

COUNTRY OVERVIEW NIGERIA

An Introduction to the Country Economy
and the National Innovation System



AID 11346 Emerging African Innovation Leaders

G7 Exchange & Empowerment Program
for enabling Innovation
within the Next Production Revolution

Work Package 1



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POLITECNICO DI MILANO
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OF BUSINESS

COUNTRY OVERVIEW: NIGERIA

An Introduction to the Country Economy and the National Innovation System

This report describes Nigeria's National Innovation System (NIS) under the lens of the Next Production Revolution (NPR). After summarizing the main characteristics of the country's economy, it introduces the NIS players and institutions that are considered to sustain the diffusion of NPR technologies and business models across the main domestic industries. The report is primarily aimed at introducing all the members of the Emerging African Innovation Leaders project, including trainers and mentors, to the country's economy, its potential for the NPR technologies and the NIS components that can foster the embracement of the NPR in Nigeria. The report content may also be of interest to local and international policymakers, enterprises and civil sector organizations that are working toward the NPR adoption in the country.

The document was produced by Leonardo Rosciarelli and Blessing Ugwoke between April and August 2018 as researchers of Politecnico di Torino and the Energy Center Initiative. The report is part of a serie of six Country Overviews, which were designed and reviewed by the "Emerging African Innovation Leaders" research team composed by Pierluigi Leone and Leonardo Rosciarelli from Politecnico di Torino, and Emanuela Colombo, Paola Garrone, Andrea Gumina, Fabio Lamperti, Boris Mrkajic, Felipe Repetto, Nicolo' Stevanato and Stefano Pistolese from Politecnico di Milano.

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Executive Summary

This report aims at describing and analysing the National Innovation System (NIS) of Nigeria, inspecting the topic, the key institutions and the specific actors under the lens of the Next Production Revolution (NPR).

The first Section of the report describes the country focusing on several important aspects (e.g. geography, politics, economy, industry structure, etc.) with the aim of providing an insight of the local situation and to critically understand the starting point for the spreading of the NPR. Specifically, Nigeria shows some of the most interesting features among sub-Saharan countries. It is the most populous country in Africa with a total of 180 million people and its former capital Lagos is the third most populous city in the world. Its GDP raised after the 2008 world financial crisis, posing the nation in a leading position in the continent. Most of Nigerian population lives within the poverty threshold and most of Nigerians live in rural areas. Rural settlements often suffer also from many other social problems such as water scarcity, especially in the central-northern areas, or organized crime-related issues. Nevertheless, Nigeria, since the early 90s, experienced a slow but continuous evolution. Sectors that have raised most during this period where mainly textiles and food production, agriculture and chem-

ical sector especially for fertilizers. The recent years have instead seen a paradigm shift in which Nigeria has started betting on digital infrastructure, renewable energies especially for the supply of strongly delocalized areas, and human capital. Despite these great efforts towards a more manufacturing-oriented future, the nation still relies heavily on its exports of crude oil and natural gas. In fact, these sources represent today the largest trading goods in Nigeria with nations such as United States and China. In terms of infrastructure, the country can rely on a good and expanding railway line and roadway network, but there is still lack of structured maintenance measures. In terms of energy and digital infrastructures, they show low reliability and availability, especially regarding the electricity distribution network. Nigeria also have numerous state and private universities and presents a good network of educational sites but presents a high level of abandonment of juvenile education mostly registered into the poorest segment of the population.

Section two provides a synthetic but insightful picture of the country's NIS, critically analysing the major categories of actors, their actions and readiness towards the embracement of the NPR, and the existing linkages and interactions between them. Nigerian culture and population shows a deep incli-

nation for entrepreneurship and for productive activity in general, demonstrated by the numerous initiatives born on the territory in the last 30 years. Unfortunately, unfavourable foreign market conditions and various internal problems including corruption, criminal activities and illegal trade have deeply undermined the stability of the country's production system. Only in recent years with a growth led by government subsidies and a reduction in duties and taxes, Nigeria has been able to aspire to the leadership role it now occupies in the continent. Many holding companies have arisen in this period, especially in the field of construction and services. Foreign capital has been attracted again to boost local production. Now Nigeria is betting on the digital transformation and innovative technologies to increase its international competitiveness. Many innovation and start-up hubs have been born in every part of the country and recent economic and demographic development has led an increasing number of foreign companies to invest in innovation in the African country.

In line with the current line of government and with the choices of the country, we have provided in the third section a list of possible institutions both governmental and private which can provide support for future actions in the country. Therefore, we focused mainly

on innovation hubs, employers' associations, governmental associations, universities and research centres, in the vision of raising the level of involvement and facing all the souls that populate the Nigerian environment. Finally, we identified key learning needs such as the necessity to incentives and support for rural communities in terms of infrastructure, connectivity and mobility. The proposed final table will provide a general overview of some possible intervention strategies suggested for each of the main sectors selected for the country.

1.

Country overview

This first Section of the report presents a synthetic overview of the Nigerian framework in terms of socio-political and infrastructural aspects. This kind of analysis is necessary to proceed in further chapters to a critical assessment of the country innovation ecosystem and definition of its own peculiarities.

1.1 General description

Nigeria is a country of the sub-Saharan region that counts more than 180 million **people** divided in more than 250 ethnic groups. The most diffused religion is Islam (Sunni branch, located in the northern regions) followed by Christianity (mainly protestants). The country achieved **independency** from UK in 1960 and, after a democratization process, it became a presidential republic with a federal administration structure that nowadays counts for 36 states and 1 territory, the Abuja capital state. In the last decade, Nigeria experienced a great fertility rate, becoming the 19th country in the world in terms of fertility and the first African country per population. It reflected on the population structure such that today more than 40% of people are aged between 0 and 14 – the same amount of population that belongs to the much wider group of individuals aged between 14 and 60. On the other hand, **life expectancy** is only at around 52

years at birth. Nevertheless, it is constantly increasing by 0.9% per year, so it is expected to pass 60 years by 2030.

The overall **land** area is more than 910 thousand km², with 9.5% of forests located in the southern regions with more tropical climates; agricultural lands cover 78% of the territory and mainly focus on crops and pasture. Indeed, morphologically Nigeria is a country with wide profiles and smooth heights, and its features depend mostly on different climatic condition that the country experiences from north, with a semi-arid desert with low precipitation, to south with monsoon climate. The country also suffered great issues of soil degradation, leakage of arable land and pollution. In the last years, it additionally experienced a great urbanization rate, which brought the most populous **city** in the country, Lagos, to be the third in the world with around 16 million inhabitants. Approximately 15% of people live today in cities and more than 50% of them live in disadvantaged neighborhoods and more frequently in slum settlements. Yearly, emigration ratio of -0.2 migrants/1000 inhabitants is registered, translating in roughly 40,000 emigrants per year.

