AFRICAPITALISM INSTITUTE

# THE GEOGRAPHY OF SCIENCE & TECHNOLOGY INNOVATION IN NIGERIA

REPORT OF INNOVATION CLUSTER RESEARCH IN NIGERIA

**JANUARY** 2015


The African Institution of Technology Inc. (United States of America) prepared the research.

The statements, findings, conclusions and recommendations are those of the author(s) and do not necessarily reflect the views of the Tony Elumelu Foundation.

A visualisation of the results is available at
www.NGClusterMap.com

THIS REPORT WAS PREPARED UNDER A GRANT FROM

THE TONY ELUMELU FOUNDATION

## PROJECT SPONSOR

This project is sponsored by the Tony Elumelu Foundation, an African-funded philanthropic organisation that supports entrepreneurship in Africa by enhancing the competitiveness of the private sector. The Tony Elumelu Foundation creates impact through business leadership and entrepreneurship development programmes, impact investments, research, and policy advocacy.

## THE PROJECT

Across the world, research shows that clusters play a major role in regional job growth, wages and how new companies are formed. Most nations are developing policies to support clusters because they have an impact on sustainable economic growth. This project identifies what really drives regional competitiveness, using research-based methods that will improve the welfare of Nigerians.

The Nigeria Innovation Cluster Mapping Project's goal was to reveal similar companies that co-exist within pockets of industry, science and technology clusters. It gives government and the business community data and tools that will allow them to understand what drives clustering and how they can become more efficient thanks to new business processes and policy. Data will increasingly drive policymaking and government needs to have a better understanding of where innovations occur and how they can be nurtured.


## ACKNOWLEDGEMENTS

We begin by thanking Tony O. Elumelu, CON, the Founder of the Tony Elumelu Foundation, the project sponsor. We also thank the staff of the Tony Elumelu Foundation, especially Dr. Wiebe Boer, CEO of the Tony Elumelu Foundation and David Rice, the Director of the Africapitalism Institute for their contributions. We would also like to thank some individuals, entrepreneurs, start-ups, companies, government agencies, universities and many other entities that provided their platforms for our presentations, took our surveys or offered their time and input into our study: Prof. Seidu Mohammed, National Space Research and Development Agency; Dr. Mike Ndinechi, Federal University of Technology Owerri and Electronics Development Institute Awka; Dr. Olalekan A. Jesuleye, National Center for Technology Management; Prof. Lucy Ogbadu, National Biotechnology Agency; Brig. Gen EG Whyte, Nigerian Army; Commodore Augustine Duruoha, Nigerian Navy; Mrs. M.I. Mbuk, Raw Materials Research Development Council; NDDC; Corporate Affairs Commission; Prof. CK Ayo, Covenant University; Dr. Sam Amadi, Nigerian Electricity Regulatory Commission; Mr. Eyo Ekpo, Nigerian Electricity Regulatory Commission; Ben Agweye, EFCC; I Essien, National Export Promotion Council; Federal Ministry of Science & Technology; Agu Collins, NigComSat; National Bureau of Statistics; National Information Technology Development Agency; Nigeria Communications Commission; I. Ogbogho, Landmark University; Peter C. Ekweozoh, FMST; Prof. Babatunde Rabiu; Goddey Edache, G.J.Edache & Co; Ahmad Sadiq, Microscale Embedded; Engr. Agu Chux, FASMICRO; Prince Anene, National Orientation Agency; Chimere Okoro, CBN; Abubakar Narasa, Noor Logistics Synergy Ltd; Debo Olateju, IBB Int'l Abuja; Japheth J. Omojuwa; Mohammed Mustapha, Hypertech; Dr. H.D. Ibrahim, RMRDC; Bello Maruf, Afbell Ltd; Ogo Akabogu, Bank of Industry; Engr Umar Bindir, National Office for Tech Acquisition & Promotion; Dr. Victor Dike, Imo State Poly; Loy Okezie, TechLoy; Anie Akpe, Innov8tiv; and many others space will not allow us to mention here.

Dr. Ndubuisi Ekekwe of the African Institution of Technology Inc. USA authored the study.

# EXECUTIVE **SUMMARY**

The African Institution of Technology, funded by The Tony Elumelu Foundation, conducted a research project to examine how Science & Technology (S&T) innovation clusters can drive economic growth. By looking at how these clusters form and exploring their relationship with infrastructure, it is possible to understand how investment and economic policies can be used to develop clusters more fully, which will boost Nigeria's economic growth.

Harvard Business School professor Michael E. Porter defines clusters as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities." Worldwide, they are recognised as more than just a collection of companies: they also nurture startups and stimulate technological innovation. An entire S&T ecosystem grows up around a cluster. In Nigeria, clusters generally consist of small, homegrown businesses that have sprung up organically. They may be inventive and rich in ideas but they are still growing. The picture is promising, particularly in southern Nigeria, which is attracting technical talent, superior management and foreign investment.

By looking at how these clusters form and exploring their relationship with infrastructure, it is possible to understand how investment and economic policies can be used to develop clusters more fully.

# SOME OTHER FINDINGS THAT EMERGED FROM THE PROJECT ARE:

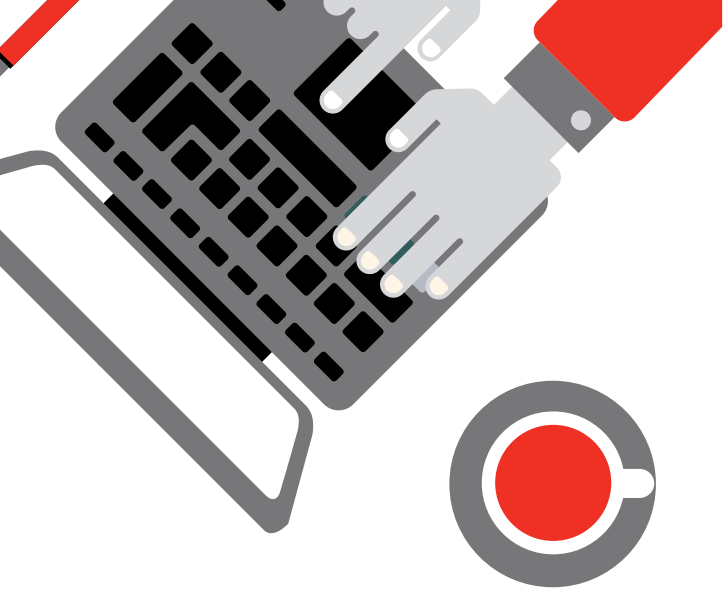
## GENERAL

- Nigeria does not have a strategic approach to nurturing companies within clusters, which means it does not have a particular policy in place. Our study shows that all clusters experience infrastructural challenges, whether they have grown up organically or due to policy mandates, as in export processing zones (EPZs).

- The quality of infrastructure affects the density of clusters, which explains why Lagos has some of the most vibrant cluster-firms. Abuja will be extremely competitive as its serene environment favours more creative entrepreneurs. It will likely benefit because it is drawing talent that is fleeing other parts of northern Nigeria.

- Most of the clusters function without research and development (R&D). At the moment, there is no vital relationship between what happens in clusters and what government-funded labs are doing, which means government R&D is not an essential ingredient of growth in clusters.

- There are weak partnerships between universities, companies, government labs and researchers in most clusters in Nigeria. When government labs or universities strike, clusters do not immediately suffer setbacks. Relationships among universities, industries and governments should be structured and schools must show more influence in local economies by working together to nurture innovation.

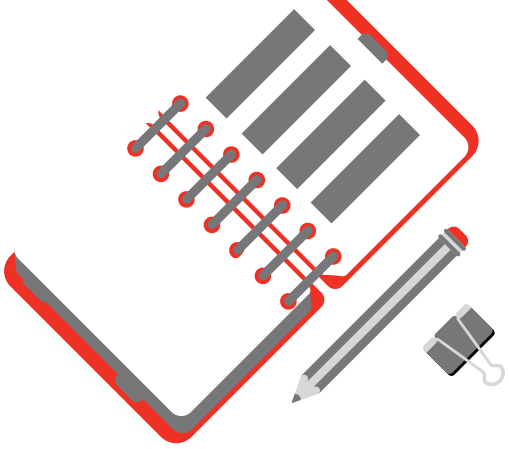


## ICT

- Nigeria's economy has seen very little innovation in ICT. There are pockets of innovating ICT firms but growth will need more than new tech ideas; infrastructure and capital are very important.
- The ICT sector is dynamic and is growing but its internet subsector will only grow if it can encourage people to shop online or create credible, commercial digital platforms.
- Education, quality workforce and collaboration can promote cross-cluster opportunities: because these three enablers are present in Yaba, we expect to see a dynamic ICT sector emerging.

## Craft technology

- Craft technology is strong but growth is limited because participants may not have the vision to improve: most merely survive, without planning to expand and build a strong business. Craft technology is widespread in Nigeria because a low level of skill is required.



## Engineering/Scientific

- S&T (Science and Technology) innovation is not evenly distributed in Nigeria as vibrant S&T innovation clusters are concentrated more in the southern region than the northern region.
- There are pockets of inventive engineering and scientific activities. Unfortunately, most operate within the informal sector and cannot grow. From making local inverters to redesigning car engines for electricity, it is not clear how these activities can be scaled – even if an entrepreneur can turn a car engine into a generator, he will need more disused car engines to keep his trade going.
- The manufacturing sector in Nigeria is underperforming – it needs to be more labour intensive and low-tech.
- Nnewi could well become the light manufacturing capital of Nigeria in the coming years, as soon as the electricity problem is fixed. Its entrepreneurs can potentially support the West African market with their products as automation increases and management processes improve.

## Healthcare/Medical

- Ibadan is likely to become the future hub of Nigeria's healthcare sector. It already has an environmental advantage, but it also boasts a top-notch university and teaching hospital, a relatively large market and top talent. Its proximity to Lagos is also an advantage.

