Science, Technology, Engineering and Innovation in a Globalizing World: Whither Nigeria?

By

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Central Message of the Lecture

- *First*: The on-going globalisation of the world economies is such that developing nations, such as ours, are 'casualties' in the 'take-no-prisoner' war of global competition for markets and resources;
- *Second*: The major tools of offence and defence in this 'war' are basically knowledge and information driven by science, technology, engineering and innovation (SETI);

Central Message of the Lecture

- *Third*: The development and deployment of SETI capacity is sine-qua-non to the socio-economic development of our nation state; and
- *Fourth*: The situation calls for partnerships between the elements of our innovation system to produce a new generation of young Nigerians – free, educated, and technologically literate – who will become the scientists who can push the edges of knowledge, the business leaders who can transform knowledge into goods and services demanded by internal and global markets, and the government officials and the national leadership who are able to come to grip with the dynamics of global competition in creating a fertile policy environment that promotes SETI-driven development.

THE STRUCTURE OF THE PRESENTATION

- What is Globalisation?
- What are the challenges for the socio-economic development of our nation state?
- What are the consequences of not meeting these challenges?
- Elements of Science, Engineering, Technology and Innovation (SETI) capacity for National Development
- Way Forward for Nigeria
- Concluding Remarks

What is Globalisation?

- *"Globalization is the growing view of the world as a single coherent entity with respect to socio-economic planning, coupled with its enforced development as a single coherent entity, under the pressure of international market forces, engineered primarily by the perspectives, national interests and current values of the Western world."*

What is Globalisation?

Oil Crisis of 1975:

Most of the oil revenues filtered back into the western banking system, and the West used these to offer loans to the developing countries in distress, leading to the enormous debt burden that was to debilitate their economies throughout the 1980s and 1990s. The debt burden crippled the capacity of many developing countries to finance their development through internal sources.

Anyaoku (2008)

In Zambia during the 1980s, for every dollar worth of export of copper, 83 cents went to repay the debt, and only 17 cents was left to finance regular and development budgets. This was the so-called "resource gap" in the World Bank literature, which the IMF and the World Bank filled by further loans to repay the debts. This simply increased the debts, thus creating a vicious circle. But worse than the burden of debt, and indeed tied to the debt repayments, were the conditionalities imposed on the borrowing countries by the donors and the IMF/WB.

Anyaoku (2008)

Oil Crisis of 1979:

The second oil crisis in 1979 also hit the countries of the North. In the United States and the United Kingdom, President Reagan and Prime Minister Thatcher responded by deregulating the economy, privatising national assets, imposing firm control over the workers, and trade and financial liberalisation. Later, in the form of the so-called Washington consensus, these policies were to dominate the thinking of the Bretton Woods institutions and the World Trade Organisation (WTO).

Anyaoku (2008)

Oil Crisis of 1979:

When the World Bank and IMF adopted this as their orthodoxy, they put a rigid ideological matrix on their conditionalities that came with their funds. It is no wonder that later, they were criticized for "one fit all" strategies for the countries of the South irrespective of the context and circumstances of each country to which the BWIs lent their money and advice. It is this that was the beginning of what is now identified as the neoliberal ideology which came to govern globalisation in this period from about the mid-1980s to 2005.

Anyaoku (2008)

Macroeconomic Policies of the BWIs and Donors:

- Free market ideology - let the market decide;
- Privatization of state assets and denationalisation;
- Deregulation (minimum state interference in the economy);
- Control over wages and conditions of works;
- Stiff budget deficit controls;
- Trade liberalisation and reduction of tariffs:
- Reduction of social expenditure on things like health and education; and
- Forcing the South to open up their capital market to investments from the North

Anyaoku (2008)

Malaysia jettisoned the BWI Policies

"I do believe that it is also necessary to stress that for most countries today, human resources development and human capital formation are either extremely important, absolutely vital or a matter of life or death. In the case of Malaysia... we think it is a matter of life or death"

Badawi, Prime Minister of Malaysia

Economic Globalisation: Industrial Competitiveness?

Economic globalisation has serious impact on the industrial development of any country. It is a well acknowledged fact that one of the important prerequisites for the economic well-being and prosperity of any nation is the sustainable development of industry. It is industry that provides services to members of a society by making consumer and capital goods, creating new products and processes, generating new companies and opportunities, and providing, in the process, unlimited new jobs for the population. **The key to the success of modern industrial development is science, engineering, technology and innovation (SETI)**

Economic Globalisation: Industrial Competitiveness?

"It is a very different kind of conflict. There is no clash of competing military forces and the struggle is not defined by national borders. But it does involve an often violent struggle for control of physical resources and territory that is destroying lives and communities at every hand. It is a struggle between the forces and institutions of economic globalisation and the communities that are trying to reclaim control of their economic lives. It is a conflict between competing goals – economic growth to maximise profits for absentee owners versus creating healthy communities that are good places for people to live.

Economic Globalisation: Industrial Competitiveness?

It is a competition for the control of **markets** and **resources** between global corporations and financial markets on the one hand and locally owned businesses serving local markets on the other.

From Berlin to Brussels: That Europe may not under-develop Africa again

AFRICA is in trouble. Its future is once again on the table, and it is Europe that holds the ace. Unlike the Berlin Conference of 1884 to 1885 which balkanized Africa among 13 European powers as guaranteed sources of raw materials and markets, the current contraption under the Economic Partnership Agreements (EPAs) spearheaded from Brussels is the modern day equivalent of the Berlin Conference. At issue in both Berlin and Brussels is whether or not Africa can be allowed latitude to conduct trade, industrial and development policies for her own development or for the development of Europe.

Chukwuma Charles Soludo (Guardian 21/3/2012)

What is the kernel of the EPA?

Put simply, in order to continue to have access to European markets (on the terms that it had enjoyed for more than three decades) Africa is now required to eliminate tariffs on at least 80 per cent of imports from the EU; in some cases, abolish all export duties and taxes, in others, countries can retain existing export taxes but not increase them or introduce new taxes; eliminate all quantitative restrictions; and meet all kinds of other intrusive and destructive conditionalities that literally tie the hands of African governments to deploy the same kinds of instruments that all countries that have industrialized applied to build competitive national economies.

The Globalisation Pill:

A major difference is that the ‘agreement’ will now be signed by free people, under supposedly democratic regimes, and in contexts where the African people again have neither voice nor choice. Only about 10 out of 47 Sub-Saharan African countries (SSA) have either signed or initialled the EPAs. Trade ministers of the affected regions—the African, Caribbean and Pacific (ACP) countries as well as African trade ministers and the African Union — have largely rejected the EPAs. Despite all of these, and the reported public protests in 20 countries against the raw deal, it seems all but certain to be rammed through**. In private whisperings, not many Africans or policymakers are happy with the deal but there is a certain sense of helplessness.**

Land Grabs in Africa

A 21st-century land rush is on. Driven by fear and lured by promises of high profits, foreign investors are scooping up vast tracts of farmland in some of the world's hungriest countries to grow crops for export…The largest investors in foreign croplands hail from China, India and South Korea, along with Saudi Arabia and other oil-rich Gulf states. What these countries have in common is that all were shaken financially or politically by the 2007-08 food crisis; **and all lack sufficient land or water to ensure that they can feed their populations in the coming years.**

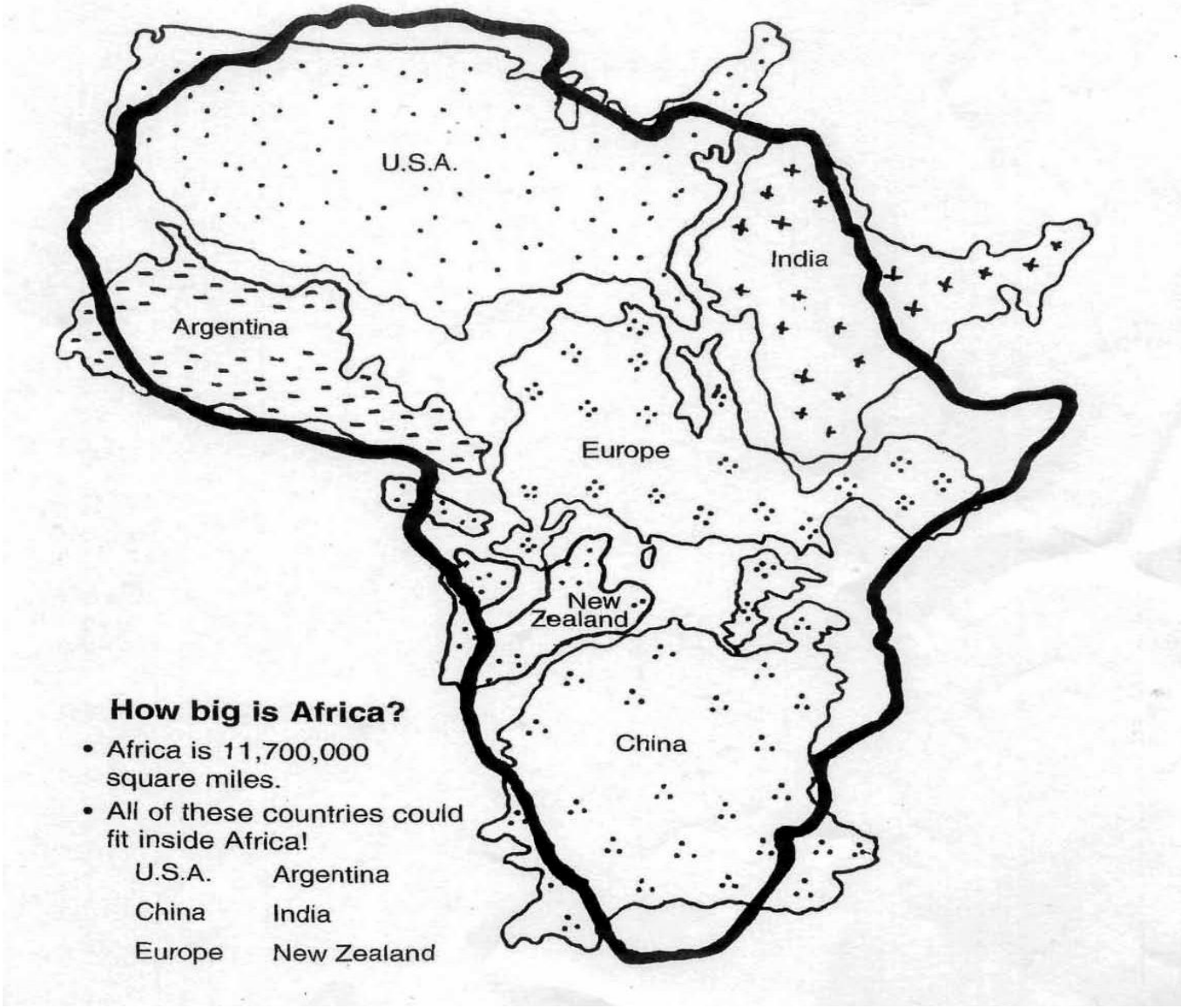
Terry J Allen, Senior Editor, In These Times

Land grabs in Africa

Some have noted that the new "land grab" is a more sophisticated incarnation of old colonialism—driven today by a tangle of factors, including climate change, population growth, fear of social unrest, diminishing water and land, trade restrictions, erosion and pollution, the volatility of commodity prices and markets, speculation, the energy crisis, agro-energy/biofuel production, the global financial crisis, carbon trading and on and on.