Especially, Nigeria is the first world country for migration in Italy, accounting for almost 18,000 migrants in 2017 and more than

36,000 in 2016. Most of them (more than 80%) requested humanitarian protection for many reasons including persecutions, abuses, rights to health. Notably, 24% of Nigerian people asking protection were women compared with 3% of the general trends, showing a serious problem of trafficking in human beings. Nigerian is relevant also for Italian economy being among top 10 countries for Italian FDI (\$US 505

Nigeria national income raised fast in the last twenty years and the country is now becoming economically one of the most powerful countries in Africa

million stock out of \$US 21,531 million in 2015).

Overall, Nigeria plays a key role in the geopolitics stability of the whole western Africa after having passed South Africa in terms of GDP in 2015 and being the most populated country of the continent. These two figures together make Nigeria as the one of poorest and unequally world country with most of population in Lagos living

with less of \$US 2 per day and few elites among the richest in Africa and worldwide (the richest African, for the seventh year in a row, was Nigerian according to Forbes). Finally, Nigeria is rich in resources being the top African oil exporter with 2.3 million barrels per day out of 5 from West Africa; finally, it is the second African gas exporter after North Africa.

1.2 Economy

Nigeria as part of the MINT countries (Mexico, Indonesia, Nigeria, Turkey), is one of the world economies with the highest rise in gross domestic product and market share during the years after the world economic crises in 2008-9, that more strikingly hit the first world economies. Nigeria national income raised fast in the last twenty years and the country is now becoming economically one of the most powerful countries in Africa. The national gross domestic product is today around US\$ 415 billion. Its economy is balanced between the service sector, which accounts for 41% of GDP, while trade as well as agriculture accounted each for 20% of the national GDP. Total per capita GDP in constant 2010 dollars is actually around \$US 2,500 (around 6,000 in PPP). Despite this, most of population (more than 50%) lives in extreme poverty under \$US1 per day, while the country deals with an high inflation rate of its national

Population 180 M

Divided in more than 250 ethnic groups

Fertility 19th country

**In the world
in terms of fertility**

In the last decade, Nigeria experienced a great fertility rate, becoming the first African country per population

Urban population 15%

More than 50% of them live in disadvantaged neighborhoods and in slum settlements

Life expectancy 52 years

It is constantly increasing by 0.9% per year.

It is expected to pass 60 years by 2030

Product US\$ 415 billion

National gross
domestic product

Economy

Is balanced between
the service sector

41% of GDP

trade as well as
agriculture

20% of the national GDP
for each

GDP per CAPITA \$US 2,500

(around 6,000 in PPP)

In constant 2010 dollars.

Despite this, more than
50% of population lives
in extreme
poverty under
\$US1 per day

currency, the Naira (NGN), that was around 16% in 2016.

Finally, on GDP basis, gross fixed capital formation is equal to 14%, governmental expenditure accounts only for 6%, while public debt is around 15%.

Nigerian main **export** partners markets are India and Netherland (14.56% and 10.20%), while the main import quantity is provided by China (21.92%) followed by the United States at 10.39%. **Raw materials** are the main exported products, while the consumer and capital goods are the most imported ones.

Main export products are indeed petroleum oils for a total of \$US 75 million in the last five years, not including the other \$US 6.3 million of refined oil products. Also natural gas is highly exported, accounting for at least \$US 8.7 million. **Imports** main voice is refined petroleum products for a total of \$US 7.1 million showing a paradoxical lack of refining infrastructure despite recent plans to build new installations in the Lagos State (with \$US 9 billion of investments). Other imports are divided in consumer goods (16%) and intermediate goods like cements, construction material in general and machinery.

Nigeria subdued a dramatic decline recently in foreign direct investments (FDI), while the country still ranks in the top five

African economies in terms of hosting **foreign capitals**. However, trends on FDI are again weakly increasing thanks to the improved transparency on exchange rates, which resulted in the inward flow of around \$US 4.5 billion for 51 greenfield investments in 2016. The total share of FDI on GDP is also increasing, passing from 15.2% of 2014 to 23.2% in 2016, augmenting also its influence on fixed capital formation for 9.2%. It is also worth to notice that almost the entire inflow capital, amounting to \$US 5.1 billion in 2016, was invested on risk capital, of which 29% on shares acquisition, 18% in banking and communication and 14% in oil and gas sector. A major source of foreign capital inflow for Nigeria are **remittances**, or money earned abroad and sent home by Nigerians people living and working in other countries, accounting today for 5% of GDP. The major sources of this money are estimated to be USA, UK and Italy, followed by Spain and France.

Nigeria is a Member of a number of international unions and associations:

- Organization of the Petroleum Exporting Countries (OPEC)
- Commonwealth of Nations – as United Kingdom former colony
- African Forum of Utility Regulators (AFUR)
- African, Caribbean and Pacific Group of States (ACP), partnership with Europe for

sustainable development

- African Monetary Union (Abuja agreement 1991)
- West African Monetary Zone (WAMZ), monetary unit that want to fight against CFA franc whose exchange rate is tied to that of the Euro and is guaranteed by the French Treasury, with a currency called Eco (not implemented yet), as the members are all English speaking country.

1.3 Industry structure

The industrial backbone of the country has undergone a profound change in the last 20-30 years. Total productivity expressed as GDP per person employed in \$ PPP raised to nearly \$US 19,000 per worker in 2015 but has been constantly decreasing until today's value of \$US 17,000 per worker. Furthermore, Nigeria has passed, since the beginning of the 2000s, from predominantly subsistence agriculture to more advanced forms, improving **harvesting techniques** and irrigation through dam construction. An increase in productivity in the agricultural sector highlights this process, which is nowadays still increasing. Indeed, the value added per worker (constant 2010 \$US) reached \$US 9,000, growing by 4% year-by-year. Strategic products harvested in Nigeria are cocoa, peanuts, cotton, palm oil, some kinds of cereal like corn and millet. Usual cattle are sheep, goats and pigs.