# INTRODUCTION

As the 21st century enters the mid-point of its second decade, Nigeria's challenge is to build a new generation's workforce as well as critical infrastructure. It does not just have to think about competing globally – it must also prepare for a future beyond minerals.

Since the dawn of its democracy, the Nigerian government has looked at different reforms to improve the economy and make it more competitive. Although it is the largest economy in Africa and the 26th largest in the world, it needs a competitive advantage to attract international investors; it already has a regional advantage in oil & gas, light manufacturing, services, agro-processing, solid minerals and ICT industries.

...Nigeria's challenge is to build a new generation's workforce as well as critical infrastructure. It does not just have to think about competing globally – it must also prepare for a future beyond minerals.

Clusters can help, but problems like poor financing, the high cost of capital, a lack of electricity and transportation must be overcome. The challenges of poor governance, a tertiary-level education crisis, an inadequate healthcare system and undeveloped infrastructure have also made it difficult to build a prosperous, diversified economy.

In late 2013, the African Institution of Technology (AFRIT) looked at cluster formation and why companies within clusters are more competitive (this is supported by Michael E. Porter's research, which shows how clustering leads to economic prosperity). It investigated the relationship between some industry clusters and the existing infrastructure to understand

how to bring Nigeria's goals of strategic investment and economic development together.

ICT plays a major role in development – industrial areas have changed thanks to more efficient processes at lower cost and Nigeria is better able to compete regionally and internationally because of the deployment of human resources and organisational capabilities. Advancements in other technology areas have been eclipsed because ICT has had remarkable success in integrating people, processes and tools: from metal processing to agriculture, from shoe-making to dyeing, innovation is springing up thanks to hobbyists, entrepreneurs and start-ups.

This cluster-mapping project will show policymakers which areas should receive government help – S&T innovation policymaking is driven by data, even at local levels, and this should allow local and international investors to understand technology patterns, penetration and diffusion trends. Because it will be easier to link certain fields of technology with particular geographic areas, investment capital can be allocated far more cleverly.

This project indicates where S&T innovation is strongest and shows government where innovation is occurring (and what forms it takes). In this way, it provides a guide for building better development strategies.

# METHODOLOGY

The study used a multi-modal methodology to gain insight, commentary and guidance from over 7,000 companies, industry leaders, academics and development experts. Many high-level and grassroots activities were used to engage these large stakeholders. The methodology consisted of study design, literature review and pre-data collection study, data collection and data analysis.

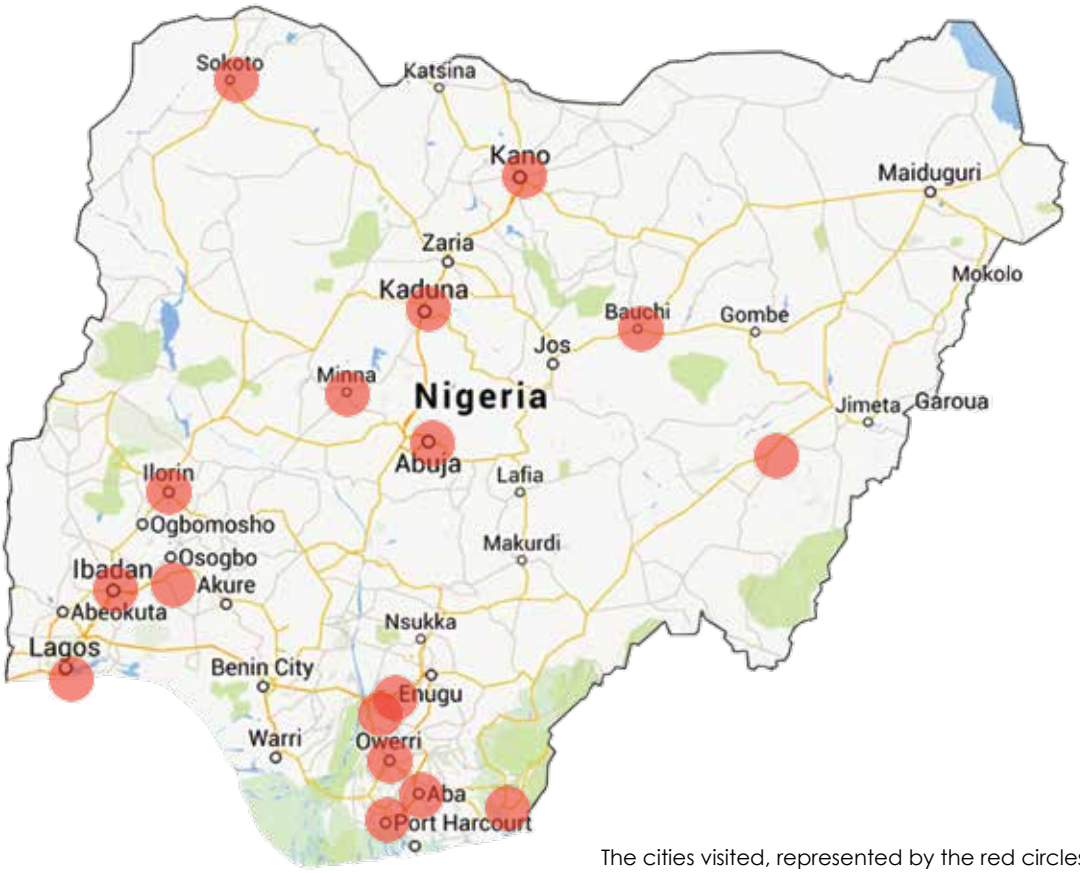
## 2.1 THE CLUSTER CITIES

In the map below, we show the locations visited for this study. At least 15 cities, represented by red circles, were visited over two months, covering all the geopolitical zones.

## 2.2 LIMITATIONS

The methodology used in this study faces some limitations in data.

First, numerical data relating to patents was not used in this study (this is usually applied when looking at statistical relationships in cluster innovation). We hope that, in future, companies will have patents that we can examine to understand the ecosystem. This explains why Nigeria's innovation system is in its infancy. Secondly, we have not included an analysis of venture capital or private equity funding because these activities are limited in the sectors/clusters. Thirdly, we lack current employment numbers at local government area levels, so we have not modelled regions' industrial specialisations, which would have helped to quantify how concentrated an industry is in a region, compared to a larger geographic area such as the state or nation.