By 2010, deals were being struck for 140 million acres, with 75 percent in sub-Saharan Africa, according to a World Bank report.

Africa Is Big!



How big is Africa?

- Africa is 11,700,000 square miles.
- All of these countries could fit inside Africa!

U.S.A.	Argentina
China	India
Europe	New Zealand

Land grabs in Africa

With a 99-year lease for 2,500 acres, a Saudi Arabian investor brought in Spanish engineers and Dutch water technology, and hired 1,000 women to pick and pack 50 tons of food a day in Ethiopia. The food supply is driven 200 miles to Addis Ababa and flown 1,000 miles to the shops and restaurants of Dubai, Jeddah and elsewhere in the Middle East. The same company grows wheat, rice, vegetables and flowers for the Saudi market on four farms in Ethiopia. **With $332 billion in assets, the China Investment Corporation is one of the world's largest sovereign wealth funds**. And like the Saudis, China's concerns about growing unrest and food insecurity are factors in its increasing investment in foreign farmland, including Africa.

Land grabs in Africa

However, it is pertinent to note that backlashes have already started. When, for example, word leaked that Madagascar planned to sell 3 million acres to the South Korean firm Daewoo Logistics, popular outrage quashed the deal and toppled Madagascar's government. In the Philippines, as food prices were spiking in 2007, outcries from Filipino farmers stopped China from buying 2.5 million acres on which to grow export crops.

Some of the Consequences

- Unregulated global economy
- Concentration of power and wealth in the hands of fewer companies and people
- Loss of jobs
- Brain Drain

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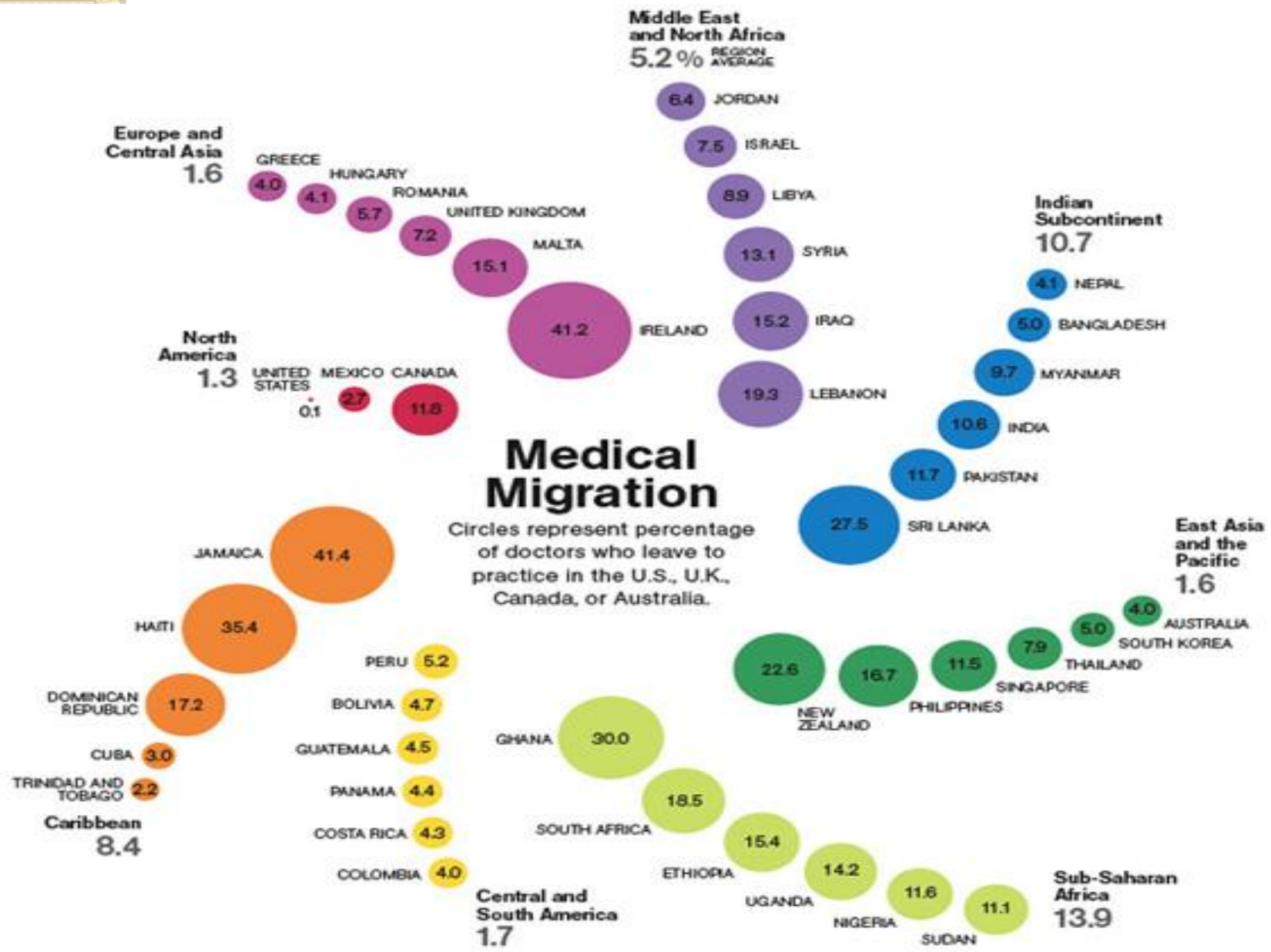
J. Salmi


Middle East and North Africa
5.2% REGION AVERAGE
6.4 JORDAN
7.5 ISRAEL
8.9 LIBYA
13.1 SYRIA
15.2 IRAQ
19.3 LEBANON
Europe and Central Asia
1.6
GREECE 4.0
HUNGARY 4.1
ROMANIA 5.7
UNITED KINGDOM 7.2
MALTA 15.1
41.2 IRELAND
North America
1.3
UNITED STATES 0.1
MEXICO 2.7
CANADA 11.8
Indian Subcontinent
10.7
4.1 NEPAL
5.0 BANGLADESH
9.7 MYANMAR
10.6 INDIA
11.7 PAKISTAN
27.5 SRI LANKA
Medical Migration
Circles represent percentage of doctors who leave to practice in the U.S., U.K., Canada, or Australia.
East Asia and the Pacific
1.6
4.0 AUSTRALIA
5.0 SOUTH KOREA
7.9 THAILAND
11.5 SINGAPORE
16.7 PHILIPPINES
22.6 NEW ZEALAND
JAMAICA 41.4
HAITI 35.4
DOMINICAN REPUBLIC 17.2
CUBA 3.0
TRINIDAD AND TOBAGO 2.2
Caribbean
8.4
PERU 5.2
BOLIVIA 4.7
GUATEMALA 4.5
PANAMA 4.4
COSTA RICA 4.3
COLOMBIA 4.0
Central and South America
1.7
GHANA 30.0
SOUTH AFRICA 18.5
ETHIOPIA 15.4
UGANDA 14.2
NIGERIA 11.6
SUDAN 11.1
Sub-Saharan Africa
13.9

J. Salmi

The Challenge

Reclaiming and building our local economies by working to create and sustain locally owned enterprises that sustainably harvest and process local resources to produce jobs and the goods and services that we need to live healthy, happy, and fulfilling lives in balance with the environment.

The Imperative

The imperative of the above is the need for us to seek to understand, and hopefully steer, the forces that drive globalisation and global competition.