The **industrial** sector, on the other hand, has lost ground both in terms of productivity since value added per capita data show a step backward from \$US 14,800 per worker to only \$US 12,400 per worker in 2016, losing the 16% in five years. An important trend in industry is represented by the **manufacturing sector** ascending importance. During the same period considered before, it passed to represent the 26% of total value added from industrial sector to 40% in 2016, mainly pushed by the rapid increasing in oil and gas sector refining processes. Concerning high tech products instead, the total volume produced represents the 0.2% of total manufactured exports and raised slowly in productivity to a 0.33% of total manufacture value added.

Today Nigeria ranks 1st in African countries for **services** output and 25th worldwide. Financial services and information technology services accounts for the highest share in overall national product, in particular real estate and Telecommunications & information services counts each for an 8% on GDP. The overall value added produced in 2016 by service sectors turns out to be \$US 7,758, steadily growing of +0.9% per year in the last 5 years.

We must finally focus on data about the **informal sector**, and analyze

Total productivity is constantly decreasing
\$US 19,000 GDP per worker in \$PPP (2015)
\$US 17,000 GDP per worker in \$PPP (2018)

Industrial sector **16% lost in 5 years**
value added per capita data show a step backward from
\$US 14,800 per worker to only
\$US 12,400 per worker in 2016

Informal sector
Nigeria as one of the nations with the largest shadow economy
60% of the total production

Proven reserves

Crude oil

37,453

million barrels

Gas

5,475

billion cubic meter

Arable land

72 million

hectares

which could guarantee
a great amount
of agricultural products

High renewable energy potential

Average **wind speed**

4/5 m/s

at 10 meters height

Solar radiation goes from

4 to 7

kWh/m²/day

Hydropower

estimated potential

11 GW

for large-scale
generation

3.5 GW

for micro
generation, contrasting

them with caution. The great efforts required and the intrinsic difficulty of measurement make the estimates very varied. In fact, while some speak of Nigeria as one of the nations with the largest **shadow economy** and claim that it accounts for a 60% of total production, others exclude it from the top 20 with just 40% of total production. However, it is clear that something is going on there, regarding informal economy, and it would be appropriate to have a better outlook of the situation.

1.4 Natural resources

Nigeria is one of the major fossil fuel producers in the world, due to the abundance of natural resources. For instance, proven reserves of **crude oil** were 37,453 million barrels (higher reserves can be found only in Venezuela and Saudi Arabia) and 5,475 billion cubic meter of **gas** (higher reserves only in Qatar and Iran), as of 2016.

The soil has been also recognized as a major source of value exploited through agricultural activities; actually, government started to look at the **land** as the real gold mine for Nigeria after the financial crisis. Indeed, it can count on 72 million hectares of arable land could guarantee a great amount of agricultural products. These characteristics are particularly interesting also for **renewable energy potential**: in the northern areas, high-rise

plateau guarantees a medium wind speed of approximately 4/5 m/s at 10 meters height, and the solar radiation goes from 4 to 7 kWh/m²/day. There is also a large **hydropower** estimated potential of around 11 GW for large-scale generation and 3.5 GW for micro generation, contrasting by the way with the water scarcity problems that the nation is still fighting.

Finally, it is important to remind that Nigeria faces an increasing urbanization rate that we could translate into a continuously

*Nigeria is one
of the major
fossil fuel
producers
in the world*

increasing source of municipal solid **waste**. Up today, a rough estimation accounts for a total production of approximately 30 million tons per year that could be recycled and reutilized in a series of sustainable ways, including electricity production.

1.5 Smart and integrated infrastructure (Enabling quality infrastructures)

1.5.1 Energy

The country is ranked 110th in the energy infrastructure performance, the ranking defined by the World Economic Forum,

and it continues to suffer for high discrepancies between production structure and energy demand requirements. Its 2015 **energy intensity** was of 0.14 tons of equivalent oil (Toe) per thousand 2005 dollars produced, a quite high value that however could be compared to the one of its neighboring nations. Fast rising in population of the past years brought to a consequent enlargement of the national

*Nigeria
undergoes a rural
electrification
process that is
nowadays still
ongoing*

grid. This frenetic spreading of the network coupled with lack of adequate maintenance could probably be two of the many reasons why firms reported at least 30 electricity outages per month in 2014.

Nigerian per capita **energy consumption** is around 0.76 Toe per capita, while the total electricity per capita consumption are around total electricity produced was 171 kWh per capita. The country dispose of a theoretically amount of around 12 GW total **installed capacity** but due to all the above discussed issues, in combination with the

fact that water scarcity is shading the contribution of water dams, only a peak of almost 4 GW where reached in 2015.

As most of the African countries, Nigeria undergoes a **rural electrification** process that is nowadays still ongoing. It bases on the concept of little decentralized electricity production through mainly PVs and Diesel generator, switching today to preferable full renewable solutions. In 2013, this process brought to an overall decentralized installed capacity of 305 MW and raised trend for electricity access in rural areas up to 40% for people living in the countryside.

The Government owned Transmission Company of Nigeria (TCN) manages the national **transmission lines** and has an estimated potential of about 5.3 GW, but with an actual capacity of only 4.5 GW. The total estimated length of transmission network is 12,300 km (5,650 km of 330 kV and 6,687 km of 132 kV). The Nigerian Electricity Regulatory Commission (NERC) provides the lists of all distribution companies (DISCOs) and yearly averaged **tariffs** for each of them. Fees structure for electricity is divided in 5 classes from household to commercial, industry, special cases or public lightning, and these electricity prices vary from 2.58 to 16.55 \$US cents/

**Energy
intensity**
0.14 tons
of equivalent oil (Toe)
per thousand 2005
dollars produced
(2015)

**Per capita
energy
consumption**
0.76 Toe per capita, while
the total electricity per capita
consumption are around
total electricity
produced
171 kWh
per capita

**Electricity
access**
in rural areas
40%
for people
(2013)

Government expenditures

on infrastructure

\$US 116 billion

in the last 5 years

Road infrastructure

193,200 km

of which at least

24,000 km

of asphalt or concrete roads

6 km

of dressed road

Railway system

3,505 km

of narrow gauge lines

479 km

of standard gauge lines

Port and navy infrastructure

8,600 km

of safe navigability
of inland waterways

Airports

54

of which

38

have paved runways and
7 are international hubs

kWh, value that depends on state and on the above classification. For industries, an average tariff fees amounts to 10 US cents/kWh that mainly for line distribution costs and generation costs. For what concern the **regulatory framework**, the Federal Ministry of Power (FMP) established the policy structure in collaboration with local institutions, the Federal Ministry of Environment (FME) and other local commissions. Then the Nigerian Electricity Regulatory Commission (NERC) that operates in collaboration with FMP updating contracts and tariffs structure, while Rural Electrification Agency (REA) and Electricity Distribution Companies (DISCOs) follows local planning and projects.