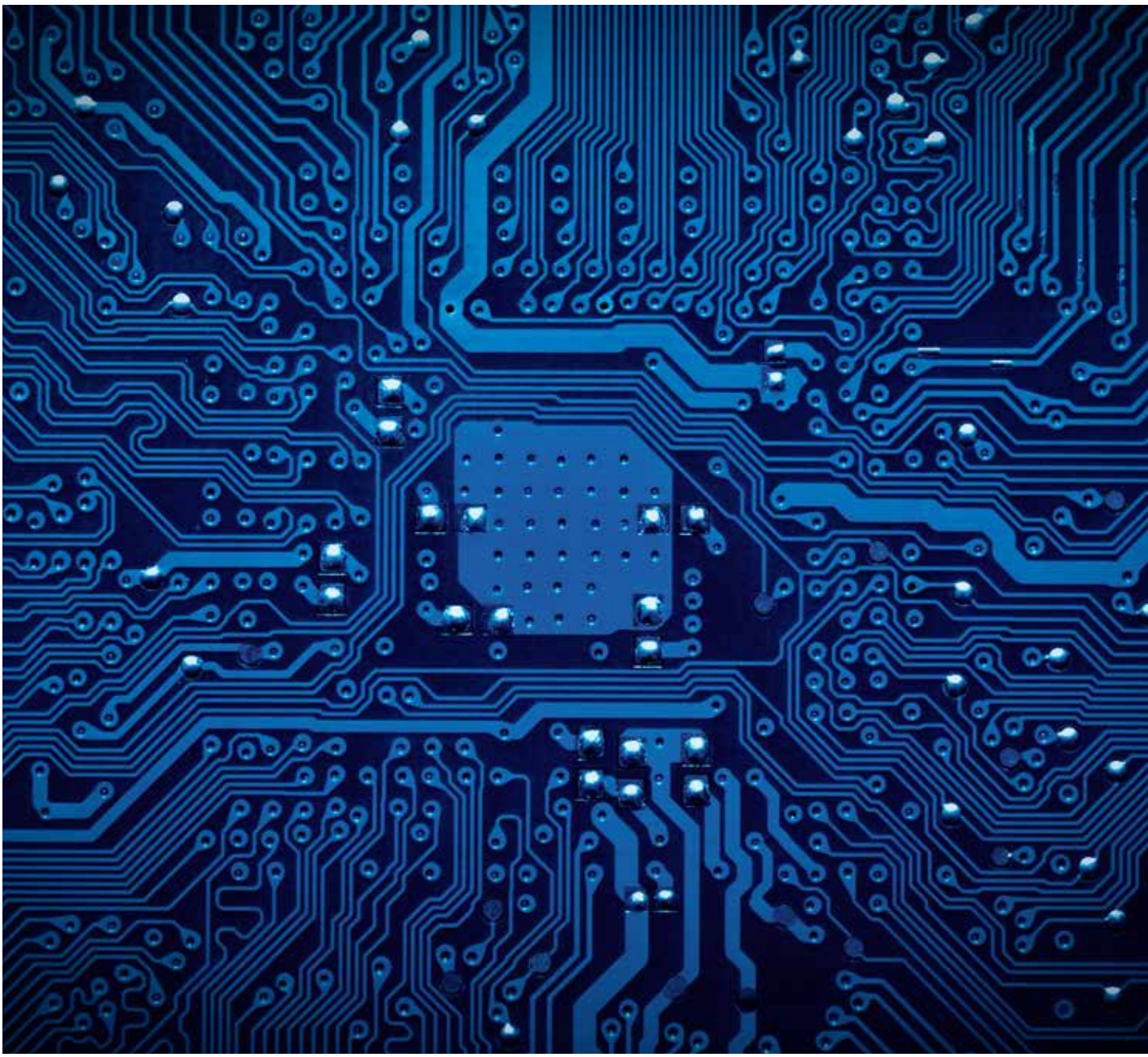

The cities visited, represented by the red circles

# MAPPING **ANALYSIS**

## 3.1 S&T INNOVATION CLUSTERS

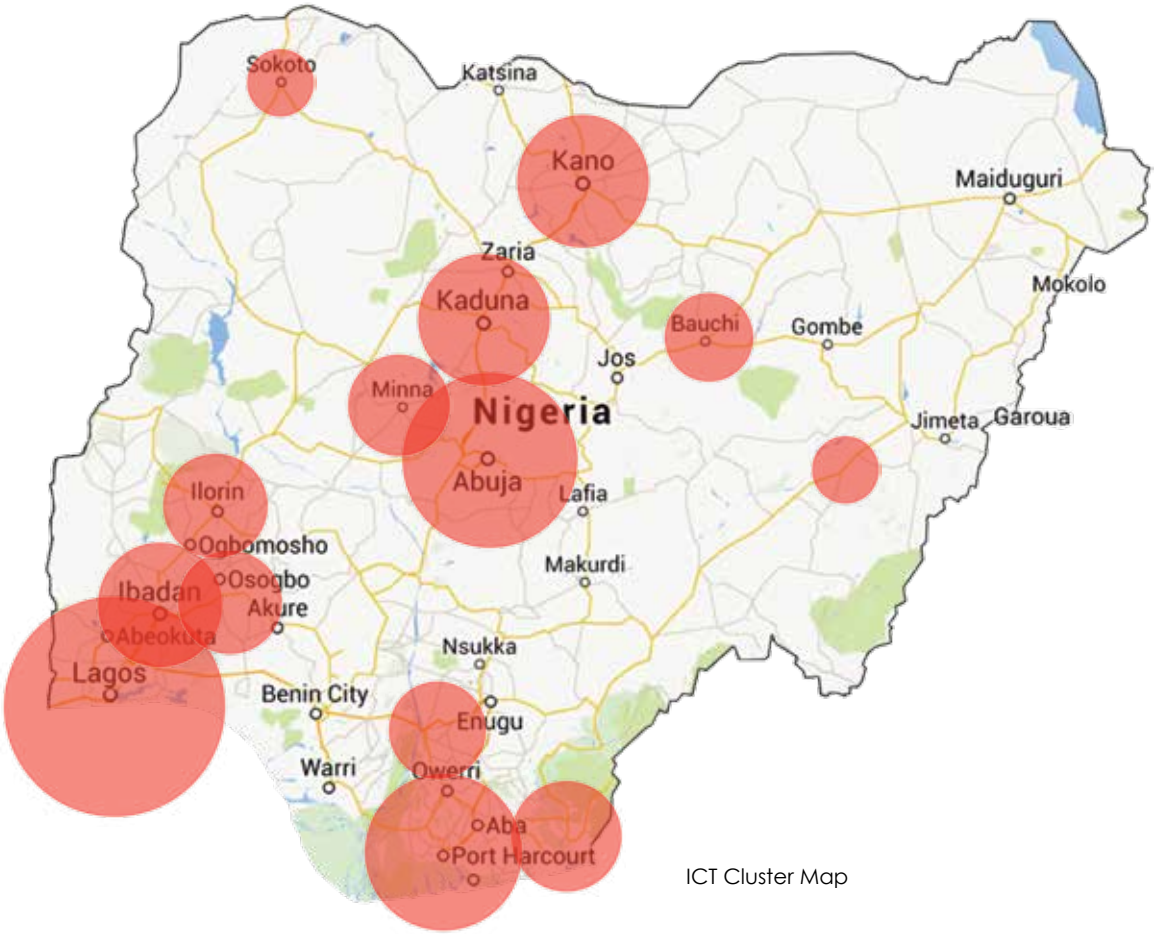
The results highlight the comparative strengths and weaknesses of the regions. The data points represent the local density around each firm as well as employment size in each category in the cluster, based on our study. Our analysis presents the industry data and cluster maps for each of the four sectors within the clusters we studied.

Some Nigerian engineering firms have the potential to be players in the West African market if they can adopt sound technical policies and can access capital.



### 3.1.1 ICT

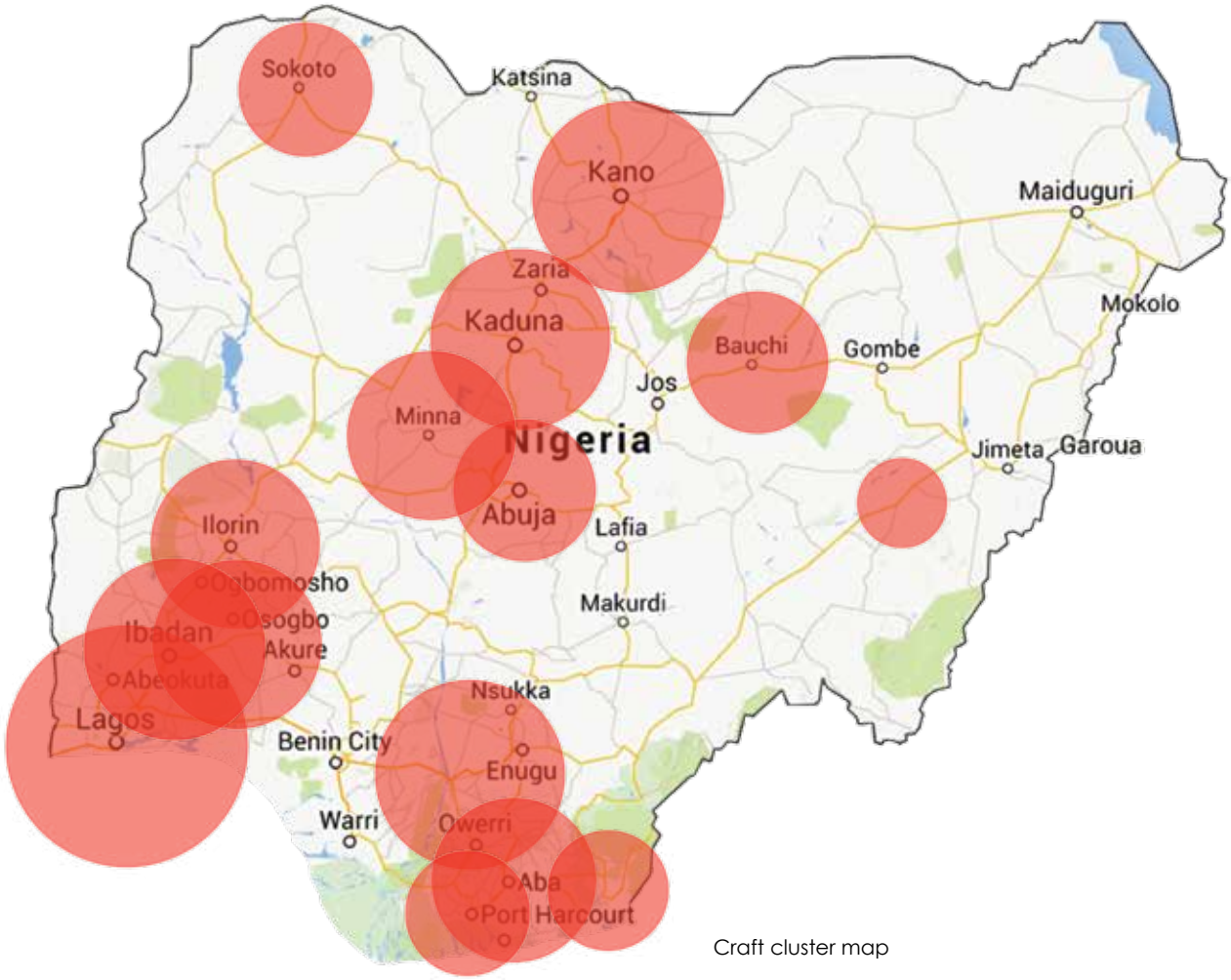
Lagos has the most dynamic cluster in this sector. It boasts the best pool of talent in the nation. In Yaba, we noticed pockets of companies looking for capital to move from startup to ramp-up. Abuja and Port Harcourt are also becoming dynamic. There is a strong correlation between the density of ICT companies and broadband/telecom services. Entrepreneurs flock to the big, top-tier cities because they have overwhelmingly better service delivery and market players roll out their new products there.




ICT Cluster Map

### 3.1.2 CRAFT TECHNOLOGY

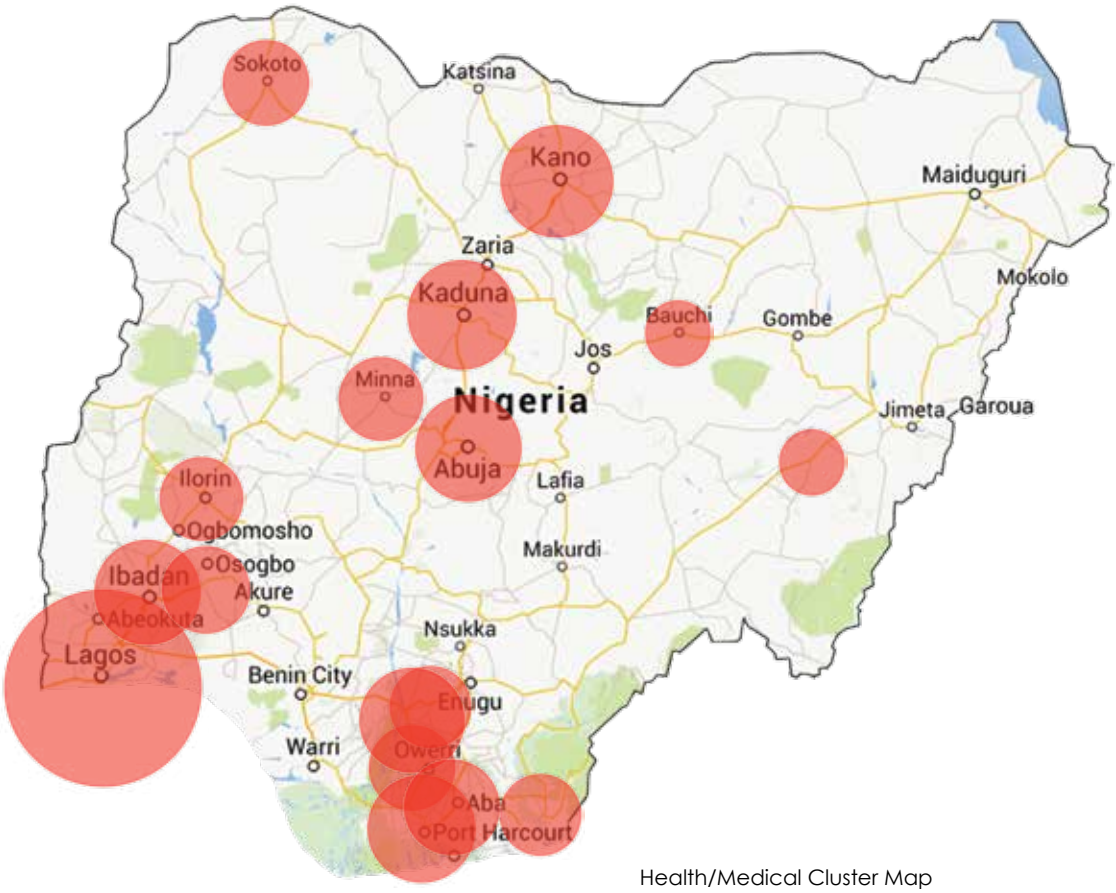
Craft flourishes everywhere but the main barrier to entry is that most enterprises struggle to support themselves and cannot grow because they lack entrepreneurial vision or access to capital. From shoe-making to sewing, there are opportunities to transform these crafts and produce brands that can compete regionally and internationally. State-of-the-art technologies or modern equipment are seldom used to improve quality and reduce costs.




Craft cluster map

### 3.1.3 HEALTHCARE/MEDICAL

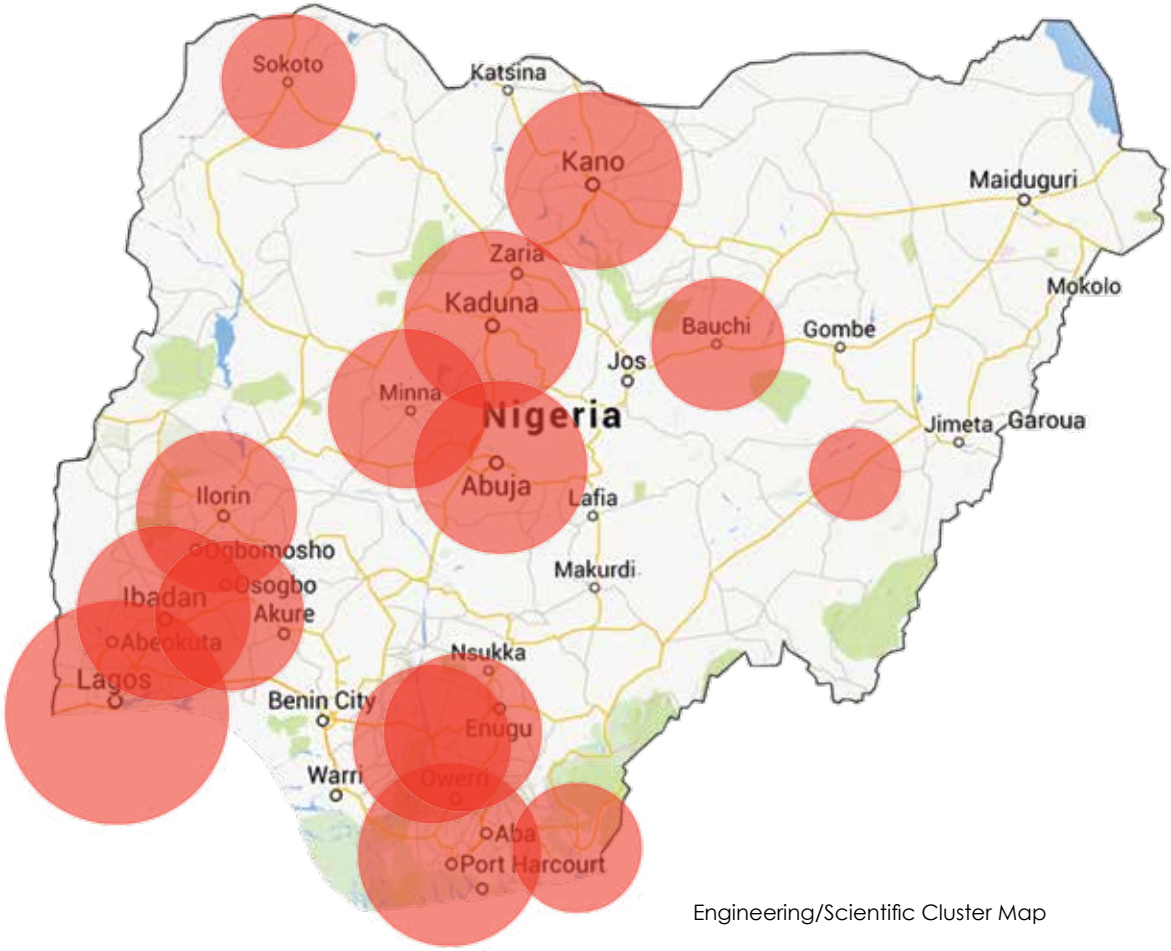
Generally, the healthcare system in Nigeria is of poor quality – life expectancy at birth, infant mortality, child malnutrition and access to hygienic water sources are still worse than in many lower-income economies. There is a huge need for intervention programmes that will speed up the adoption of modern health technologies. Pharmaceutical firms must charge more since they run generators and distribute where infrastructure is poor or lacking. Lagos leads in the sector and will help to redesign the sector if funding and new technologies can be used.




Health/Medical Cluster Map

### 3.1.4 ENGINEERING/SCIENTIFIC

Some Nigerian engineering firms have the potential to be players in the West African market if they can adopt sound technical policies and can access capital. More opportunities can be unlocked if they adopt policies on standards and product safety. In Nnewi, there are companies creating different types of products, but the key challenge is product quality. Across the nation, standards must be seen as a weapon not just to win locally but also internationally.




Engineering/Scientific Cluster Map

## 3.2 STATE OF REGIONAL INNOVATION IN NIGERIA

We used our data to understand relative regional competitiveness in Nigeria as well as business cycles and the overall strength of regional clusters. We then created the plot below, which shows how innovation unfolds across each region of the country. Trends show where clusters are vibrant, emerging, declining, or losing edge. The cluster size is the sum of the weighted firm density and the innovation factor (IF). Based on the factors in a business environment, demand, human capital, funding ecosystem, infrastructure, security and output, we allocated a position within the rectangle for each cluster. The boundaries are defined as follows:

**Vibrant Lions**
Dynamic, buoyant entrepreneurial environment

**Walking Cheetahs**
Sustaining and finding paths on innovation re/discovery

**Caged Cats**
Held back and losing initial innovation capabilities

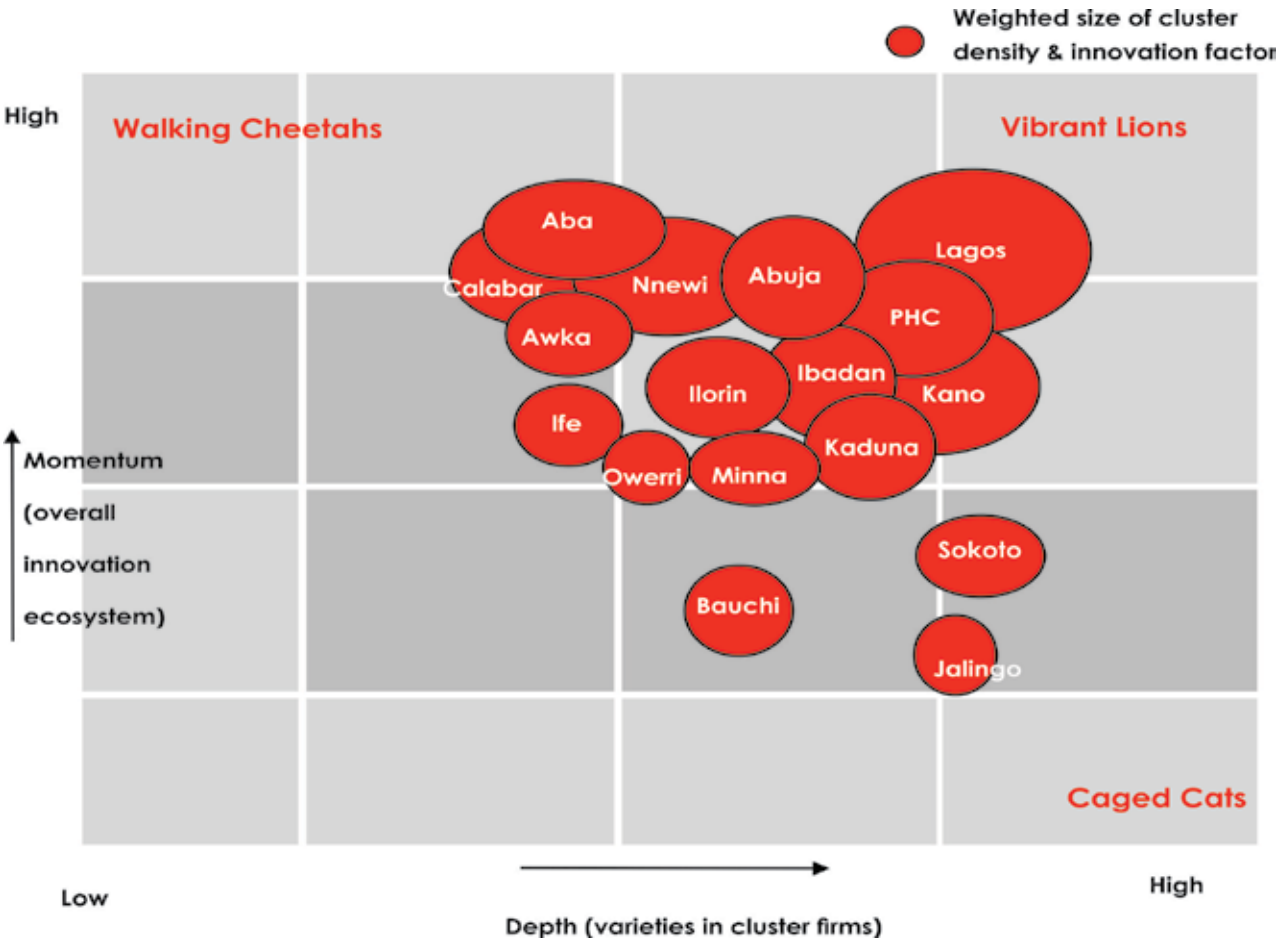



Figure shows the state of regional clusters in Nigeria

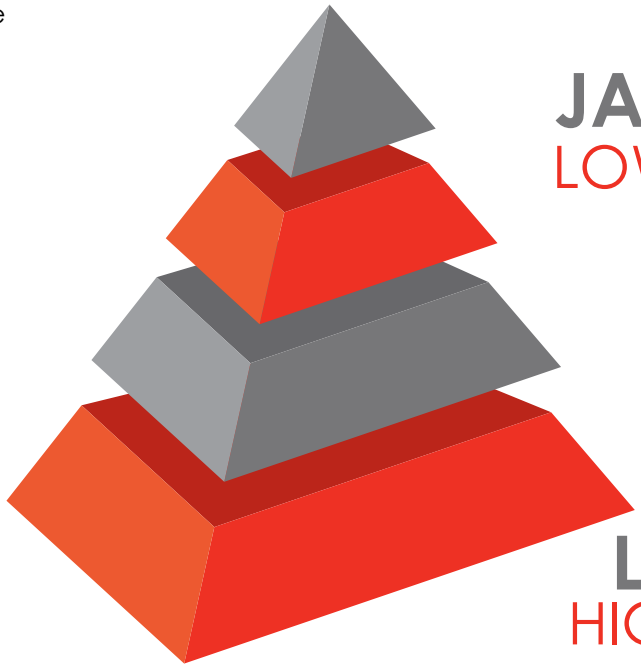
The size and position of the circle for each city was determined by cluster density and innovation factor. The cluster density represents how dense or sparse a specific cluster is; *dense* has a heavy concentration/large number of firms in cluster, and *sparse* has a small number of firms. Using data from our study, we relied on some factors to determine each cluster IF. The IF gives the Cluster Innovation Scoreboard (CIS) and is determined by dimensional components:

Table presents cluster dimension and its explanation:

| Dimension | Explanation |
|---|---|
| **Geographical scope** | • Localised: tight grouping in small geographic area<br>• Dispersed: spread across large region or city |
| **Breadth** | • Broad: variety of products in different but related industries<br>• Narrow: focused on one or a small number of products or industries |
| **Depth** | • Deep: region includes range of supply-chain activities<br>• Shallow: firms rely on external inputs |
| **Activity base** | • Activity-rich: firms are involved in a wide range of value-adding activities<br>• Activity-poor: firms are only involved in a limited range of activities |
| **Growth potential** | • Industry context: sunrise industry, 'noonday', sunset<br>• Competitive or non-competitive within each industry |
| **Innovation capacity** | • High innovation: the cluster is able to use its structure to generate innovation<br>• Low innovation: the nature of the cluster inhibits innovation |
| Industrial organisation | • Core and ring: few large firms – many small firms<br>• Ring no core: small firms only |
| **Coordinating mechanism** | • Formal structures (i.e. cluster management)<br>• Informal structures |
| **Development phase** | • Working: critical mass of firms, knowledge and resources with dense interaction<br>• Latent: critical mass of firms but not enough interaction and information flows<br>• Potential: some elements present but a need to be deepened and broadened<br>• Wishful thinking: chosen for government support but lack critical mass or favourable conditions for organic development |

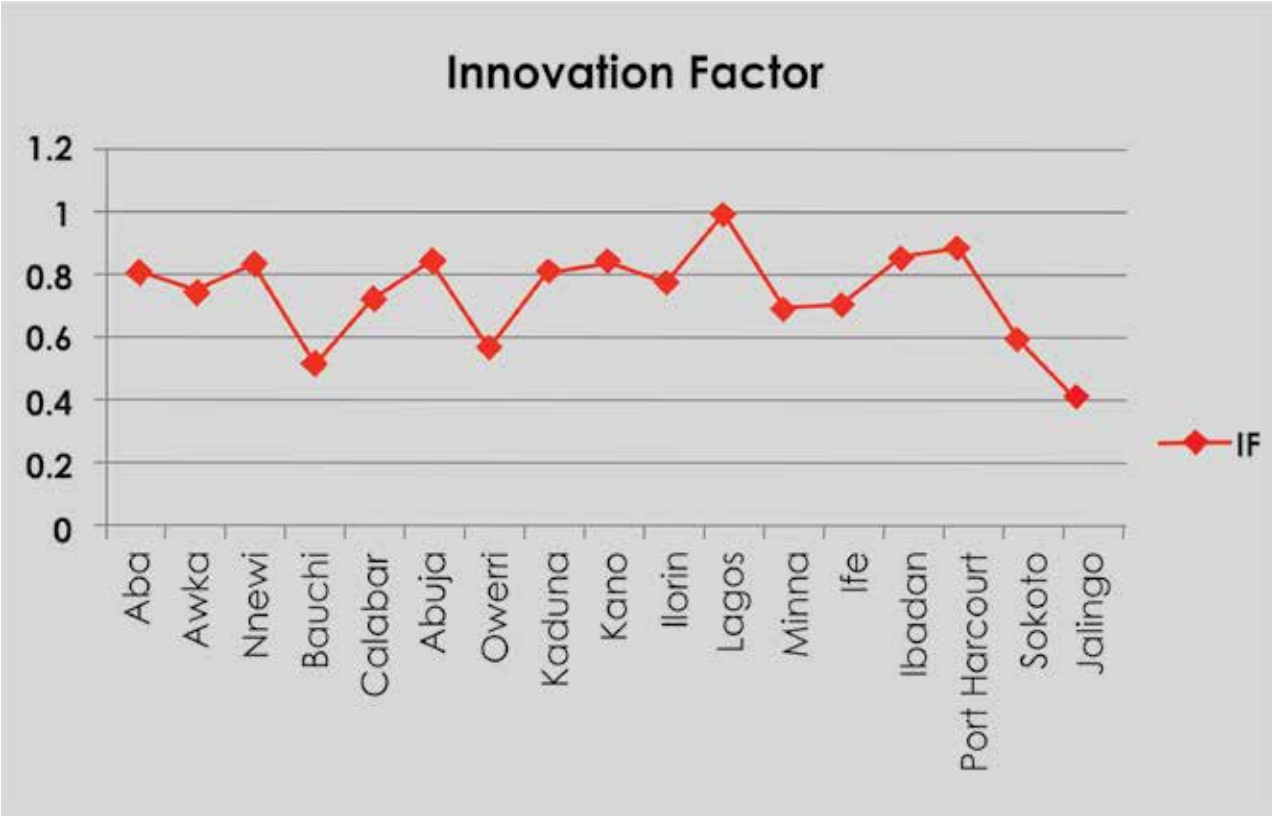
Source: Adapted from Enright (1998)

The IF or CIS is calculated to be a number, an index between 0 and 1. Jalingo has the lowest CIS at 0.42 while Lagos is the highest with a CIS scoring of 1 (these numbers are within Nigeria-only clusters and there is no implied comparison with other non-studied clusters, local or international. Analysis looks at the relative performances of the clusters studied).



**0.42**
**JALINGO**
LOWEST **CIS**

**1.0**
**LAGOS**
HIGHEST **CIS**




The figure shows Nigeria's IF (also called Cluster Innovation Scoreboard). The numbers are within Nigeria-only clusters.

## 3.3 RECOMMENDATIONS

**General**

- Promote industry and increase partnerships among universities, polytechnics and trade schools. Regions must unveil Innovation Partnership Week where they focus on increasing regional competitiveness.
- Provide more funding to universities and government labs, but tie them to outcomes that can be measured.
- Hand over the management of YouWin! programmes (where government provides funding to entrepreneurs) to VCs or banks, indicating that they must return principals on their investments, even while government asks for sureties to all investments without collateral. When market forces work on YouWin! it will perform better than the current grant giveaway.
- Each region should attract venture capital focusing on the private sector and find a way to develop the industry with incentives.
- Administer the National Technology Incubator programme regionally. If limited resources are focused instead of stretched across states, better quality will result (e.g. providing special tools and equipment could be possible if there are six incubators instead of 36).
- Taking aggressive steps to improve the postal system is important – either via a joint venture or selling it outright. Without a distribution network, e-commerce will not grow in Nigeria.

**Engineering/Scientific**

- The military can encourage local industry by sourcing some of its resources locally and funding R&D for the same. All other sectors of the economy will benefit from a growing S&T ecosystem, provided they are given reasons to find local solutions to problems.
- Continue investing in power and telecoms to drive light manufacturing.
- Redevelop or support new trade schools in electrical and machining/mechanical areas to train youth in electronic soldering and packaging. Opportunities can be created through import substitution of electrical products.

**Craft Technology**

- Support and train entrepreneurs in the craft sector to make them more effective. A cheaper way of doing this is creating virtual classrooms, where some of the best practices can be filmed – and participants who watch will be given incentives.

**Infrastructure**

- Provide incentives to generate power on site at light manufacturing facilities, hospitals and private universities.
- Develop a better transportation network, especially rail, across regions with central hubs in Lagos, Port Harcourt, Kano and Abuja (using trucks for distance haulage is not sustainable). Government must explore PPP to finance infrastructure if it does not have the resources.

**Healthcare/Medical**

- Use incentives to stimulate medical careers in the regions and promote the construction of private hospitals.

# CLUSTER **INFRASTRUCTURE**

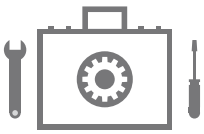
Infrastructure is vital for states, firms and citizens – it improves the quality of life of people and can actually be the reason why they live in certain communities. Nigeria's cluster analysis shows that it is an important factor that drives the formation and nurturing of clusters. Most of these organic clusters are forming in the big, important cities in the nation. We observed that if these facilities are improved upon the clusters will be more effective.

Infrastructure is vital for states, firms and citizens – it improves the quality of life of people...

The following infrastructures have an impact on the development of the regional clusters:

**Transportation**

Providing transportation networks that link raw materials in rural areas to the cities where some of these clusters have formed should unlock clustering.



**Technical workforce**

Government must pick five or six universities and transform them into global centres of learning and research.

**Legal system**

Nigeria must show that it can enforce its intellectual property and property rights laws, respecting land ownership and prosecuting violators of software IPs.

**Standards**

Product standards define quality. A culture of product quality means greater acceptance of local products rather than a preference for foreign brands.

**Investment climate**

The investment climate suffers because of the perception of corrupt public institutions at all levels of government.

**Power**

Nigeria is making progress in providing electricity to drive its industrial policy. The power sector has been commercialised; the success of new power players will define the success of the nation's industrial power.

### Broadband and telecoms

Broadband internet exists in most of the big cities and clusters studied, but the cost remains high compared to most global economies. Competition will bring the cost down and improve service quality.

### Hospitals/Recreation

The health sector is important when it comes to sustaining the wellbeing of citizens. Cluster players will look into the quality of care so the private sector must work to improve the sector. The same argument applies to recreation.

### Higher education institutions

Despite having more than 100 universities, Nigeria does not have a top-rate technical institution – clusters would have benefitted from better universities.

### Parks, centres and labs

Nigeria must improve the quality of research in government labs and centres. It needs to come up with new systems and processes to fund, measure and speed up local innovation.

### Water and sewers

Despite having water everywhere in Lagos, clean drinking water is still very expensive; the same applies in most of the cities. Access to water and a well-planned sewage system are vital.

### Capital

The lending structure in Nigeria needs to be looked at because high-interest, short-term loans cannot drive big projects – this means a strong industrial sector cannot be built. The Bank of Industry needs more capacity to expand its services and the private sector must push capital to fund and grow ideas.

### Security

Nigeria must find a lasting solution to its security crises. Peace in the North East and Niger Delta will create more opportunities as a result of new investments.

# UNLOCKING THE **CLUSTER OPPORTUNITIES**

## 5.1 HOW TO FIND VALUE IN SPECIFIC NIGERIAN CLUSTERS

Although Nigerian clusters are different they share some common features. Nearly all came about spontaneously, not due to government intervention. Unlike most developed clusters, they have little to do with universities and local government labs. Clusters can partner or network with local associations and clubs, but they do not have a strong innovation base and are short of R&D, good managers and decent infrastructure. Poor infrastructure is keeping multinational firms out of the country because they cannot set up R&D operations without basic amenities. Startup corporate finance is also lacking – for example, the Aba leather industry is at subsistence level although there is a demand to be met. How can opportunities be unlocked in some of these clusters?

Clusters can partner or network with local associations and clubs, but they do not have a strong innovation base and are short of R&D...

**Aba**

Find ways to allow different shoe-making businesses to become one brand. That brand will push for a higher quality through better tools and training and will lead to more collaboration.

**Abuja**

Establishing a commodity exchange in Abuja will take advantage of the agro-allied sector and agriculture in the northern part of Nigeria.

**Ibadan/Ife/Calabar**

They have top-notch universities, so chemical processing (especially typhoid, HIV, vaccine plants, etc.) is possible here, as long as power and other amenities are readily available. An ICT service subsector is also attractive.

**Kano/Bauchi/Kaduna**

There are opportunities in food processing (especially beverages, packaged food products), textile and garments and leather products in these clusters. The challenge is risking capital in a region where security is a problem.

**Lagos**

Lagos needs an early-stage venture capital fund. An early-stage fund in the ICT sector will help take some of the ideas around Yaba to the market.

**Nnewi/Awka**

An auto parts light factory or general light manufacturing will tap into the manufacturing and makers ecosystem. An electronics PCB plant to serve the whole nation can link up with the government-owned Electronics Development Lab in Awka.

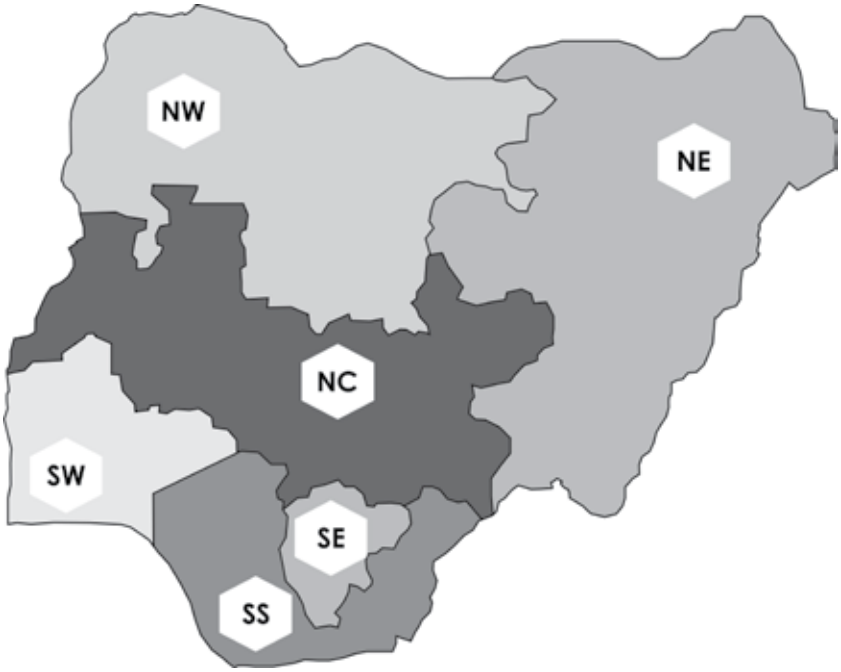
It is not easy for any of these clusters to host any regionally competitive manufacturing firms without investing in infrastructure – their cost models will not be competitive because China is importing products. The country needs to invest in providing water, improved sewage facilities, airports, roads and better agricultural facilities.

Table shows the regional cluster SWOT Assessment

| Region | Strength | Weakness | Opportunity | Threat |
|---|---|---|---|---|
| **South-East** | An entrepreneurial culture and largely peaceful. | Most talents migrate out of the region to South-West and FCT. | The construction of the 2nd Niger Bridge will provide resources and new opportunities for firms. | Poor public infrastructure, too much informal sector in business. |
| **South-South** | Presence of anchor firms in the energy sector. | The continuous challenges in Tinapa make this region primarily about energy. | Top-rate firms like LNG, Shell, etc. that can incubate new technology leaders. Latent opportunity in wind energy. | Seasonal security issues and enforcement of ownership rights. |
| **South-West** | A better skilled workforce and national economic hub. | Over-stretched public infrastructure in Lagos. | Great emerging universities to educate new technology leaders. | High population density, stress on public infrastructure and traffic congestion. |
| **North-Central** | Links the north and southern parts of the country; agriculture. | Security, poor education at primary and secondary levels. | Abundant solar, new energy sources. | Competition from Abuja, poor primary education. |
| **North-West** | Military institutions to anchor development in the sector. | Increasingly losing appeal for investment because of security. | ABU Zaria continues to attract international funds. Strong historical trade routes. | Consistent emigration of talents, poor STEM education. |
| **North-East** | Agriculture – has good arable land. | Increasingly losing appeal for investment because of security. | Massive arable land that can be used to feed the nation. Post-crisis boom during reconstruction. | Security problems, inadequate basic education. |

## 5.2 WHAT GEOPOLITICAL ZONES CAN DO

States in geopolitical zones must work together to identify how to attract multinational companies. There should be regional competition when it comes to attracting firms, which will choose carefully where to locate their plants and factories. A few years ago, California approved a $3bn bond to attract the best minds in the biotech area to get ahead in stem-cell research, beating other regions in the US in the process. Nigeria must look at similar ways to finance shared infrastructure by pooling resources. Though this report does not believe new clusters should be created, it recognises that states in geopolitical zones must make existing clusters more vibrant.




The following are programmes or initiatives we recommend at regional levels.

**Innovation Hub Initiative:**
Geopolitical zones must name certain areas within existing clusters as Innovation Hubs: the South-East could set aside Aba for the leather industry, Enugu for ICT, Awka for metal processing, etc. Private firms could administer and manage these hubs with agreed Key Performance Indicators.

**Development Finance Institutions (DFI):**
Most entrepreneurs have not grown their businesses because they lack capital. The regions must access Development Finance Institutions (DFI) capital to provide this and other resources, which will help to promote and develop new technologies, products and enterprises. They can partner with banks or registered investing firms to make sure capital gets to their regions. Funding decisions should not be tied to political patronage.

**Accelerated Growth Hubs:**
Federal government can support regions in operating special economic zones that will be geographically confined areas within existing clusters. Giving different companies in the region tax incentives to co-locate would make it easier to get resources to them.

## 5.3 CASE STUDIES – STARTUPS AND FEDERAL LABS

The following are short case studies of some of the institutions that made up the components of our study.

### Case Study – National Biotechnology Agency (NABDA)

**Background**

NABDA was established through Federal Executive Council approval on the 23rd of April, 2001 with a vision to use biotechnology for economic development and poverty alleviation in Nigeria. It promotes biotechnology activities to meet national aspiration like food security, wealth creation, affordable healthcare and a sustainable economic environment.

**Description**

NABDA conducts research in the areas of biotechnology with a special focus on agriculture and health. It has set up a joint venture, Trinitron Biotech Ltd., in partnership with the private sector to commercialise some of its research works. NABDA is also exploring international partnerships with major vaccine producers, with the goal of running a production plant in Nigeria. The agency is also pushing for reforms and policies that will ensure that the field of biotechnology develops ethically in Nigeria.

**Outcome**

Building local capacity by setting up a joint venture to raise funds from the capital market to produce vaccines/diagnostics kits for HIV/AIDS, Malaria, Hepatitis B, and Typhoid. This would reduce costs and help to vaccinate and test more people. Nigeria needs to expand its capacity in light manufacturing and must carry out import substitution in as many industries as possible if it wants a brighter future. It cannot afford not to be a leading biotechnology player. NABDA will develop a new generation of scientists and companies to help Nigeria to compete in the sector.

### Case Study – Electronics Development Institute, Awka (ELDI)

**Background**

ELDI is a research institute under National Agency for Science and Engineering Infrastructure (NASENI) within the Federal Ministry of Science and Technology. Recently, it has come to operate under the Presidency. The target of ELDI is to provide innovative local solutions in existing technologies in Electronics and Information Communication Technology. The worldwide electronic revolution has pushed a number of electronic products into Nigeria – the agency understands that Nigeria is reputed to be the fastest growing electronics market. Its mission is to create import substitution in the electronics sector.

**Description**

Over the past three years, ELDI has invested in developing its workforce manpower. It has also established the most advanced embedded systems laboratory in Nigeria in two important areas of Field Programmable Gate (FPGA) and microcontroller programming. In addition, it has expanded its focus from research to making products, which it hopes will commercialise or sell rights through joint ventures with the private sector. In the near future, it plans to go into integrated circuit design so that it can design silicon chips and fabricate them abroad.

**Outcome**

By setting up a world-class embedded systems lab and allowing students in any tertiary school in Nigeria to use it for school-related works, ELDI provides a practical, common-sense solution to problems that have held back electronics education in Nigerian schools. Of course, the few workbenches ELDI has cannot serve all the students but the vision is promising and can be expanded. ELDI does contract work by helping some government units and agencies in the areas of electronics development. Quality may be patchy in the beginning, but it will improve as it learns and gains experience. We think the 'Do it in Nigeria' mantra in ELDI is what the country needs.

## Case Study – Alternative Energy Solutions Ltd

**Background**

Affordable Energy Solutions Ltd. is a renewable energy company registered to provide solutions to modern living challenges through affordable technology. The company distributes solar panels, inverters, deep cycle batteries, charge controllers, etc. It also drills boreholes and powers them with solar energy. Its business is the total ecosystem of solar as it sells solar fridges to store vaccines/drugs to hospitals, homes and offices.

**Description**

It is designing and developing new ways to improve people's lives where the national grid has failed. By providing drinking water in the northern part of the country by using solar, it is keeping water-borne diseases down. Its booster technology helps companies to use fairly small generators to drive bigger loads ; it is also discovering new ways to solve problems using solar energy.

**Outcome**

Its products for hospitals and clinics, distributed in some of the most rural regions in Northern Nigeria, are saving lives. Without grid, special drugs and vaccines will not survive the hot temperature in the region. But this innovative company is meeting

a special need in the healthcare industry. It distributes solar fridges used by health centres to store drugs and vaccines. Its market will continue to grow as it adds more products and focuses on new solutions to market needs.

## Case Study – Wild Fusion

### Background

Abasiama Idaresit, Nigerian-born, London School of Economics graduate and Manchester Business School MBA, is the founder and CEO of Wild Fusion, one of Africa's leading digital marketing agencies, with offices in Nigeria, Ghana and Kenya and about 40 employees. As a returnee in 2008, Abas was keen on finding how the internet could help increase sales and brand awareness for local businesses in Nigeria. He founded Wild Fusion in 2010 as a lean startup with no outside funding. His first paying client, Baby M, was a local store for baby products – he helped advertise their products on popular social networking site Facebook with just N40 000 (about $250).

### Description

Wild Fusion has reportedly made $6 million in annual revenue, offering internet marketing and digital strategy solutions to some of the world's largest international corporations operating in sub-Saharan Africa, like Etisalat, Samsung, Unilever, Visa and Vodafone. In a recent interview with TechLoy, Idaresit says that, while his company has had acquisition talks with leading digital agencies in the world and has been approached by investors, his focus is on building human capacity in the digital marketing industry, where the right skills and talents are hard to find.

### Outcome

As the internet becomes a big commercial platform, Wild Fusion has great growth prospects. It was one of the first companies in Nigeria qualified by Google to place advertisements for clients. Its unique business model allows it to understand the cultural context of businesses in Nigeria. It certainly satisfies clients as it is expanding rapidly across the continent. The growth of the industry is promising as broadband expands and more businesses in Africa set up a presence, even as more Africans are active online.

Adapted from Techloy

# RECOMMENDATIONS **AND CONCLUSIONS**

Below are some general recommendations based on our study:

- While a national cluster plan will be important, a regional one will be better for Nigeria because levels of development vary. Specialised infrastructures like communications, transportation and real estate are vital.
- All stakeholders must work together to improve the competitiveness of clusters. The private sector must call for the right policies and government must act on them. Donors can be shown where entrepreneurs within clusters need help.
- Policy should support existing clusters – because cluster development is driven by the market and takes years to evolve – instead of working to create them from scratch.
- A framework for cooperation among companies, universities, research institutions at local, regional and national levels should be developed, with government acting as a catalyst.

Investing in expanding clusters and making them more efficient by allocating more budget resources to them should be part of government's strategy.

- Government must build infrastructure and legal systems before it gives incentives that will influence how participants in clusters invest and innovate. Entrepreneurs cannot compete against Chinese imports if they have seasonal grants or handouts but no basic amenities.

- Extended financial instruments like venture capital funds, private equity funds, credit guarantee schemes, etc. must be developed to stimulate cluster growth.
- Early-stage VC funds will unlock opportunities not just in ICT but in other sectors like craft technology and engineering/science.
- Government could administer start-up financing programmes like YouWin! by focusing more on companies within sector-targeted clusters to improve overall performance. For example, it could decide all ICT firms to be funded must be located near Yaba because of the concentration of talents and collaboration centered there.

**Engineering/Scientific**

- The private sector should participate more actively in S&T education/training by creating vehicles that will do away with any asymmetry between university programmes and the immediate needs of the clusters.

## 6.1 FEDERAL GOVERNMENT

This report emphasises the importance at Federal Government level of:

**General:**

- Developing a framework to make federal research and aligning industry standards more affective.
- Restructuring the research funding process, via a peer-reviewed competitive grant process, through the US National Science Foundation and National Institute of Health.
- Investing in recruiting anchor firms into regions and promoting a greater awareness of clusters.

**Engineering/Scientific**

- **Technical education** – The educational system and focused, specialised training programmes should focus on promoting science, technology, engineering and math. These are vital to the S&T clusters in this report. Giving federal funding to local governments that invest in S&T will support innovation, and government should increase its investment in the subjects mentioned above while also creating strong standards and accountability.
- **Technology transfer from universities** – The National Universities Commission (NUC) must push all universities, especially the technical ones, to establish technology transfer offices to transfer inventions to businesses and enterprises that can sell them. The technology transfer scheme could be given incentives so that universities can build good relationships with the industry. Research funding in universities and government labs should be increased.
- **Legal education and intellectual property** – Nigeria has too few Intellectual Property (IP) attorneys with expertise in patents, trademarks, trade secrets and anti-trust law. Law schools must remedy this situation.
- **Patent & IP laws** – Government must enforce the Intellectual Property laws and transform Nigeria into a place where intellectual properties are respected. Entrepreneurs must patent their ideas.
- **Physical infrastructure** – Better transport within and between clusters will allow goods and services to be moved more efficiently. Firms should look for places with good amenities, including housing, hospitals, roads and access to communication facilities.
- **Talent pipeline** – The development of technical talent, especially in emerging areas of technology, must be strengthened.
- **Foreign entrepreneurs** – Government could lure foreigners into the country, offering special funding and visa programmes to develop local counterparts. Chile did something like this by which its government

gave seed capital to entrepreneurs and attracted talent from the US and Europe.

- **Technology adoption** – Government dominates GDP in most Nigerian cities, so it can help expand clusters by adopting modern technology and redesigning some of its own processes. From eGovernment to eTax to new farming techniques, changes in the way government operates could help clusters to grow.
- **Cluster redevelopment** – Each of the geopolitical zones must improve at least one cluster and transform it into a globally competitive industrial one within a decade. Governments at all levels need to think about how to unleash the full potential of these clusters – the first step is to assess each one's strengths, weaknesses, opportunities and challenges. Each cluster policy has to be different because Nigeria is multi-faceted and what works in Kano may not necessarily work in Calabar.
- **Catalytic role** – Government effort to create clusters will not pay off because most clusters in Nigeria are spontaneous, the result of competitive market processes and stakeholders working together. It should rather think about nurturing networking and collaboration in each cluster, which will bring players together.

## 6.2 STATE GOVERNMENTS

Most of the points noted in the recommendations in the federal government also apply to state governments. The states must ensure the following:

- **Development** – Regional economic development plans that focus on innovation must be encouraged in geopolitical zones. Once participants have solved local problems identified by the state they should receive awards – this will foster competition.
- **Cluster development** – Each state must invest in at least one cluster and transform it into a globally competitive industrial one within a decade. Cluster development must be a key element in the state budget – companies in other states or regions must be offered incentives to stimulate development.
- **Data gathering** – State governments should fund the gathering of economic data (employment, wages, etc.) at local government area levels. Tools that measure economic composition, innovation and performance at local government and state levels should be developed.
- **Collaboration** – Develop more collaborative relationships with federal agencies in the states to work with schools and businesses within clusters and make sure only one tax and one set of fees is applicable at federal government level. This will encourage investment. States should fund a Regional Innovation Roundtable that brings researchers, businesses and universities together. Students should be sponsored to attend international universities but interns should also be sponsored to work at leading global firms, where they can gain practical work skills. At the same time, funding in state universities should be increased, but outcomes must be measured.
- **Electronic systems** – Developing electronic systems to run government is important in every state, largely because it will improve processes, create opportunities and also reduce government corruption.

## 6.3 PRIVATE SECTOR

The role of the private sector is just as important in making Nigerian clusters more efficient. It is known for carrying out plans practically, including those designed by government.

The following are some recommendations:

- **Financial instruments** – Nigeria is in dire need of early-stage VC funds and the private sector can offer support when it comes to startup projects, networking, research, education and infrastructure. Business-to-business relationships should be formalised with contracts because it is risky to enter into informal loan agreements.
- **Anchor companies** – The private sector, especially the financial and investment sector, could look for anchor firms in each region and turn them into global players by investing in them and improving their management. HP anchored Silicon Valley, Nortel anchored Ottawa, and IBM did the same for Raleigh-Durham: Nigeria needs anchors that will attract other players over time. Anchor firms generally seed startups and SMEs that come to service them.
- **Build cluster integration platform** – Building a platform that will make Nigeria more collaborative is important – not just in technology, but also in finance, law, etc. A business could build a system that will allow universities, government labs and firms to collaborate more. Universities and government labs could use cloud-based services to share research and firms can communicate a need for skills and funding in specific areas of research. Trained managers should run the clusters to make sure they stay innovative and globally relevant.
- **Investment in education** – The private sector must pay more attention to the quality of technical education in Nigeria. Investment should improve the quality of learning environments, technology parks, lab facilities and international internships: this will help Nigeria to produce leaders in global technology.
- **Integrated manufacturing facility (a JVC)** – Nigeria does not have a single PCB facility to support the local industry, although there is some activity across universities and the hobbyist community. A PCB plant will make it easier to make the move from simulation to prototype and production. The local industry cannot compete because the present model involves designing boards, fabricating and importing from China. A PCB Joint Venture (JV) similar to MOSIS (USA), EMC Canada and Europractice (Europe) will give Nigeria a future in the hi-tech arena.

## 6.4 CLUSTERS

Most clusters are managed informally by trade associations i.e. the Aba Traders Association. They appoint their leaders and manage the development and growth of their clusters. The following are some recommendations for making these clusters competitive:

- They should pool resources to provide general machinery and tools to improve product quality – this could make clusters more productive. In other words, when one company cannot afford specific machinery, they can join resources to purchase and share.
- Cluster-leaders must develop PPPs in areas of investment, infrastructure and overall growth in their clusters.
- Training cluster-members is important. They should liaise with universities and international trade partners to improve productivity.
- They must be effective in how they lobby government and exert their influence during political campaigns, demanding politicians make policies that improve trade and industry.

The table below provides cluster-specific recommendations.

| City | Recommendations |
|---|---|
| **Aba** | Over the decades, its leather industry has promised but not delivered. The key factor stifling innovation is a lack of automation. The cluster administrators must push members to learn new industrial processes and entrepreneurs should train some of the craftsmen to make modern shoes and bags by using computer software to improve specs and quality. |
| **Abuja** | The University of Abuja is underperforming for a university in the nation's capital. Government needs to push resources and demand accountability from its leaders. The business community in Abuja must find ways to substitute some imports with locally made products. A government mandate may be needed in the construction sector: new projects should source a percentage of materials locally. |
| **Awka, Nnewi** | The engineering practice must grow beyond rudimentary subsistence level. Entrepreneurs must look for ways to provide scale and quality and work more closely with government labs like Electronic Development Institute, Awka. |
| **Bauchi** | Bauchi must work hard to do away with the perception that city security is lacking. Investors cannot risk capital if they do not think their properties will be protected. Bauchi must distance itself from security challenges in Yobe and Adamawa. |
| **Calabar** | Calabar is a promising tourist capital of Nigeria but to attract technical talents the state must show that Tinapa is not a failing project. With General Electric setting up in Calabar, a strong anchor firm will be present to seed new engineering firms. The cluster must use the talent in UNICAL to improve cluster-firm quality to service a global technology leader like GE. |
| **Ibadan, Ife** | Among all the clusters, Ibadan and Ife have the best edge to develop a biotech sector in Nigeria due to the presence of top universities and the quality of their basic sciences. Clusters and entrepreneurs must work with universities to see how a biotech sector can be formed in Nigeria in the Ife and Ibadan clusters. |
| **Ilorin** | Ilorin is positioned on a trade route linking North and South. There are promising new agricultural inputs and raw materials from UNILORIN which entrepreneurs can bring to the market together. |
| **Kaduna** | A traditional national innovation power must find ways to tap into the ecosystem of one of the finest African universities, ABU Zaria. Through closer partnership, this cluster can transform agro-processing and engineering with innovation. Cluster leaders must work with government to ensure security is heightened to avoid losing talents to other clusters. |

| | |
|---|---|
| **Kano** | The aviation school in Kano can shape aerospace innovation. As in other northern parts of the country, Kano must make sure it does not lose talent because of security. |
| **Lagos** | If Lagos does not improve its public infrastructure, it cannot develop with the promise everyone has expected. The transportation system, sewage, water, etc. must be upgraded if Lagos wants to attract and keep the nation's top talents. |
| **Minna** | FUT-Minna is a strong technical university that can drive innovation. The goal will be to provide unique training programmes specific to the Minna business environment to help businesses unlock more opportunities in the city. |
| **Port Harcourt** | Hosting iconic firms like Schlumberger and Shell, Port Harcourt must use those companies as anchors to develop a vibrant oil and gas engineering sector. The local content mandate must improve quality and capabilities. UNIPORT and RSUST can serve as catalysts to boost the innovation system in this cluster. |
| **Sokoto** | It is supposed to be the home of the renewals and alternative energy cluster in Nigeria with partnerships between Usman Danfodio University and some Malaysian universities. But lack of capital is stifling talent. Government must attract outside capital to nurture the energy subsector in this cluster. |

## 6.5 ENTREPRENEURS

Entrepreneurs are the lifeblood of the cluster system. They nurture and sustain the organic nature of clusters, which refreshes and renews them in turn. The following are some recommendations:

- Nigerian cluster-entrepreneurs must learn to collaborate and share best practices.
- The habit of continuous learning should be learnt because technology changes and the best ideas today may be irrelevant tomorrow.
- Entrepreneurs must form closer relationships or partnerships with universities and government labs, not just for learning, but to develop training and commercialise ideas. Universities should be seen as partners and entrepreneurs should approach them to develop specific training they need.
- Workshops from the Nigeria Export Promotion Council must show these entrepreneurs how they can tap into new markets, especially within the African region.
- While thinking global is important, entrepreneurs may best be served by solving specific local problems.
- Successful entrepreneurs must angel-fund promising new ideas in their clusters, as is the case in some global clusters.

## 6.6 DONOR COMMUNITY

The donor community has not played a direct role in developing clusters in Nigeria. Our recommendation to the donor community will be to focus on strengthening existing clusters instead of establishing new ones. The UN has assisted in IT Parks in a couple of countries. They can do the same by introducing such projects to already existing clusters. When they support and fund artisans, they can look at areas where these professionals have local comparative advantages and show signs of having a higher level of success.

## 6.7 THE NEW 'CLUSTERS' LIKE EPZs

Government has created new 'clusters' by establishing Export Processing Zones (EPZs) or tax-free communities to stimulate non-oil exports. These 'clusters' can benefit from the following recommendations:

- **Policy instruments** – The new clusters can benefit from smart policy instruments and regulations. Sustainable strategies that can fuse local and international entities must be put in place.
- **Incubation and mentoring** – Government must work with private companies to incubate and mentor startups in these zones – traditional, organic cluster-firms already support one another in the cluster environment.
- **Finance** – From banks to private VC funds, companies could be given incentives to inject capital into these clusters. Understanding the risk profile and investment criteria of investors and how they work within the entrepreneurial ecosystem in the clusters is vital.
- **Trans-border network** – In EPZs, there is a need to build a trans-border network of clusters with structures that support trade. Such networks could bring special financing packages that support a cluster in one country in order to provide goods or semi-processed raw materials to clusters in another.
- **Skills and human resources** – Government should cultivate sources of top talent and develop a pipeline of innovators – it can use tax incentives and special funding vehicles to lure talent from global markets.
- **R&D/Universities** – Working to build close collaborations with government labs and universities will help make these zones productive and internationally appealing for investors and entrepreneurs.
- **Infrastructure** – This will be the key factor that will drive the success of these new clusters. They must be available to attract talent and capital.
- **Create awareness** – Local awareness is important for participation and investors will make capital available when they see the interest of value creators. Catalyst organisations like chambers of commerce and specialised service providers like technology transfer offices play a very important role.

## 6.8 CONCLUSION

The right governance and effective processes to measure whether intervention programmes are working when it comes to cluster development are still lacking. Investing in expanding clusters and making them more efficient by allocating more budget resources to them should be part of government's strategy.

Luring local and international investors to develop clusters will improve the competitive state of the national economy as, on average, most of the companies in clusters have a higher chance of success than those in silos. It is vital that government funds its labs and also makes them accountable to investors. The same applies to how the country educates its youth and citizens. Top-grade talent will drive the success of any S&T innovation cluster.

While it is hard to model their existence with traditional economic tools, examining clusters as networked community partners makes things clearer. The strength and vitality of each cluster comes from the networks that form a deep, dynamic fabric. From Aba to Lagos to Kano, the process of co-competition, where they compete even while cooperating, shows they have a higher shared vision. A climate that fosters innovation and provides basic amenities and funding in these clusters will create a new era of development for Nigeria.

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