$\Rightarrow$

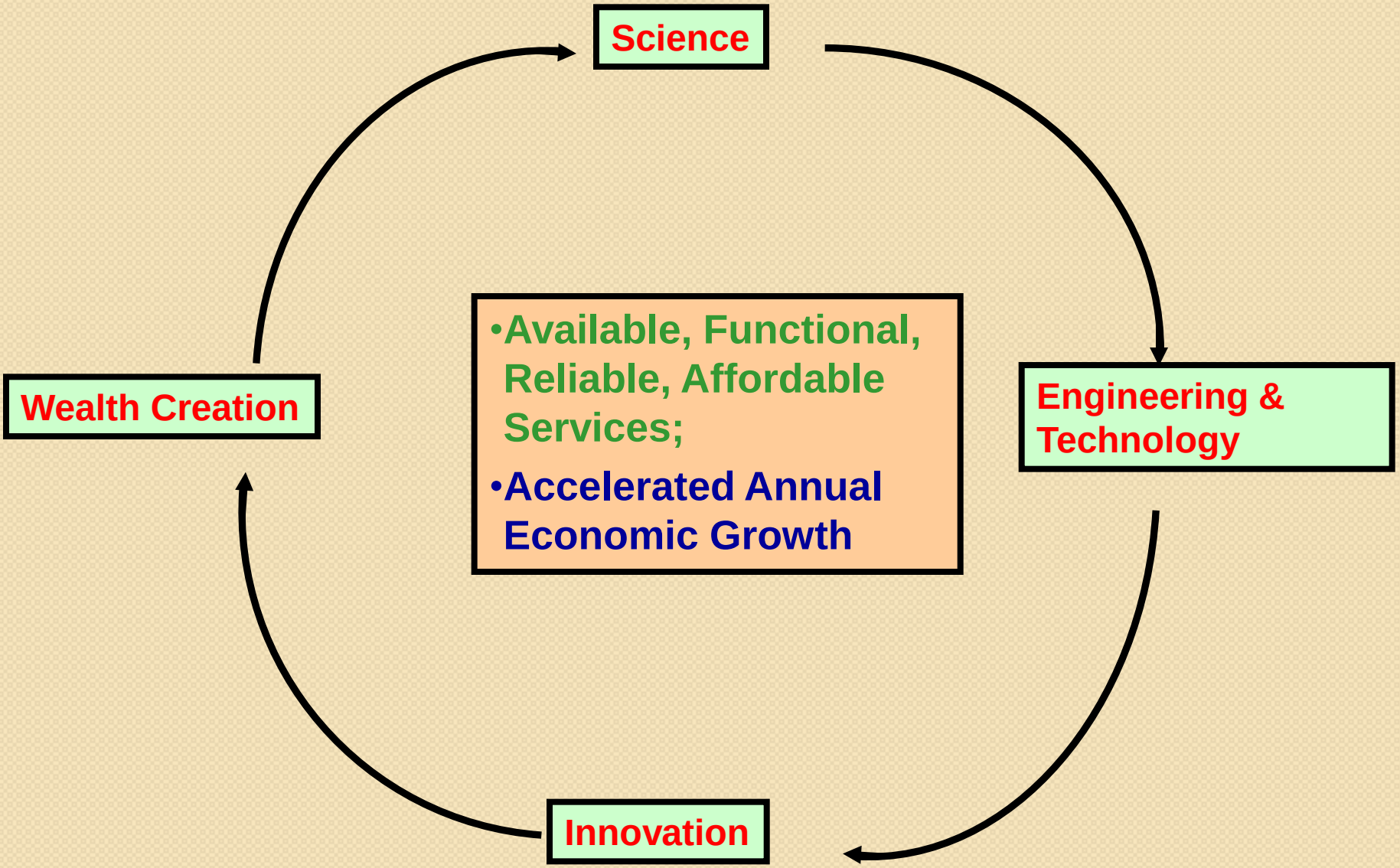
The New World economic Order

Contemporary events have shown clearly that throughout the world, private and public sectors are seeking to chart directions for future growth and development using the triad of knowledge, information, and innovation. The imperative for these strategies is not simply to survive, but to thrive.

The Imperative of Knowledge

Global or local competition will continue to place an ever greater premium on harnessing the energy of Science, Technology, Engineering and Innovation (SETI) to the engine of economic progress. Knowledge is becoming a leading factor of production around the world, and the ability to create, master, and mobilize knowledge now distinguishes economies.

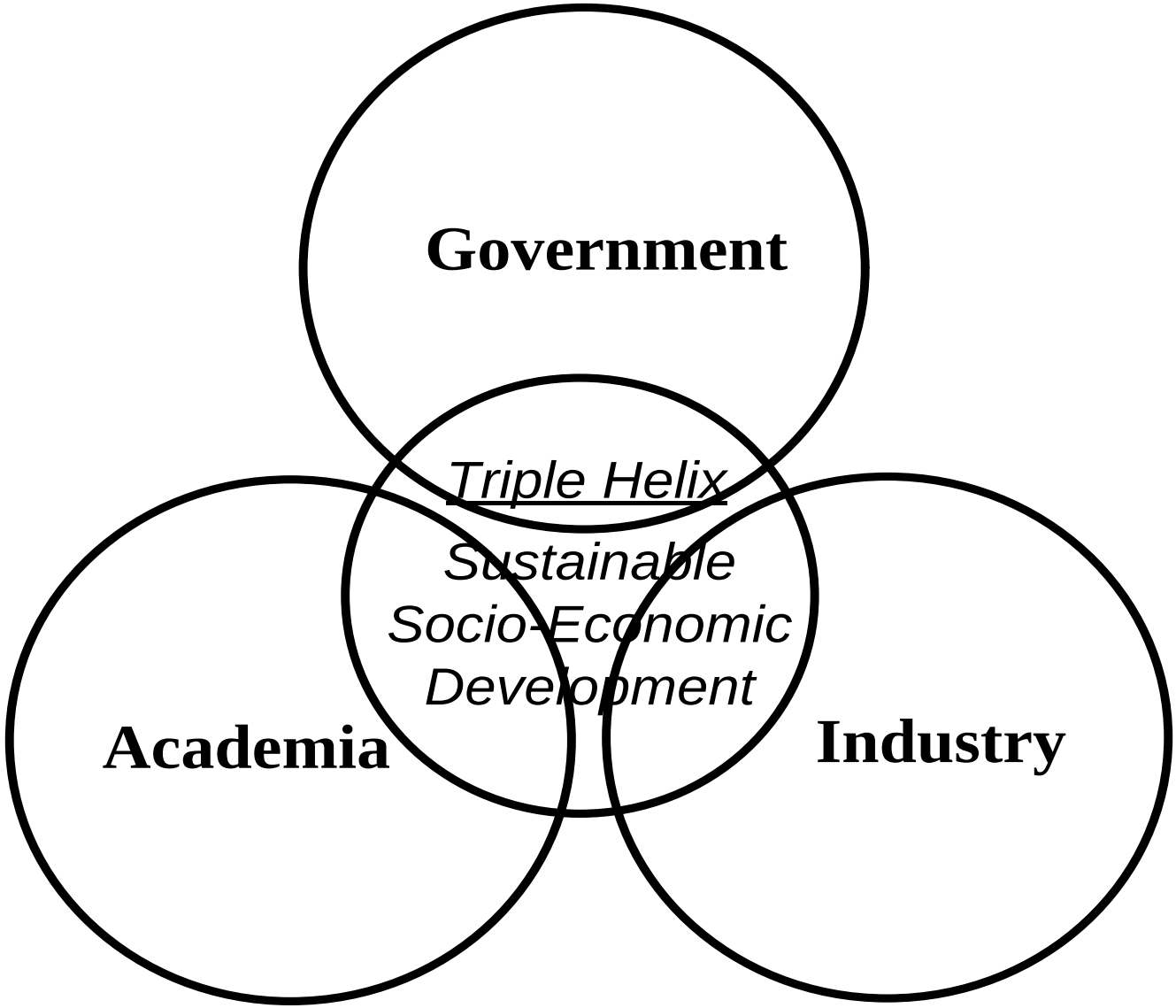
The 360-degree curve of SETI



Major Challenge facing Industry

Development of Science, Engineering, Technology and Innovation (SETI) Capability to face the challenges posed by the on-going globalisation of the world economy.

The Triple Helix Partnership



What is the state of our Industrial Competitiveness?

According to the 2009 Africa Competitiveness Report, 23 African countries out of the 31 that were surveyed remain at the most basic stage of the competitiveness index of a factor-driven economy (that is, one whose ability to compete is based on unskilled labour and natural resources). Only five countries – Algeria, Mauritius, Namibia, South Africa and Tunisia - have reached the second stage of competitiveness – the efficiency driven stage (which is driven by efficient goods, sophisticated labour and financial markets, a large market size and the ability to utilize technology effectively). No African country has reached the innovation-driven stage, that is, a stage based on an ability to compete with new and unique products, and the use of sophisticated production driven competition."

- *The industrial processing of mineral resources can serve as a trigger for industrial diversification of the economic basis of Member States. This will trigger a carry-over effect on the development of technology, well-trained labour and managerial methods. Industrialization based on mineral processing can have as objective, the creation of a regional industrial base, geared towards producing intermediate products to meet national and regional needs and the export of a part of those products to meet foreign demand. The key drivers for these include having, among others:*

Conference of African Ministers of Industry (CAMI)

- *A significant entrepreneurial base looking at opportunities to service local, regional and export markets;*
- *Competitive production (high productivity, low costs compared to competitors);*
- *Craftsmanship and specific skills;*
- *Access to markets (domestic and foreign);*
- *Good market intelligence; and*
- *Research and development.*

Conference of African Ministers of Industry (CAMI)

Import substitution and the 2012 Agric Budget

The Honourable Minister of Agriculture, Dr. Akinwumi Adesina has been challenging all stakeholders, including research establishments, to join hands in achieving complete replacement of imports of rice especially while diversifying the industrial uses of cassava.

We probably all witnessed Mr. President eating the cassava bread from the IITA Lab!

But who will address the value chain – from the cassava farm to the processing bay and the bakeries for onward transmission of the innovative cassava bread to our dining tables?

Lesson from beyond

The African Development Bank (AfDB) approved US $63.24 million funding package for the implementation of a five-year agricultural research project. The project, dubbed, *'Support to Agricultural Research for Development of Strategic Crops in Africa (SARD-SC)*, involving research establishments in the region, was meant to enhance the production of staple food items like cassava, rice, maize and wheat. Surely, this is an excellent step towards achieving food security in the region.

What is my take on this?

- This is the type of initiative one can expect in Nigeria at the national and state levels. Our universities have to show commitment to research-driven incremental innovation to support the elements of the value chain in agriculture and other sectors to achieve sustainable development. Fortunately, the country can boast of at least 122 universities as at 2011 spread over the country with some states having quite a number. Our universities must take up the challenge of providing R & D-driven innovation as input to the various enterprises in the value chains of the different industrial sectors.

From Waste to Wealth, the story of the Organo-mineral Fertiliser Production at the University of Ibadan and the journey through the 'Valley of Death'

In the Beginning

The Journey.

- In 2001, 2 Professors assisted by 3 graduate students at the Department of Agronomy and the Department of Preventive and Social Medicine, using a N50,000 Senate Research Grant, developed an organo-mineral-based fertiliser utilising mainly biodegradable municipal wastes.
- The field testing of the experimental organic fertilizer was highly successful and was well received by farmers.
- This created demand by the farming community that could not be met by the Laboratory.
- N1.0 million grant was provided by the RMRDC for prototype plant development.

The Professor of Mechanical Engineering contacted towards the development of the prototype plant had this to say:

> ***"I dare say that it was not an easy task to convince my academic colleagues that a student could earn a Ph.D degree from the design and fabrication and testing of such a system. I can recall one of them saying "there would be nothing new and therefore it would make no contribution to knowledge"***

However, reluctantly, the project was finally approved by the Postgraduate Committee of the Department.

The Organo-Mineral Fertiliser Pilot Plant

- Some critical elements of the Prototype plant for the production of the plant were designed and fabricated through the Ph.D research project at the Department of Mechanical Engineering using the limited RMRDC grant and the facilities of ill-equipped fabricators in the capital goods sector.
- A partially commercially viable prototype plant (including sorters, millers, mixers, and baggers) was finally designed and tested using the N10.0 million grant by the Oyo State Government at a big market in Ibadan noted for high generation of bio-degradable wastes.

The Waste Composting Bay

The Milling System at the Bodija Market

The Mixer and Bagger System

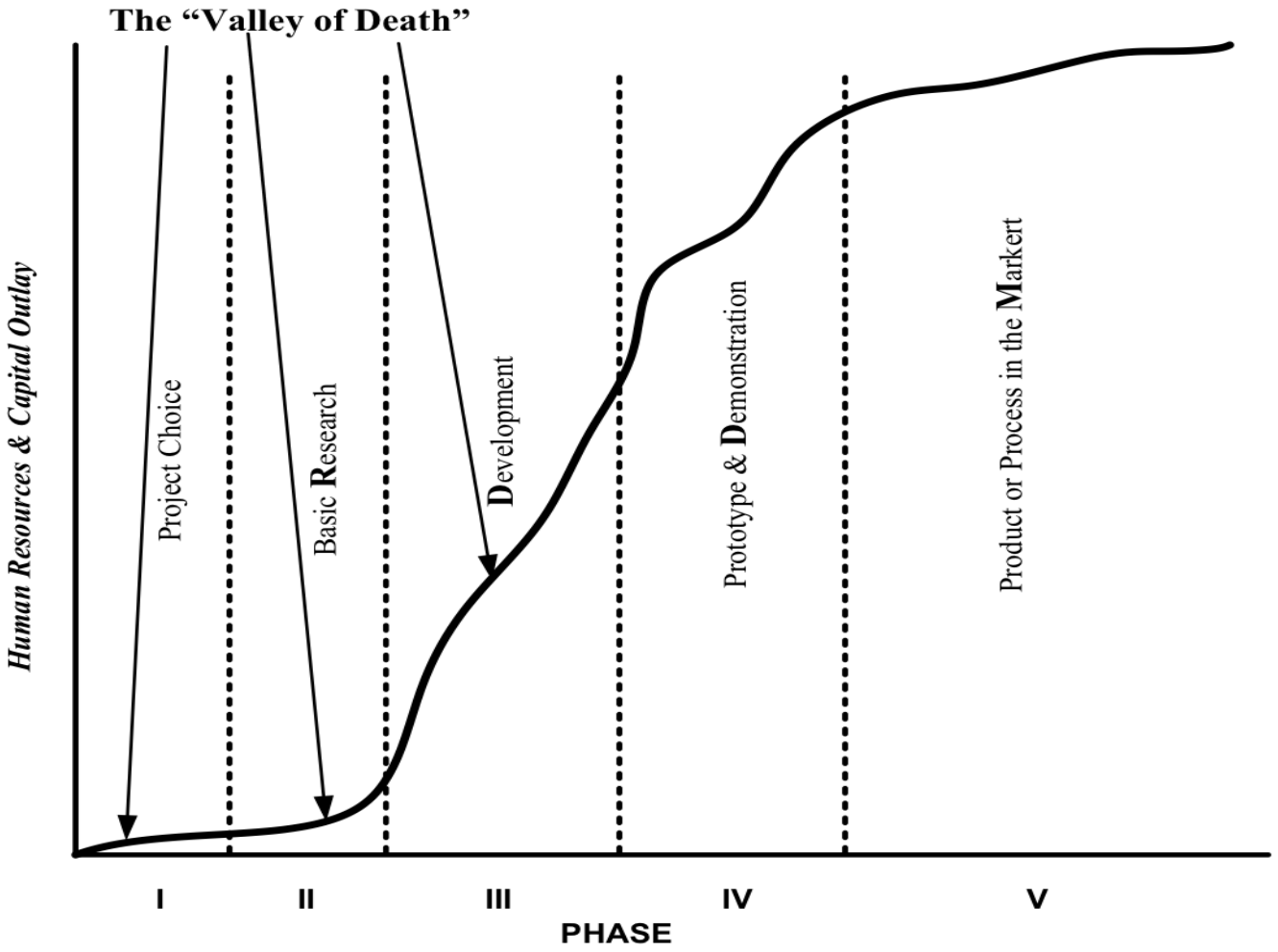
The Organo-Mineral Fertilizer Plant

- At this stage 3 engineers, a metalworking outfit with 2 technicians, 2 craftsmen and 10 artisans were involved. This brings the number of people involved to 22 from the original 5 agronomists.
- The P.h.D student of mechanical engineering was awarded the Ph.D degree while 3 agronomists also got their P.h.D degrees from the formulation and field testing of the different formulations of the fertiliser in several ecological zones in the country.
- However, no investor yet to take the plant to the market through large scale production to meet the growing demand.

Lessons from the Case

- A research idea can start with one or two researchers with moderate funding.
- As the research result progresses into the developmental phase it will move into the multidisciplinary phase through the involvement of researchers or professionals from other disciplines. It will also require significant increase in funding.
- As it progresses into the pilot stage, more funding is required from diverse sources as well as additional professionals.
- Whether the product or service gets to the market or not depends critically on the investment climate of the country to turn the research idea to a product in the market.

The Basic Phases of Research Commercialisation: The 'S-Curve' and the 'Valley of Death'



- The funding of the R component, which is mainly by government allocation, has been dwindling with budget allocation to the universities mainly geared towards meeting the recurrent expenditure. The Nigerian situation is such that government funding of R is nothing to write home about with the pockets of on-going research now mainly funded by international Agencies and Foundations. Needless to say that such researches are never geared towards industrial development as they are almost invariably conducted to satisfy the interests of the sponsors.

What is the nature of each of the basic elements of:

- Science
- Engineering
- Technology
- Innovation

in relation to industrial development and competitiveness?

Scientific Capacity

- *Science* designates man's organized attempts to comprehend how things work as causal systems. Science creates understanding which itself is neutral, but that understanding may be used by man to invent or improve or create technology.
- *Scientific capability or "know-why" is acquired through research and its acquisition from whatever sources - domestic or foreign - can take place meaningfully only if there exists* ***a critical mass of scientific manpower in our country - within our firms and/or in our national R & D institutions*** **including basic education and training institutions**

Scientific Capacity Buildup

- *After two decades of neglect of all aspects of higher education in Africa, there are now signs that the situation is changing. In particular, there is awareness that* ***Africa cannot achieve any of its developments objectives including the MDGs unless there is a substantial investment in building scientific human resource capacity and in scientific research****. There is therefore a renewed commitment to support S & T training and research institutions. The trends, though very encouraging, may not however yield good results, unless the institutions involved in research and training, acting collectively and individually, develop action plans that will become the basis for the investment.*

Technological Capability Buildup

While science essentially aims at understanding how things work ("know-why"), *technology* relates to ways of doing things ("know-how"). *Technological capability or know-how* has always been in existence in any human society. What varies is the level and intensity of its transformation of materials into goods and services most especially on a scientific basis

Engineering Capability Buildup

- Engineering is the package of actions we take to put technology to work in the production of goods and services. Engineering provides the final vehicle for producing development out of the knowledge provided by technology and, by extension, science. Thus, *engineering capability comes into play in the translation of new technologies or processes into plants and processing machinery.*

Engineering Capability Build-up: ARCEDEM

- design, development and adaptation of machinery and equipment dissemination to member States;
- development of prototypes of machines and equipment and promotion of entrepreneurship by demonstration;
- manufacture of machines and equipment and promotion of same in member States in collaboration with manufacturers from other countries;
- training of engineers and technicians in the fields of machine design and manufacture and also maintenance of plant and equipment;
- co-operation with national and international centres involved in design and manufac-ture of machines and equipment.

Basic Concept of Innovation

- *The process by which firms master and implement the design and production of goods and services that are new to them, irrespective of whether or not they are new to their competitors - domestic or foreign'*

Innovation can also be defined as the introduction into a market (economic or social) of new or improved products, processes or services.

Illustrative Case of Technological Innovation

The Avian Specialities Case

The Nigerian Chicken Market (2002)

- Supply/Demand gap of 28t/week
- N5 billion per annum market
- Increasing supply/demand gap due to the rapid growth of fast food chains
- Non-competitive prices in the open market with imported cheaper chicken

Challenges

- Increase in capacity
- Lower production cost

"With my production cost at N190 to N200 per kg of flesh, there is no way I can compete with imports coming into the country at N140 per kg and being sold at N200 per kg, which is basically my production cost! I do not believe in government banning imports to protect local producers. I will rather compete and I believe I will be better off competing."

Justus, MD of an Integrated Poultry Farm

Investment Decision

“The Tunnel Ventilation System automatically controls the temperature and humidity of the pen house. There is no way I can achieve control of the environment in my pen houses under the present system, which relies on natural ventilation. I have no alternative but to acquire technology similar to that used by the global players if I am to compete globally. I am not afraid of the technology game. I have done it before in respect of my hatchery, which is the most sophisticated in the country at present and doing very well. I can do it again.”

Techno-Economic Impact of the Innovation

ITEM	TRADITIONAL TECHNOLOGY	NEW TVS TECHNOL
Duration of rearing to slaughter	56	38
Total no. of rearing cycles per year	5	7
Average weight per bird (kg)	1.9	2.0
Feed requirement in kg per kg of flesh	2.52	1.88
No. of birds per pen (of standard size 40ft by 320ft)	10,000	20,000
Cost per kg of flesh	**N191.52**	**N142.8**

The Triple Helix at Play

The Ministry of Agriculture, Fisheries and Food in UK (GOVERNMENT) commissioned the Silsoe Research Institute of UK (UNIVERSITY) to conduct a three-year research project to develop a system which will enable broiler producers (INDUSTRY) to breed birds that meet the exacting requirements of their customers.

Key Lessons

- Innovation can take place outside the R & D system
- Innovation is not necessarily big science as it can utilize the technological knowledge already in the public domain.
- It can however become a sustainable instrument of competition if it is backed up by R & D institution for incremental innovation.
- Government can scan an industrial sector, identify technological needs, challenge R & D institutions to undertake necessary R & D for diffusion of solutions to the end users. This must be a deliberate policy as in the case of South Africa.

WAY FORWARD FOR NIGERIA

- We will have to improve our capacity to produce and manage knowledge. We must find ways to nurture scientific and technological research and to process the fruits of these endeavours into innovative solutions to the various development challenges identified above. This calls for a **well-focused, integrated and analytical** approach to managing the diverse factors that drive the application of science and technology to development issues. In the industrialised countries, and in a growing number of newly-industrialising economies, policy makers have been engaged with critical review of their **national system of innovation (NSI)**

NSI Institutions/Agencies/Organisations

- Government
- Business
- Education and Training Institutions
- Multipartite Bodies
- Organised Civil Society
- Interested Outsiders

Government

- Central policy and financing agencies
- Relevant National Assembly Committees
- Science councils and/or other government S&T Institutes
- Agencies/departments of government, including those with regulatory functions
- State corporations
- Defence forces, especially their technical support groups
- Government advisory mechanisms
- Other levels of government

Business

- Large local corporations
- Local subsidiaries of transnational corporations (TNCs)
- Small and medium enterprises (SMEs) in the formal sector
- Business Associations
- Micro-enterprises in the informal or subsistence sectors

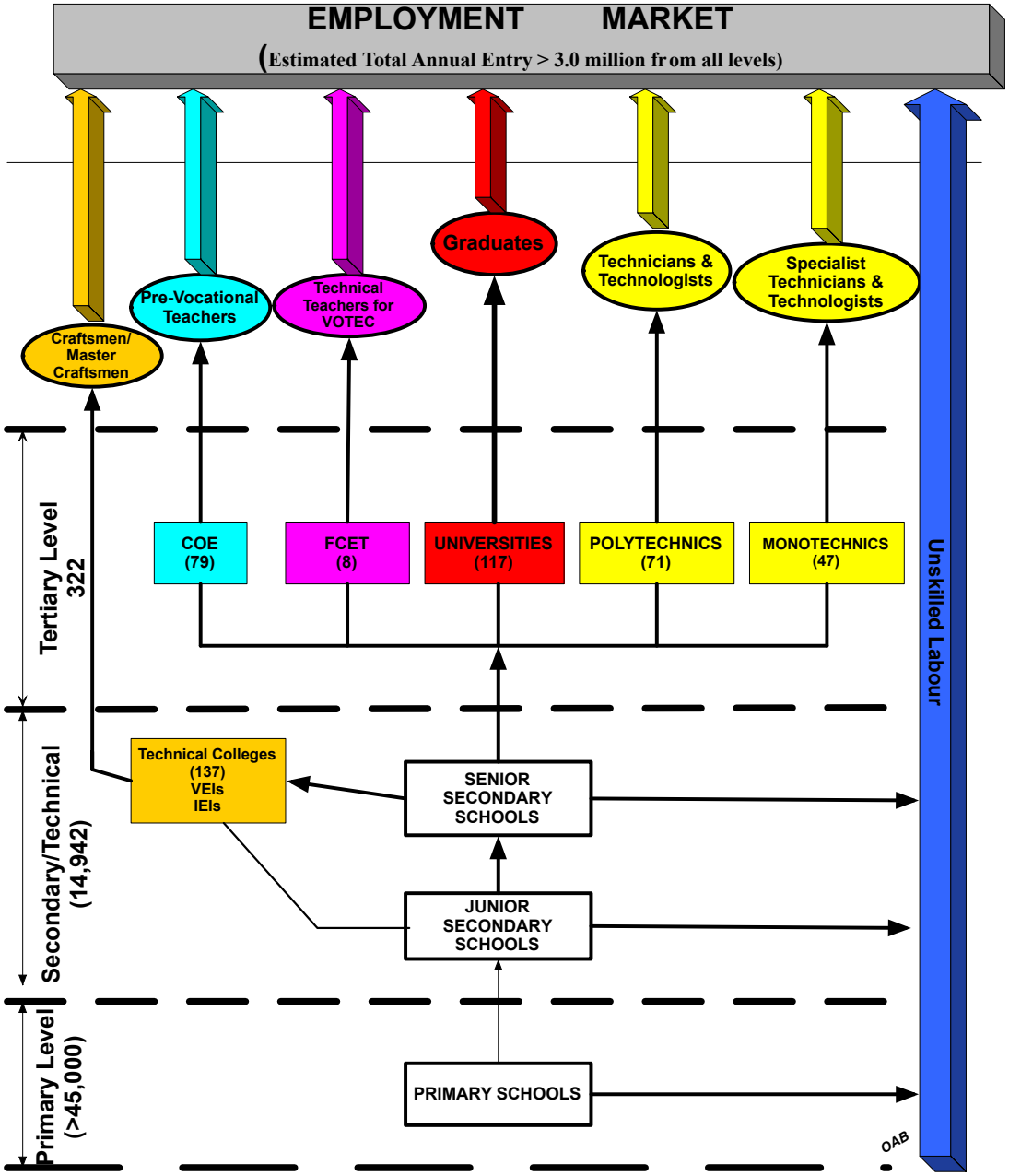
Interested Outsiders

- Other countries in the region, especially the participants in their national systems of innovation
- Other developed countries, including both the participants in their national systems of innovation and their Official Development Assistance Agencies
- Multilateral Agencies active in the country (including the World Bank, WHO, UNESCO, UNIDO, UNDP, etc.)
- Foundations such as MacArthur, Carnegie, etc.

Education and Training Institutions

- Universities
- Technical and vocational training institutions
- Teacher training institutions
- Primary and secondary schools
- Other education or training institutions including apprenticeship organizations.

NIGERIAN EDUCATIONAL & TRAINING SYSTEM AS AT 2011



Secondary School Enrolment in 2010

Total No. of Secondary Schools: 14,942

- **Total JSS & SSS: 5,004,560**
- **JSS: 2,738,327**
- **SSS: 2,266,233**

Transition from JSS to:

- Senior Secondary Schools: 60%
- Technical Colleges: 20%
- Vocational Training Centres: 10%
- Apprenticeship Schemes: 10%

Performance of SSS candidates in SSCE in 1999

Subject	Total No Candidates	Passes at Credit Level and Above	%	Ordinary Pass	%	Fail	%
English	757,233	73,531	9.71	171,098	22.59	491,593	64.91
Maths.	756,680	138,098	18.25	212,514	28.08	381,029	50.35
Biology	745,102	207232	27.81	204,214	27.4	312,758	41.97
Chemistry	223,307	69,411	31.08	51,665	23.13	94,347	42.24
Physics	210271	64,283	30.57	61,772	29.37	77, 709	36.95
Economics	717,509	155,418	21.66	245,000	34.14	297,332	41.43

Technical and Vocational Education (TVE) Initiatives (NBTE/UNESCO)

- The National Vocational Qualification Framework (NVQF)
- Vocational Enterprises Institutions (VEIs): National Vocational Certificate
- Innovation Enterprises Institutions (IEIs): National Innovation Diploma (NID)

International and Local Models of TVE

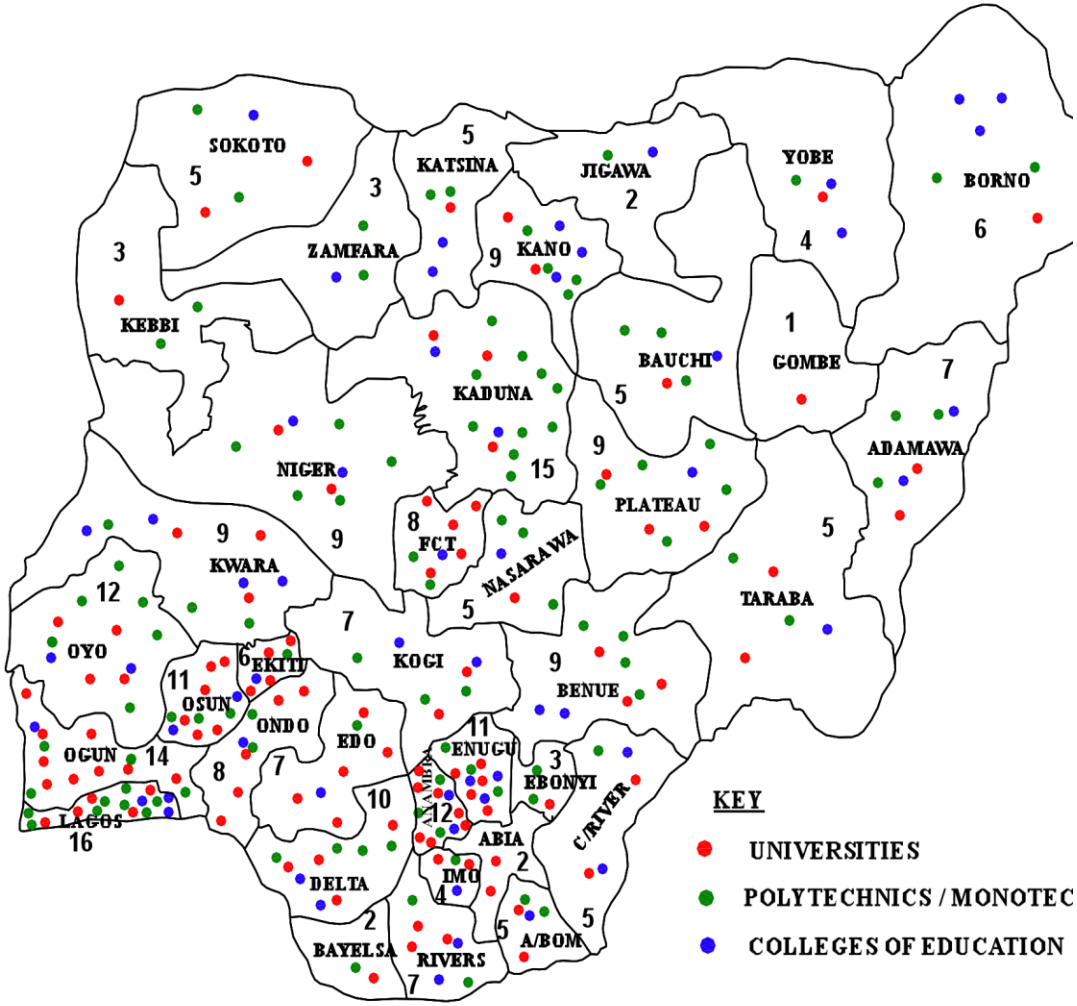
- South Africa: survey of skills needs in the different industrial sectors
- Australia: establishment of vocational training institutions under the Technical and Further Education (TAFE)
- The University of Ibadan Vocational Skills Improvement Model: Road side mechanics
- The Lagos State Graduate Vocational Employability Skills Training Programme (GV-ESTP)
- The 6-3-3-4 Scheme

The Nigerian HEIs

The HEIs, as at 2012, are made up of:

- ✓122 Universities
- ✓71 Polytechnics
- ✓47 Monotechnics
- ✓79 Colleges of Education

Figure 2.3: HIGHER EDUCATIONAL INSTITUTIONS IN NIGERIA



Geographical Distribution of the 117 Universities as at 2011

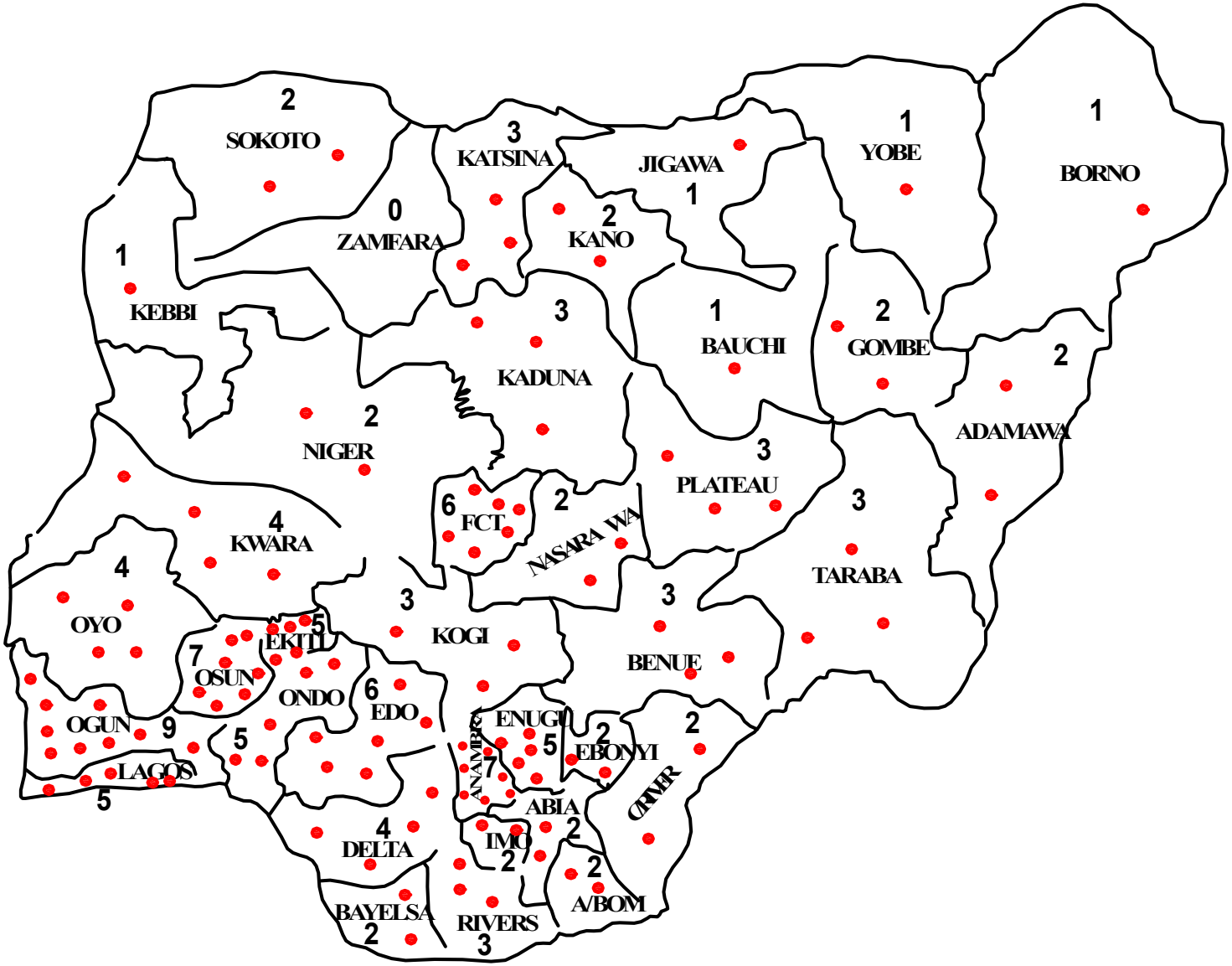


Figure 2.6a: Geographical distribution of Polytechnics in Nigeria

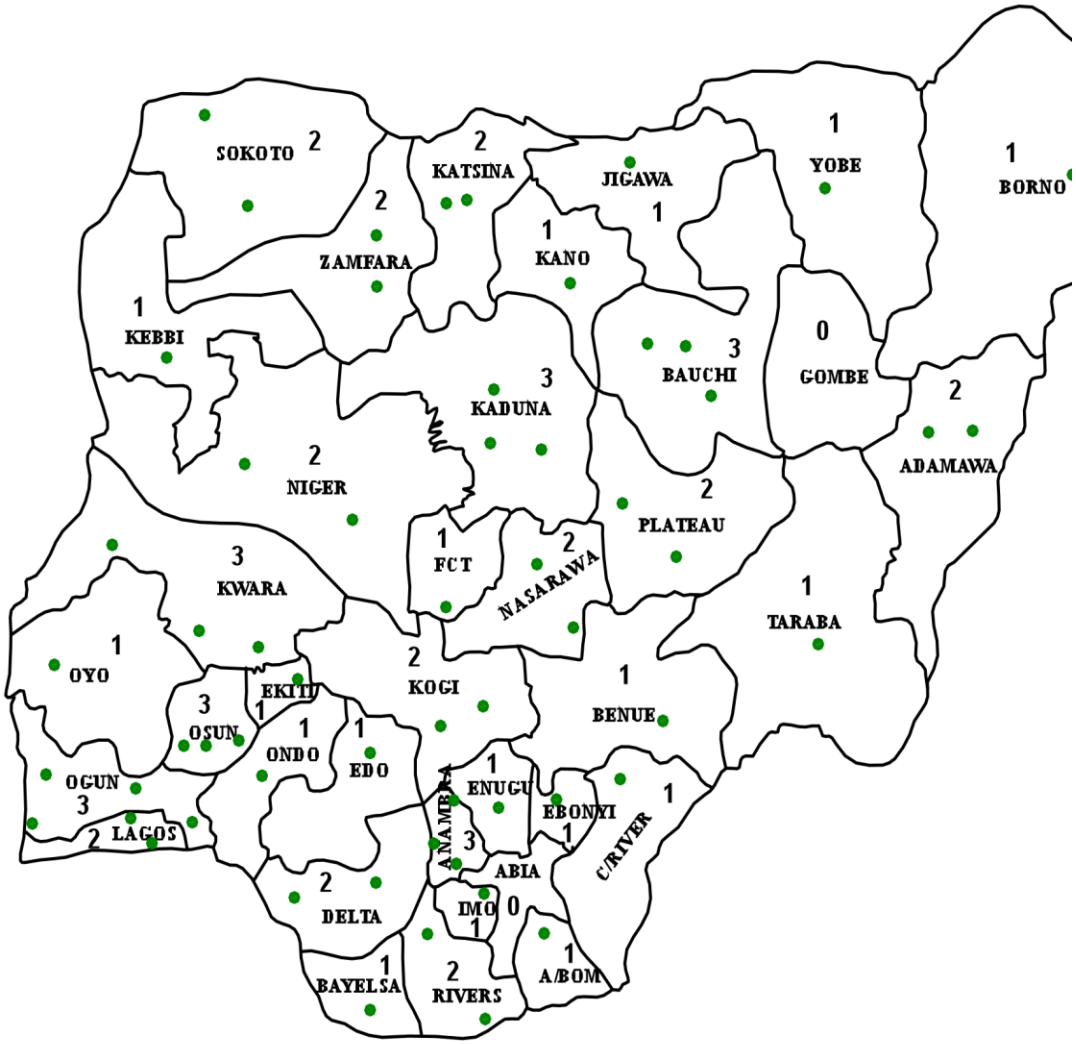
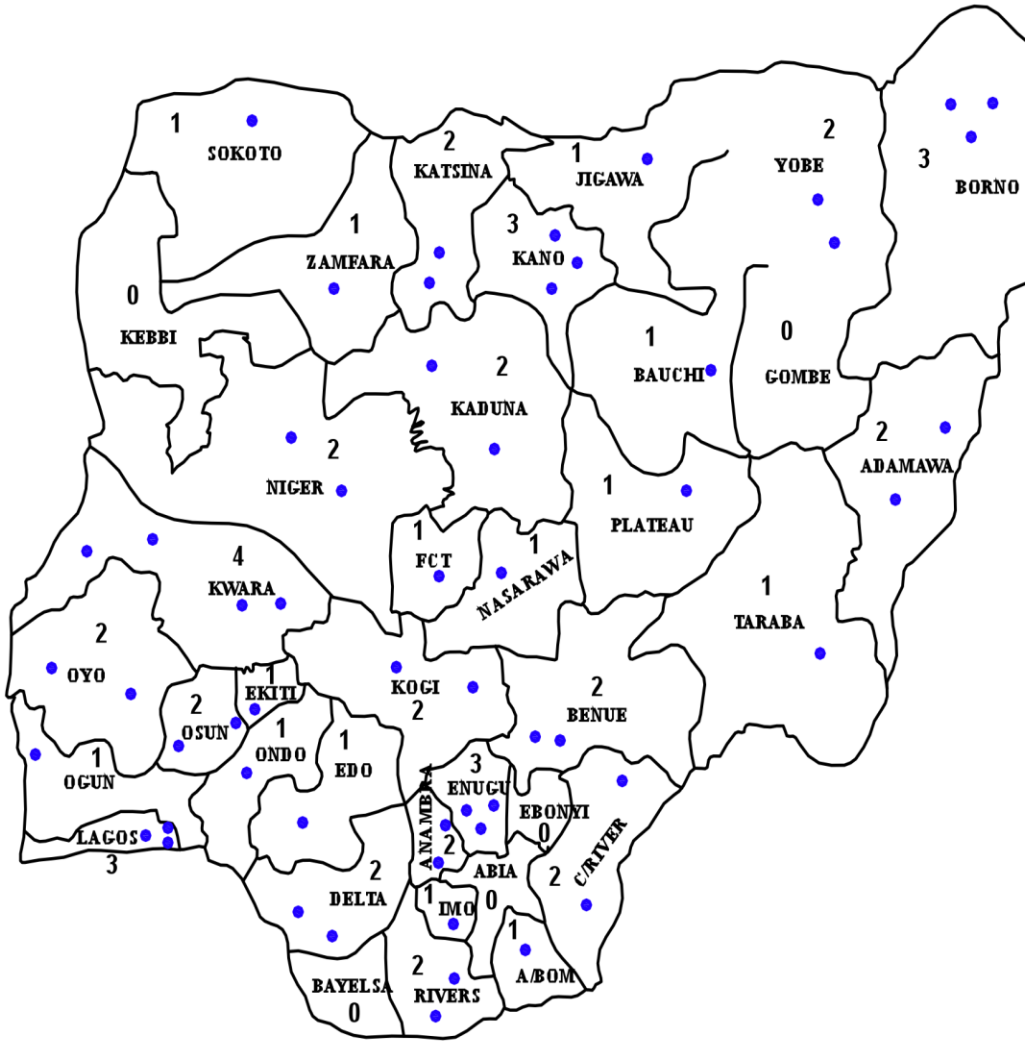
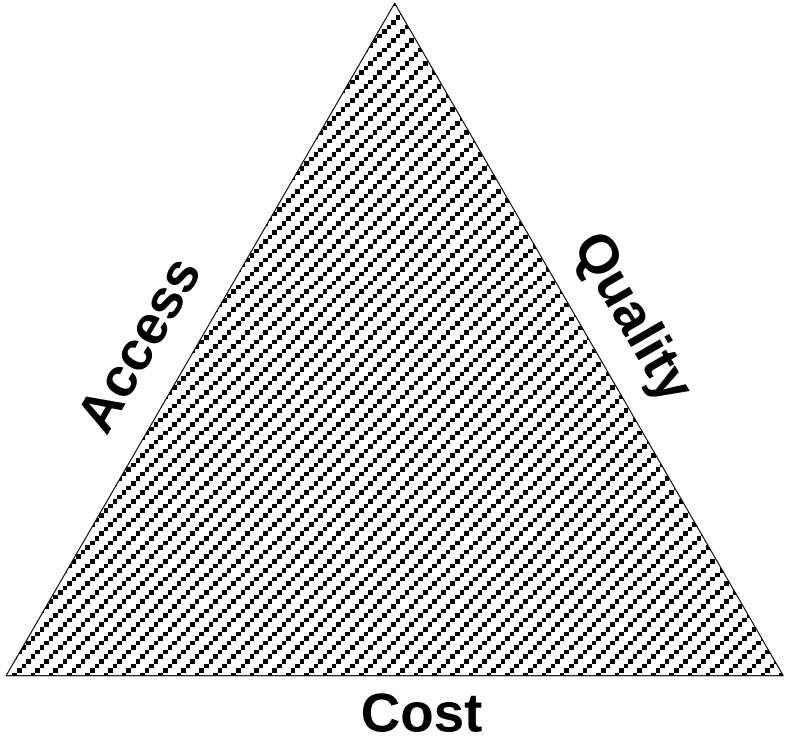


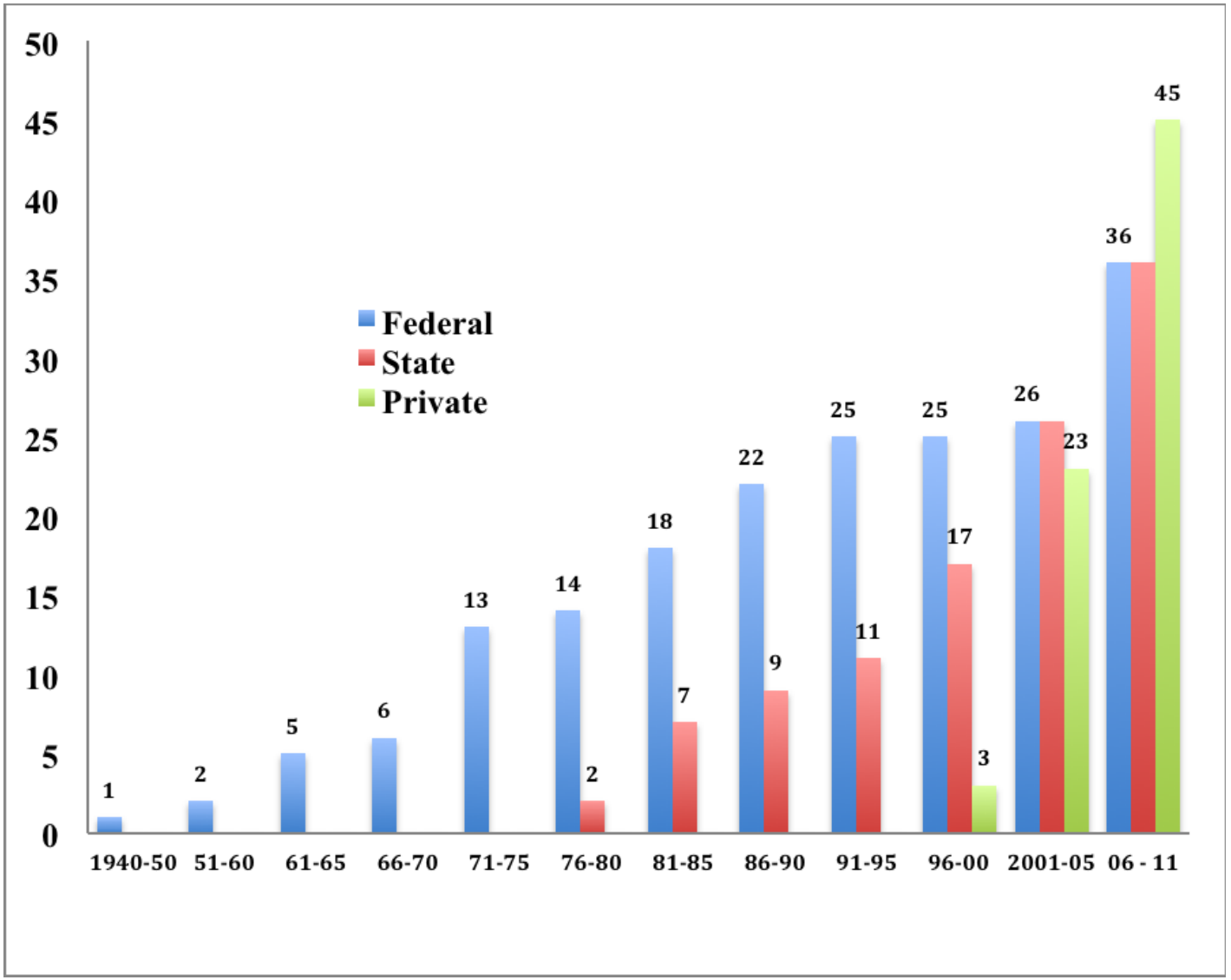
Figure 2.7: Geographical distribution of COEs in Nigeria



Nigerian HE: The Iron Triangle



Profile of Establishment of 117 Universities in Nigeria (1948-2011)



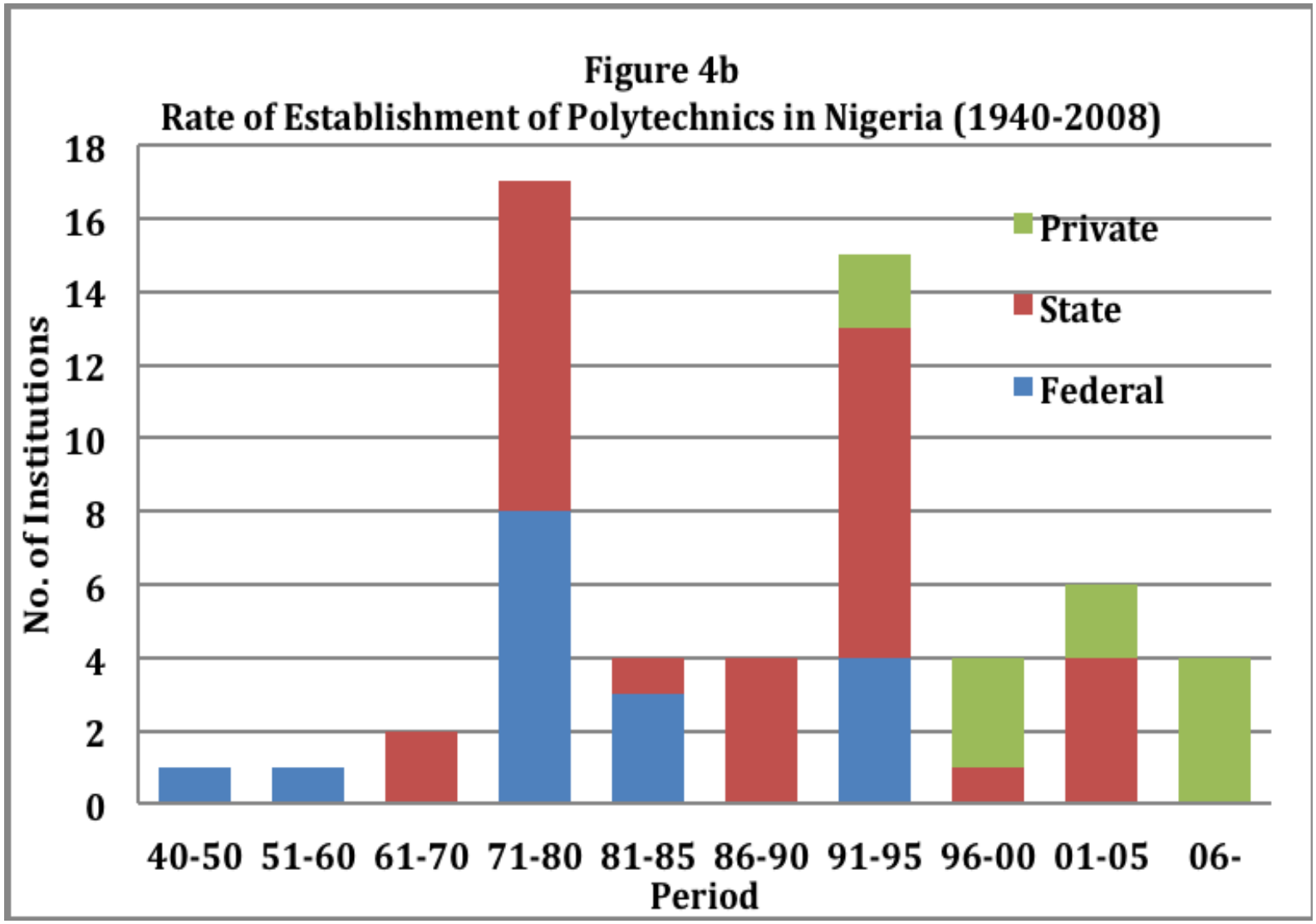
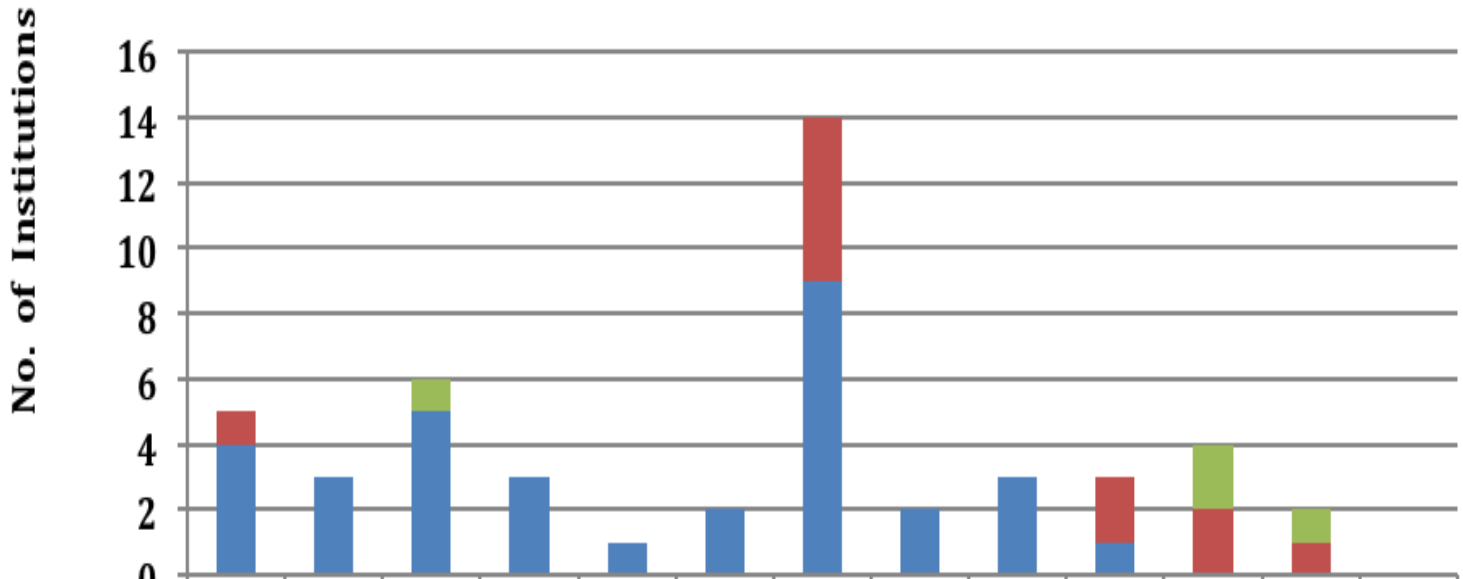


Figure 4b
Rate of Establishment of Polytechnics in Nigeria (1940-2008)
No. of Institutions
18
16
14
12
10
8
6
4
2
0
Private
State
Federal
40-50
51-60
61-70
71-80
81-85
86-90
91-95
96-00
01-05
06-
Period

Fig. 4c Rate of establishment of Monotechnics in Nigeria 1908-2008



	< 41	41-50	51-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-00	01-05	06-08
Private	0	0	1	0	0	0	0	0	0	0	2	1	0
State	1	0	0	0	0	0	5	0	0	2	2	1	0
Federal	4	3	5	3	1	2	9	2	3	1	0	0	0

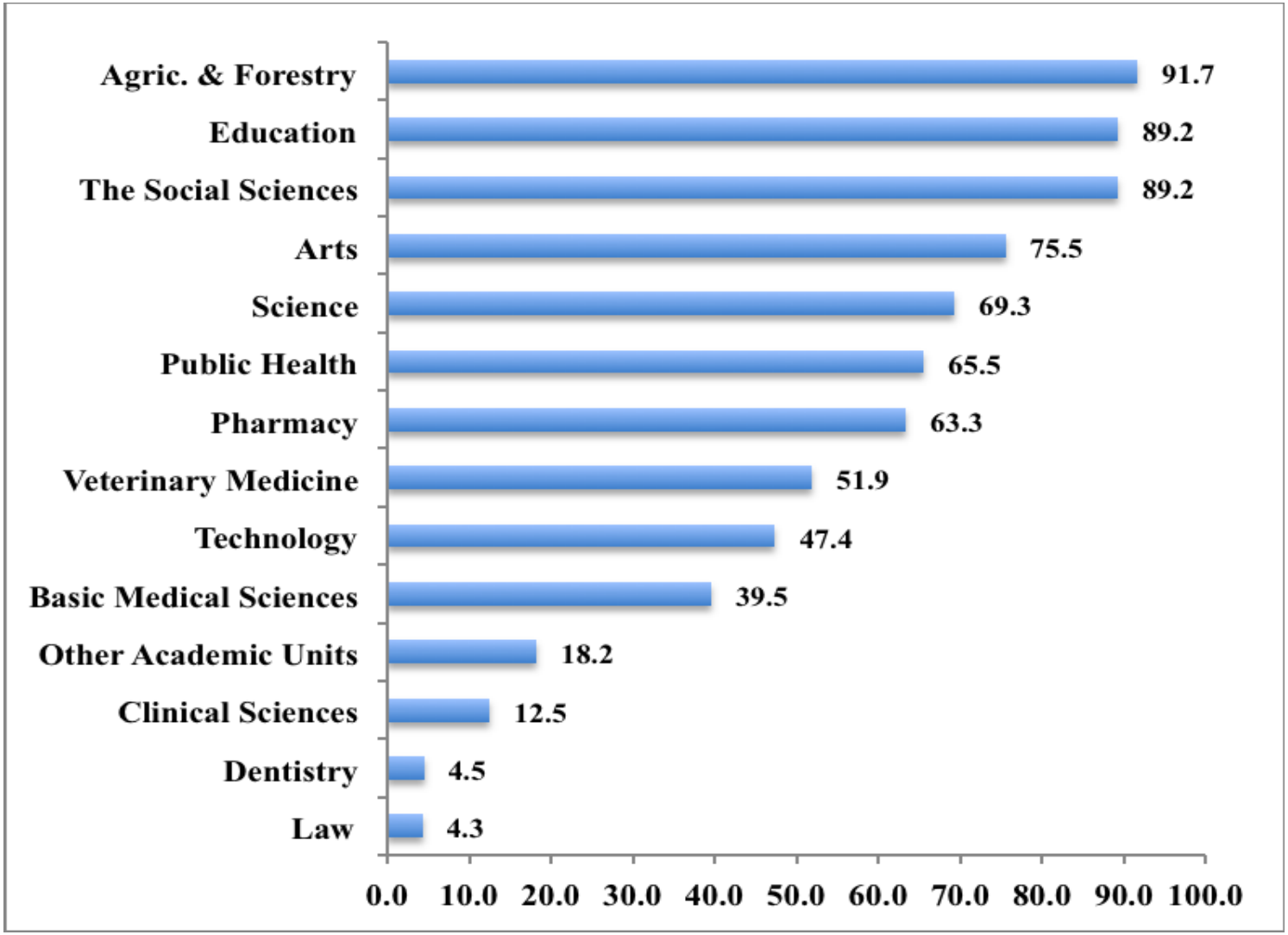
Students Enrolment and Staffing Level in the University System (2006-2007)

Ownership	Sub-Degree	Undergraduate	Postgraduate	Total	Total Academic Staff	Students/Staff Ratio
Federal	49,999	503,154	57,300	610,453	17,836	34.2
State	8,734	419,901	19,459	448,094	7,586	59.1
Private	357	36,641	767	37,765	1,972	19.2
Total	**59,090**	**959,696**	**77,526**	**1,096,312**	**27,394**	**40.0**
% of Total	**5.4**	**87.5**	**7.1**			

The Key Challenge

A key challenge at present towards actualizing the desired quality university education remains the paucity of high quality academic staff. There were a total of 27,391 academic staffs within the University system as at 2006 comprising Federal – 17,836 (65%), State- 7,586 (28%) and Private 1972 (7%). Of these, Professor/Reader cadre constituted just 5,483 (20%), Senior Lecturer Cadre 6,475 (23.6%), while Lecturer cadre constituted 15,436 (56.4%). Computation using current approved student/teacher ratios however indicates that the Nigerian University System requires a total of 34,712 academic staff for effective course delivery across the disciplines. [NUC Executive Secretary]

The Issue of Ph.D qualification: *% of Staff with Ph.D Degree on Faculty Basis at the University of Ibadan in 2010*



Concluding Remarks

Science and Technology-driven Innovation is key to Nigeria's economic future. A new generation of young Nigerians – free, educated, and technologically literate – will become the scientists who can push the edges of knowledge, the business leaders who can transform knowledge into goods and services demanded by internal and global markets, the government officials and the political leadership who create a fertile policy environment for both discovery and innovation. A spirit of collaboration between these NSI agents must nourish these efforts. Partnerships are the pathways to greater Nigerian prosperity.

Thank You