1.5.2 Mobility

Government expenditures on infrastructure were around \$US 116 billion in the last five years, that is roughly half of the total expenditures of African developing countries for infrastructural projects, while private companies invested more than \$US 6.5 billion. Nevertheless, Nigeria infrastructure position of 132nd over 138 on 2017 Global Competitiveness Report is a signal that the problems have not yet been completely solved.

For what we can say about **road infrastructure**, some rough estimation shows their spreading across the country for 193,200 km of which at least 24 thousand of

asphalt or concrete roads and 6km of dressed road. Lot of stretches still suffers of low maintenance level and damaged paving, while in the South region others are unserviceable in the monsoon season caused by floods. Today the national **railway system** has a total of 3,505 km of narrow gauge lines and 479 km of standard gauge lines. The company that deals with the treatment of the line is Nigeria Railway Corporation (NRC). In recent years, the corporation got in touch contacts with railway companies and Chinese banks, seeking funding for the expansion of standard gauge lines. At the end of 2016, the government of the Kano State Government signed a contract for a total of \$US 1.8 billion with the China Railway Construction Group for the construction of a light rail. Another proposal is to construct the great high-speed railway connecting Abuja to Lagos. The Nigeria Ports Authority (NPA) deals with the development of **port and navy infrastructure** and provides safe navigability of the 8,600 km of inland waterways through maintenance works, while the Nigerian Maritime Administration and Safety Agency (NIMASA) is responsible for regulations. The latter also carries out inspections, provides search and rescue services, while directly depends from the ministry of Transport and ministry of Navy. There are 54 **airports** in Nigeria,

of which 38 have paved runways and seven are international hubs. The total registered traffic in 2017 was of around 13.4 million passengers, with a ratio arrival to departure almost equal to one. In conclusion, Nigeria ranked 88th for **logistic performance** in the world indexing provided by the WIPO, while in the Logistic Performance Indexing (LPI) ranking provided by the World Bank it scores 2.43 for

Information and communication service sector is increasing its importance in Nigeria

international shipment and 2.73 for logistic competence. These data are useful to highlight the improvement in logistic reached by country mobility infrastructure in recent years, while more could be achieved on promoting technological improved constructions to augment the total international transport volumes.

1.5.3 Digitalization

Information and communication service sector is increasing its importance in Nigeria, highlighted also by its share in the national GDP, which currently stands over 11%.

Fixed broadband subscription in 2016 were 28,090. Nowadays only 5% of the total population has fixed telephone subscriptions, and this number is in decline. A different picture comes from the **mobile** transmission: data on contract submissions provided by the Nigerian Communication Commission speak about 233 million of mobile connection for a penetration of the estimated potential market of 98% of the total estimated market, translating in around 82 people on 100 having a mobile line subscription in Nigeria. The prevailing **transmission technology** is mainly GSM, followed by CDMA with an average speed connection of 9 Mbps and 4 Mbps, depending on location and type of connection (mobile 3G, 4G or fixed). The major mobile internet providers in the country are Spectranet with 193,892 connections, followed by Smile Communications (156,243 connections) and ipNX (28,153 connections). In addition, the government has undertaken initiatives in the Lagos and Kano areas for the electronic delivery of documentation to carry out public practices, with a view to a future digitization work.

1.6 Human capital

For what concern human capital, Nigeria turns out to be a fragmented nation. Education expenditures account for around 2% of total GDP

**Fixed
broadband
subscription
28,090
(2016)**

5% of the total population
has fixed telephone
subscriptions

**Mobile
transmission
233 M**

of mobile connection for
a penetration of the estimated
potential market of
98%
around
82 people on 100

**Compulsory
education
9 years**

Education expenditures
account for around
2%
of total GDP

Nigeria is ranked
20th
in sub-Saharan region for
doing business and

145th
in the
world in 2017

Secondary
completion rate

50%
It is above
the average for most
African countries

Scimago ranking

54th
which classifies country
around the world for number
of citable documents, as it
produced an average of
6 thousands documents
per year

of Nigeria and the law establishes 9 years of compulsory education; **richer** families expect a mean scholarship period of 13 years, surpassed in Africa just by Tunisia and South Africa. On the other hand, **poorest** individuals suffer one of the lowest levels in the whole continent (only around 1 year of scholarship expected). These levels are comparable only with Ethiopia, Benin and Burkina Faso. If we also consider the provenience and we distinguish urban from rural population, discrepancies become equally evident. As an example, richer people based in cities have absolute literacy rate (100%), while only 40% of richer people based in rural settings are literate. Finally, **secondary completion** rate is around 50% that is above the average for most African countries.

1.7 Entrepreneurship

That premised, Nigeria is ranked 20th in sub-Saharan region for doing business and 145th in the world in 2017, which is extremely low value caused by complex surroundings and barriers of innovation. The country has the highest mean rate of **bureaucratic processes** of the whole sub-Saharan African countries with a value of 8.5 paperwork per man needed to obtain a permits. It is also significant that, once the paperwork is complete, Nigerian citizens have to wait a long time for approval and for the request to be finalized. A connection to the electrical line,

as an example, takes an average of 140 days from the formal request. Moreover, the lack of **access to credit** has proved to be the most critical factor for development by companies **operating in the**. Therefore, the government has just launched new initiatives such as distributing credit information directly to retail companies and guaranteeing borrowers the legal right to inspect their credit data from the credit bureau. These and other actions are the reason why

*Nigeria is the
African country
with the highest
rate of native
entrepreneurs*

in the Global Innovation Indexes Nigeria rose in position becoming the 40th country for ease of access to credit.

However, we can say that the **social environment**, despite the premises, seems to be extremely dynamic, with high scoring social attitudes, as demonstrated by the long lists available of successful Nigerian entrepreneurs. Notably, Nigeria is the African country with the highest rate of native entrepreneurs. As we will see in the future chapter, the country shows an increasing number of social innovation hubs and enterprises.

1.8 Science, research and innovation

Research and scientific activity compartment in Nigeria is evolving rapidly in agreement with economic and social needs. This **dynamism** reflects on the most famous scientific rankings in the world. As an example, the country ranked 54th for all subject in the Scimago ranking, which classifies country around the world for number of citable documents, as it produced an average of 6 thousands documents

*Research and
scientific activity
compartment in
Nigeria is evolving
rapidly*

the aggregate voice Professional, Scientific & Technical Services presented in national accounts, to which GERD belongs, did not varied along times have suggested that research in Nigeria is still struggling to break out. As we will highlights in the next chapter, Nigeria is top ranked in Africa in terms of innovation hubs focused on ICT technologies.

per year. Moreover, it experienced an increase of scientific **international collaborations** and its main fields of interest seems to be agriculture and medicine. This scientific interest precedes the increased engineering topics such as computer science and energy. However latest available data depict a situation for which the government **expenditure** on research and development, the so called GERD voice, turns out to be around only the 0.22% of GDP, 1% financed from abroad. This information is quite dated since it comes from 2007, but the fact that

2.

Institutions of the national innovation system

The following section will exhaustively introduce the most important actors which constitutes the Nigerian ecosystem. We will shortly present their features and main activities, exploring the private and public institutions that could lead to enable the Next Production Revolution.

2.1 Firms

As a factor-driven economy, Nigeria has an entrepreneurship environment that is still competing primarily on the use of unskilled labors and natural resources valorization. Indeed, in 2017 Nigeria was the first country in FAO ranking for official development assistance provided to agriculture, as they expended \$US 30.3 million to upgrade farmer condition. On one hand, the country mainly relies on Small and Medium Enterprises (SMEs), which account for more than 2 thirds of the registered firms while most of them operate on retail sector. On the other hand, the first year of the century sees the raising of the first Nigerian big firms, as for example Globacom Limited (or GLO) multinational telecommunications company, headquartered in Lagos that counts more than 26 million internet subscriber in sub-Saharan Africa. The existing **industrial companies** does not rely on sophisticated production methodologies to generate profit. They mainly do business on price variation from produced goods from raw materials

(e.g. oil, gas and other). That could be a reason why high-tech exports are so scarce and why there is a relatively low level of firms that use material inputs and/or supplies of foreign origin. Indeed the share of foreign product user firms is around 31.9% in 2014. This value, as an example, turns out to be 75% for Niger and 61.5% for Cameroon, the two biggest neighbors of Nigeria.

Nowadays many **financial companies** operates in the country or others that offer risk

The country mainly relies on Small and Medium Enterprises (SMEs)

mitigation, credit enhancements, and guarantee for support on financial arrangements, public-private partnerships, and access to local and international capital markets. Companies like that seems to be necessary in long-term capital required by some kind of investment that could not be covered from the domestic banking market. They found fertile soil: it is clear observing to the deflating data on Nigeria inflow capital from abroad that during the last years the country became drastically less attractive for business purpose as we noticed.

An important achievement in the Nigerian companies was the growing recognition of the role of **formal training** within the company. In fact, the percentage of companies offering internal training has increased from 25.7% to 30.7% in just two years. That suggest that Nigeria is searching for new way to acquire skill and enforce processes.

The country is also undergoing to a **digitalization** process

The country is undergoing to a digitalization process that pushed an increasing penetration of innovation hubs and environments

that pushed an increasing penetration of innovation hubs and environments, mainly driven by the ICT sector that is rapidly spreading in the country. Nigeria is ranked 51st in the world and is the leader in Africa for import of ICT technologies that now accounts for 1.7% of the total imports, mainly looking for finished computer components (servers, processors etc.) and replacement parts.

2.2 Government

Nigeria is a federal presidential republic in which the president (General Muhammadu BUHARI) is both chief of state and head of government. Legislation form is bicameralism in which people by universal suffrage elects their representative staff from each of the 37 districts. Executive branch is subdivided in ministries that have also the task to manage some parastatal organizations such as universities or companies. Since Nigeria is a federal state, each district has its own internal governmental structure.

In the last years, the country suffered of some cases of **corruption**, fact that led to the formation of various task forces to fight against the phenomenon reaching its climax. Budget office of Nigeria also published in April 2018 the national open government plan to stimulate intervention against corruption, in which they also analyze and discuss the importance of the technology and innovation crosscutting in providing greater access to information and data. Therefore, they formed a specific Technology & Innovation Working Group with the scope to scan the governmental IT solutions that still exist, understand their current status and propose gap-filling actions within June 2019.

For what concern the economic

**30.3
million dollars**

The investments in 2017 to upgrade farmers condition, ranking 1st in FAO official rank for development.

Nigeria is ranked
51st
in the world
It is the leader in Africa
for import of
ICT technologies
1.7%
of the total imports

Formal training

The percentage of companies offering internal training has increased from
25.7% to 30.7%
in just two years.

policy interventions launched by the government over the years, Nigeria has experienced a deep liberalization and deregulation process that has led to a significant increase in capital importation from the outside. Today it acts actually in a more **protectionist** way, shielding existing investments from unfair competition by use of import taxation, in order to enhance **domestic production** and know-how absorption. In the meanwhile, it wants to detach itself by the role of hydrocarbons-producing nation, trying to focusing more on financial aspects, agriculture and services. They propose for

example a 100% tax exemption for seven years and other advantages for firms investing in economically disadvantaged areas and grant particularly advantageous subsidies for agro-allied companies, which means the one who can produce benefits directly or indirectly to agriculture. With these and other subsidies, coupled with a massive digitalization campaign, the government decided to re-attract **foreign investors** due to deflation of FDI in the recent years. Additionally, also Nigerian central bank started in September 2017 to work on electronic certificates to streamline capital importation.

Relevant governmental institution:

- Presidency - <http://statehouse.gov.ng/>
- Ministry of Agriculture - <http://fmard.gov.ng/>
- Ministry of Education - <http://www.education.gov.ng/>
- Ministry of Environment - <http://environment.gov.ng/>
- Ministry of Finance - <http://www.finance.gov.ng>
- Ministry of Foreign Affairs - <https://foreignaffairs.gov.ng/>
- Ministry of Interior - <https://www.interior.gov.ng>
- Ministry of Justice - <http://www.justice.gov.ng/>
- Ministry of Labour and Productivity - <http://labour.gov.ng/>
- Ministry of Power, Works & Housing - <http://www.pwh.gov.ng/index.php>
- Mines and Steel Ministry of Development - <http://minesandsteel.gov.ng>
- Ministry of Petroleum Resources - <http://petroleumresources.gov.ng/>
- Ministry of Science & Technology - <http://scienceandtech.gov.ng/>

List of some parastatal companies:

- Nigeria Communication Commission (NCC) - <http://www.ncc.gov.ng>
- National Information Technology Development Agency (NITDA) - <http://www.nitda.gov.ng>

- Nigerian Association of Chambers of commerce, industry, mines and agriculture (NACCIMA) - <http://www.naccima.com/>
- National Space Research and Development Agency - <http://www.nasrd.gov.ng>
- Corporate Affairs Commission (CAC) - <http://www.cac.gov.ng>
- Nigeria Ports Authority (NPA) - <http://www.nigeria-ports.com>
- Nigerian Export Processing Zone (NEPZA) - <http://www.nepza.com>
- Nigeria Investment Promotion Commission (NIPC) - <https://www.nipc.gov.ng/>
- Nigeria Tourism Board - <http://www.nigeriatourism.net>
- Bureau of Public Enterprises (BPE) - <http://www.bpeng.org>
- Nigeria Postal Services (NIPOST) - <http://www.nipost.com.ng>
- National Orientation And Public Affairs - <http://www.nopa.net>
- Nigeria Stock Exchange (NSE) - <http://www.nse.com.ng>
- Nigerian LNG Limited (NLNG) - <http://www.nlng.com>
- Nigeria Oil and Gas Industry Online - <https://nigeriaoilgas.com.ng/>
- Central Bank Of Nigeria: - <http://www.cenbank.org>
- Federal Capital Territory Abuja: - <http://www.abujacity.com>
- International Centre For Nigeria Law: - <http://www.nigeria-law.org>
- Nigerian National Petroleum Corporation (NNPC) - <http://www.nnpcgroup.com/>
- Department of Petroleum Resource - <https://dpr.gov.ng/>
- National Council on Privatization - <http://statehouse.gov.ng/national-council-on-privatization/>

2.3 Universities

The national university commission (NUC), whose function is to be a regulatory agency and to delivery quality indicators for university education divides Nigerian **universities** in 3 categories for a total of 47 State, 41 Federal (State Owned) and 74 Private universities. The federal ones directly rely on the central government, while state government owns the state one (local states e.g. Niger State). NUC also establishes eight **distance-learning centres** to enhance access to higher education for farther areas

that are mainly sited internally to the pre-existent universities. Finally, approximately a 50% of universities are private owned. Another issue that is now arising is the increasing rate of **illegal universities** (57 from NUC report), that provide their services illegally basing on international standards. Some of them also uses the private ownership as an excuse to claim high fees for their services. They could subdivide in monotecnico and Polytechnics universities and Colleges of education. The entrance requirement to attend the first year

Universities

47 State
41 Federal (State Owned)
74 Private

Illegal Universities
57
(from NUC report)

Learning centres

8

Distance learning centres to enhance access to higher education for farther areas that are mainly sited internally to the pre-existent universities

ICT centers

The Agency has managed to establish **740** centers at the end of 2015. Location of these centers is available on the official website of NITDA

is a Senior Secondary Certificate Examination, achieved after the completion of the six year second level school with a minimum cut-off mark. The typical duration of undergraduate programs in Nigerian universities depends largely on the program of study and goes from 4 years for Social sciences and I.C.T. to 6 years for Medicine.

Vocational education schools are also present in Nigerian higher education environment because of the early 1980s high unemployment rates for school graduates. Today students from secondary level school can access to this kind of education and government is stressing on improving this service by establishing quality commissions.

2.4 Innovation and enterprise support institutions

The World Intellectual Property Organization (WIPO) points as Technology and Innovation Support Centres two main institutions: the National Biotechnology Development Agency and the Trademarks Patents and Designs Registry both located in Abuja. The first has relatively high contact to universities like the Ahmadu Bello University and has the mandate to coordinate, promote and regulate the development of **biotechnologies** in the country, part also of the pan African

bioinformatics network for H3Africa (H3ABioNet).

National agency for communication (NITDA) started in 2010 to implement construction of IT centers for all 774 local governments in Nigeria. The aim was to spread in rural settings the Information Technology centers in all the 774 Local Governments in Nigeria and to establish a governmental e-platform for all the possible e-services (commerce, telemedicine and so on). The Agency has managed to establish 740 centers at the end of 2015. Location of these centers is available on the official website of NITDA.

The government has instead many **innovation poles** in the country and parastatal that control and supports scientific research in all fields. National Space Research and Development Agency, Earth monitoring mainly vocationed to flood prevention, rocket propulsion system or the Federal Institute of Industrial Research of Oshodi (FIIR) in Lagos. The latter is an agency under the control of Federal Ministry of Science and Technology whose objectives are the acceleration of the industrial compartment and conduce a market-driven research. Above all they focuses on equipment prototyping, packaging and product design, food-agro processes and finally pulp and paper processing.

Private **tech parks** and **innovation**

hubs are emerging too. Some of them, like StartPreneurs, Blue Hub and Co-Creation Hub (CcHub) focuses on ICT aspects, while other like the Enspire incubator are more oriented on business and job creation through innovation. Similar to the latter, the Start innovation hub, which is located in Uyo, a city in the South-east region, provides the environment

Large private multinationals have begun in recent years to take an interest in the Nigerian context and have invested in the process of training new talent

for sharing business expertise and guarantees mentorship support. The ICT based hubs have also their divergence, like StartPreneurs (located in Abuja) is specialized on artificial intelligence and machine learning implementation, touching the field of internet of things. CChub instead has a wider multidisciplinary vision as expressed in their website. Their field of work goes from smart infrastructure to governance and education. It figures as one of the most important incubator in

Africa.

Even large private **multinationals** have begun in recent years to take an interest in the Nigerian context and have invested in the process of training new talent. As example, IBM opened in Lagos an innovation Centre focused on data driven solution and analytics while the so-called Cloud Garage in Lagos, a hub for advanced manufacturing-based innovation, strategy development, idea generation and collaboration. It offers year-round series of skills training programs focused on building the next generation of Nigerian entrepreneurs that are trained to use the latest solutions in advanced manufacturing technologies like 3D printers, CNC mills, and laser cutters as well as in business development.

2.5 Linkages between the institutions

The Nigerian system of endemic institutions seems to be vast and populated by any kind of association with both public and private connotation. As we have just anticipated in the previous chapters, the Nigerian **government** uses to communicate, interact and talk to the external environment through a series of parastatal companies or semi-private owned associations (such as the NUC or similar). For example, the Nigerian Association of Chambers of Commerce, Industry, Mining and

Agriculture includes numerous chambers of commerce across the country and should be the main communication channel for businesses, allowing information to be disseminated and companies participating in the legislative process. It organizes seminars and gets in touch with various Nigerian **business associations** such as the Association of Consulting Engineers (ACEN), Road Owners

The country is undergoing to a digitalization process that pushed an increasing penetration of innovation hubs and environments

Consumer Protection Council are two of the many agencies that guarantee umbrella solutions for the protection of consumer rights. Other associations may provide **firm-to-firm** interactions like the Federation of Construction Industries (FOCI) that represents the construction industry sector and Nigerian Employers' Consultant Association (NECA) NECA that aim to consult with private sector employers on socio-economic, labor policy issues, labor force, government, communities and other relevant institutions. Finally, Nigeria has one of the biggest **trade union** in Africa: the Nigeria Labour Congress (NLC) that, basing on their data, accounts for more than 4 million members and 29 affiliates trade unions.

and so on. Furthermore, all commercial enterprises operating on Nigerian soil must be registered in the national register maintained by the Committee for Corporate Affairs (CAC).

Nigerian citizens also have at their disposal a whole series of non-profit associations for the protection of **consumer rights**, from which they can receive assistance on illicit operations and abuses received from any other agent of the system. The private Consumer Advocacy Foundation of Nigeria and the public

3.

Conclusions

Once we have gathered all the information from section 1 and after exploring the national structural composition in section 2, we can now give a few key actors that could facilitate a future development of the nation. Furthermore, we can bring to the attention of the reader the actions believed to be the most promising to be taken, in order to leverage the choice on the learning needs necessary for the future AILs.

3.1 Key actors in the national innovation system

The following paragraphs report the list of Nigerian public and private institutions that may have a role in promoting the uptake and diffusion of the NPR in the country.

3.1.1 Federal Institute of Industrial Research Oshodi (FIIRO)

The Federal Institute of Industrial Research, Oshodi (FIIRO) is a governmental institute established under the umbrella of the Federal Ministry of Science and Technology in 1956 with the aim to accelerate industrialization and entrepreneurship and drive socio-economic advancement of the country. In particular, the institute aims at promoting market-driven research and development in the field of Food and Agribusiness, Pulp and Paper Processing, Packaging and Product Design, Design and Fabrication of Equipment Prototype. The Institute also features research

that promote and valorise the use of native materials and upgrading of indigenous production technologies.

3.1.2 University of Ibadan

The University of Ibadan is located in the south-west part of Nigeria not far from Lagos. With 10 faculties and 6 institutes, the Universities covers most relevant topics of higher education with a focus on science, technologies and renewable natural resources. Besides, there are 8 academic centres including the Centre for Entrepreneurship, CEI, that was started in 2007 with the aim at teaching and doing research in entrepreneurship and innovation, and highlights the direct relevance of the university to its environment and society as large. The centre is connected and explicitly refer to main national and regional development programs such as the National Economic Empowerment and Development Strategy (NEEDS), the New Partnership for Africa's Development (NEPAD), the National Programme for the Eradication of Poverty (NAPEP), and the Small and Medium Enterprises Development Agency of Nigeria (SMEDAN). Among the other centres, it is also relevant to mention the Centre for Petroleum, Energy Economics and Law, CPEEL that foresees energy studies in a multidisciplinary framework, by increasing the pool of energy specialists, teachers, researchers and policy analysts in the country. Finally, the university counts on the Centre For Excellence In Teaching &

Learning that aims at promoting innovation in teaching methodologies and learning.

3.1.3 University of Nigeria, Nsukka

The University of Nigeria, Nsukka, is a federal university established in 1960 and located in Nsukka, Enugu State, in the south central part of Nigeria.

The university has many faculties covering many topics of science, technology, mathematics; especially, there many centres that could be of high interest for NPR including the climate change centre, the centre for rural development and cooperatives, the centre for entrepreneurship and development research (CEDR), the energy research centre and the centre for distance and e-learning.

The climate change centre offers trans-disciplinary programmes that aims at building capacity needed to address climate change and adaptation. Moreover, the centre encourages and implements action –oriented research activities, including research into climate change adaptation technologies, that will help to improve the climate adaptation capacity of the African peoples. The energy research centre carries out research, development, dissemination and training in renewable and non-renewable energy resources.

The centre for rural development and cooperatives aims at improving farming services and overall rural sector through research, training, documentation and publications.

Moreover, it has an international vocation that is based on the will to activate networks of collaboration and collaborative research projects.

Finally, the Centre for Entrepreneurship and Development Research (CEDR) was established in 2006 under the stimulus of the McArthur Foundation and aims at making University of Nigeria, Nsukka, an internationally recognized entrepreneurial University.

3.1.4 Nigerian Employers' Consultant Association (NECA)

NECA is an organization of employers of the private sector of Nigeria established in 1957. NECA provides the forum for the Government to consult with private sector employers on socio-economic and labour policy issues. In particular, NECA promotes policies and laws that will enhance the competitiveness and survival of enterprise, promote sustainable enterprise and economic development through capacity building and empowerment programmes.

3.1.5 Co-creation Hub

It is a private innovation hub started in 2011 and working mainly in the field of digital technologies. Since 2011, more than 90 ideas and companies have been supported from the hub. Areas of focus are smart infrastructure, governance, health and well-being, fintech, education, digital security.

3.1.6 StartPreneurs

It is a private innovation hub in Abuja focused on digital technologies including Artificial Intelligence, Machine Learning, Augmented Reality, Virtual Reality, Blockchain and/or Data Science. At the core of StartPreneurs is digital literacy by executing both high level digital technology/entrepreneurship trainings, across the country and software development/deployment. There are finally other innovation hub that could be of high interest for the NPR including Blue Hub, Enspire incubator, Start innovation hub, Cloud Garage in Lagos.

3.2 Challenging, opportunities and learning needs

Nigeria emerges as a contradictory reality where the potential for development struggles with unacceptable poverty levels exacerbated by huge social inequality. It shows the highest African GDP and population, but life expectancy and literacy rates are low. Nigeria is one of poorest and unequally world country with most of population living with less of \$US 2 per day and few elites among the richest in Africa and worldwide.

Most of economic activity is based on the valorisation of natural resources that however are not sufficiently deployed, as in the case of renewable sources, or follow an unsustainable pattern of valorisation, as in the case of oil and gas products.

Agriculture sector give a big contribution to the national economy and land is a real gold mine for Nigeria with 72 million hectares of arable land that could guarantee a great amount of agricultural products. Therefore, introducing **digitalization in agriculture production** may increase the productivity of this sector and improve its sustainability in terms of water and nutrients consumption. At the same time, there is opportunity to introduce new **biotechnologies** in order to effectively deploy agricultural wastes and transforming them into value-added products.

Nigeria is the 1st in Africa for output in service sector, therefore improving this sector with digital technology that may ease the governance, reducing costs, etc... could enforce the competitiveness of the sector.

Industry sector is instead mostly oriented to the oil and gas sector; even in this field, the application of digital technologies could increase the **productivity of exploitation** and increase **safety of workers and environment**.

At the level of enabling infrastructure for NPR, there is a lot of work to do in the field of energy production and distribution system where **rural electricity access** is nowadays still blocked at around 40%.

Transport and **digital** infrastructure have instead undertaken significant development in the last years, however more investments should been done to prepare the country to the NPR leapfrogging.

Leading Industries NPR Enabling Transformations	Crop and animal production, hunting and related service activities & Fishing and aquaculture (ISIC codes 01 to 03)	Manufacture of food products, beverages and tobacco (ISIC code 10 to 12)	
Energy	Use of renewables and independent mini-grid help to offset outages risk.	The use of continue energy supply could enhance quality of products and guarantee an accurate production.	
Mobility	To reach far or foreign markets and improve the exchange potentiality is one of the most beneficial action of improved mobility.	Improved road transportation allows to better reach local demand and to take part into international supply chains, while contributes to diminishing perishability issues.	
Digitalization	The use of smart agriculture solution and medium terms meteorological forecasting could enhance the farming yields and improve soil profitability. Controlling systems and strategies, using advanced digital techniques, could also allow to provide prompt intervention in specific area, diminishing the time required per worker.	Opportunities coming from ICT for handling, storing, transforming (including food safety controls), packaging local agricultural produces.	
Italian Investors	-	NASCO group https://www.nasco.net/	

A few examples of the NPR potential for leading industries and Italian investing firms.

Source: the Italian Ministry for Foreign Affairs (<http://www.infomercatiesteri.it/paesi.php>)

Manufacture of textiles & Manufacture of leather and related products (ISIC codes 13 to 15)	Manufacture of machinery and equipment n.e.c. & Repair and installation of machinery and equipment (ISIC codes 28 to 33)	Construction of buildings & Civil engineering & Specialized construction activities (ISIC codes 41, 42 to 43)
<p>Renewable energy integration and on-site refurbishments and enhancements can help improve productivity and lower the overall production costs.</p>	<p>Renewable based micro-grid could ensure the production continuity by diminishing the pressure on the national energy providers.</p>	<p>Expand power grid coverage thanks to new construction sites could be an even more effective method rather than improve upgrade existing infrastructure to fight against energy access in the country.</p> <p>Including local energy planning in the early stage of new projects development could also push to guarantee energy access to growing urban and rural contest.</p>
<p>Prioritise linkages with established regional aviation hub to enhance export opportunities. Improved road transportation allows for better organised and efficient supply chain.</p>	<p>The improvement of road pavement could allow better and more efficient transportation.</p>	<p>Improving road and railway maintenance is a key factor to raise internal and external exchange rates. Increased mobility could bring also to build in otherwise unreachable areas.</p>
<p>Opportunities for enhanced logistic optimisation (e.g. goods & info flow management). Broadband connectivity as a necessary condition for B2B and B2C marketplaces and platforms that foster access of local producers and transformers to international markets.</p>	<p>Improve speed and operations, e.g. firms adopting updated equipments (CNC machines or Additive Manufacturing), or with augmented automation. Opportunities for new business models leveraging on digital platforms. Opportunities for enhanced logistic optimisation.</p>	<p>Private-public investment & FDIs opportunities in national digital system build-up. Improved technology absorptive capacity.</p>
<p>-</p>	<p>Better Living Ltd PATED MARBLE Nigeria Limited http://patedmarblenigltd.8m.net/</p>	<p>A.G. Ferrero & Co Ltd: http://www.agferrero.com/ Cappa and D'Alberto Plc http://www.capdal.com/ MONTEROSA CONSTRUCTION LTD http://www.monterosaconstruction.com/</p>

Appendix A

Table A.1 presents an extended list of possible key actors and related contacts for Nigeria. Actors have been selected according to their relevance within the NIS, according to an interviewed local

expert. Furthermore, each actor has been classified according to the specific type of institution and ownership (e.g. Government, University, Enterprise, etc./e.g. Private, Public, etc.).

Actor & website	Contact(s)	Type of Institution & Ownership
National Biotechnology Development Agency (WIPO TISCenter) http://www.nabda.gov.ng	Umaru Musa Yar'Adua Expressway, Airport Road, Lugbe, P.M.B 5118, Wuse, 09004 Abuja Telephone: (+234) 802 544 621 5 (+234) 806 630 178 0 Mail: adeshina.ismail@gmail.com honmusty@gmail.com	STEM support center and re- source access point Government
Trademarks, Patents and Designs Registry http://www.iponigeria.com/#/	Block 'H' Old Federal Secretariat Area 1 Garki - Abuja Telephone: (+234) 803 320 466 3 Mail: sayauri@yahoo.com	Accesspoint to patent and scientific databases. Assistance center. Governative
Nigerian Association of Chambers of Commerce, Industry, Mines and Agriculture (NACCIMA) http://www.naccima.com/	National Secretariat: 8A Oba Akinjobi Way, Ikeja-GRA, Lagos. Telephone: (+234) 811 8877 562 Abuja Liaison Office: Plot 701B, Central Business District, Opp. Central Mosque, Abuja. Telephone: (+234) (0) 1 761 2099 Mail: info@naccima.com	Supporting association. Private
Nigeria Employers' Consultative Association http://www.neca.org.ng	NECA House, Plot A2, Hakeem Balogun Street, Central Business District, Alausa, Ikeja, Lagos. P.O. Box 2231, Marina, Lagos. ABUJA: Edo House, 4th Floor, RM 4-11, 75, