institutions manned by African and other international scientists -this critical mass of scientist, hopefully, can train young scientists as well as serve as mentors for them.

In addition to building R&D institutions, African political and academic leadership must show evidence of building strong science and engineering academies.

Modern technologies will be the target of African R&D in the strategic areas mentioned earlier under policy and in other areas such as oil and gas, petrochemicals, engineering materials and parts, and renewable energy including solar energy technologies and fuel cells. Equally important, African countries have a natural endowment and comparative advantage in terms of ecosystems with unique biodiversity and habitats that need protection and conservation and also preservation in gene banks, while we exploit these species and products sustainably in the areas of food security (including indigenous foods), medicine, cosmetics and building materials. In this regard, "There is a need to promote the understanding of the eminent value of intellectual property as a key to the creation of wealth in our 21st century world, and to protect such rights as presently exist in the developing world, as well as help build appropriate R&D facilities for the promotion of the search for new and cutting edge knowledge for self-and global development." <sup>1</sup>

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<sup>1</sup> Okpaku J.O. Creating New Leaders for E-Culture, Coventry United Kingdom, August 2001.



➤ *Empower Small and Medium Size Enterprises (SMEs)*

In the USA, one of the wealthiest countries in the world, over 70% of the wealth generated is from SMEs. Africa has a strong entrepreneurial culture but we need to raise the technical standard of the activities of our small entrepreneurs to raise their income levels. There is no better way to address this problem than through support for SMEs and for R&D in support of the production and services that SMEs can offer our nations.

Technology allows the small company to look bigger; the emerging company to become more mature at a faster pace; the small company to reach customers it never could reach or customers it never knew existed. In the same vein, technology gives entrepreneurs and citizens of developing nations a springboard from which to have more control of their own destinies and compete, sell, supply, and participate in educational, commercial and humanitarian ventures with their fellow, citizens domestically and around the world. The assimilation/uptake of technology in developing countries will not be unlike the scene in an African market: disconnected, vibrant, chaotic and not always efficient. However, any attempt to prevent this technology dissemination will be tantamount to “herding cats”. To be more specific, West Africa provides a window for us to look into the “African market system” with respect to the acquisition and introduction of technology *that is now taking place*. Here are two examples:

- A recent New York Times article focused on the loss of hundreds of civil servant jobs in the USA to a small Ghanaian business! The thousands of parking tickets written up daily in New York City (NYC) were being scanned and sent via the Internet to Ghana for entry into a billing and records system. Except for minor problems with reading the poor penmanship of New York’s parking maids, the Ghana connection has provided a technical service that has saved NYC tens of thousands of dollars.
- Wireless Internet Access has been the medium of choice to access the Internet in rural areas and townships that do not have cable or phone lines. The infrastructure for this technology includes the installation of satellite dishes, telecom towers etc. In the larger cities of Nigeria, these towers and dishes can be seen sprouting up from half completed buildings, banks, political campaign headquarters, non-governmental organisations (NGOs), private business, etc. You can be sure that these entities and institutions are not colluding to corner the wireless Internet market! Quite the contrary, they are probably acting quite independently. At the cost of some inefficiency these brave pioneers are taking entrepreneurial risks and not waiting for handouts to make things happen.

These two examples show that the best thing governments in developing nations can do is create an environment where there is free enterprise, minimal regulation, support in the form of training, resource centres with low cost high speed internet access and possibly providing business and eCommerce consulting expertise to SMEs. Forums can be facilitated (in Nigeria, through NITDA for example) that bring the purveyors of some of these entrepreneurial ventures together to learn from each other before returning to the gold rush-like chaos of ICT. Small business will come and go but such support services will need to be continuous, consistent and reliable.

As contrasted with manufacturing, service based industries typically have much lower fixed costs than manufacturing and are more accessible. There are huge opportunities for African entrepreneurs to start service-based SMEs for local clients as well as international ones. Africans are quite comfortable in the small business model let the world know: the African market is open for business!

## **6. Can The Science Agenda Work For Africa? Initiatives and Action in Nigeria**

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What is happening that is promising/good for Africa? Our agenda must be anchored in what is happening in Africa -we need success stories of what is working to serve as inspiration for other African countries. It may appear difficult to get examples for the continent- but I am sure others in this forum will relate some of them. I can mention a few from Nigeria.

Since the inauguration of a democratic government just over three years ago, the Nigerian government has shown evidence of the will and vision for implementing a scientific agenda for sustainable development.

Our Biotechnology, IT, and space policies have been approved by the Federal Executive Council, structures have been put in place and they are functioning; our SME policy is in the process of going to the National Executive Council.

### **The Information Technology (IT) Policy**

Following the drafting of an IT policy grounded in political vision, the political will was confirmed when the policy was approved by the Federal Executive Council and subsequently fixed through legislation. Funds were committed and infrastructure has been put in place, staff has been appointed with professional leadership and mobilisation of the private sector as strategic partners. There is a specific national information backbone; some specific training and a process for implementation of e-governance is on-going.

### **Space Policy**

Our space policy was formulated, and approved by the Federal Executive Council. Fifteen Nigerian engineers are undergoing training in Surrey for capacity building in the design, building and launching of Nigeria's first satellite (Nigeria Sat 1) and this first group will be involved in the design of Nigerian Sat 2, a communication satellite, as well as Sat 3. The space programme is preparing ground stations and receivers with the private company, Raytheon. The space policy is being implemented -there are physical structures, staff, and the professional leadership of a Director General. Nigerians are being trained so that the space programme can be sustainable -and contribute to managing biodiversity and other natural resources in sustainable ways.

## **Biotechnology Policy**

Our biotechnology policy has been formulated and approved by the Federal Executive Council, and there are structures and staff in place and a Director appointed. The biotechnology programme coordinates all biotech activities in Nigeria. Biotechnology and nuclear physics are being brought together through a programme of SHESTCO (a S&T complex) building, a US\$30 million modern biotechnology laboratory. The biotechnology programme is also completing a gamma radiation plant costing over US\$53 million. An important part of this success story is that Nigeria is meeting its financial commitment to this project (So African countries that have started similar projects but abandoned them as they could not sustain the financial support required). This gamma radiation facility will be completed in the next 12 months.

## **Support for Pan-African Institutions**

Another evidence of the Nigerian government's commitment to a science agenda for Africa is shown in its commitment of support for the AU, and the implementation of NEPAD spearheaded by South Africa, Nigeria, Senegal and Algeria. Nigeria is also committed to providing an endowment to the African Academy of Science (AAS) through support of a policy approved by Nigeria's President and the Federal Executive Council and through an appropriation Act of the National Assembly of Nigeria. Nigeria is in the process of honouring that legislation. It is hoped that other countries will also commit to support of the AAS.

## **Industrialisation**

Imported technology and transfer of technology (industrialisation) has not made the expected impact on economic development. For example, the textile industry in India and Pakistan is a huge employer of man-power and an effective producer of goods. In Nigeria, the textile industry collapsed due to liberalisation and excessive importation.

Nigeria invested in a steel rolling and manufacturing plants and in automobile assembly, but these investments did not translate into industrial capacity. The Nigerian National Petroleum Company (NNPC) didn't build capacity for Nigerians to be genuine owners or even partners in the oil industry - but only enabled them to act as brokers.

It is good to be able to report that since the institution of democracy in Nigeria, steps are being taken to reverse this situation: the rolling mills are being rehabilitated, the importation of textiles has been banned, and NNPC is being restructured to operate as a commercial entity for exploration and production.

## **7. Final Comment**

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With political will and vision and defined policies put into reality through support for education, integrated capacity building and critical partnerships at all levels, Africa can position itself along with others in the world at the frontier of science for sustaining its natural and human resources, and be part of globalised S&T-driven development in the 21<sup>st</sup> Century

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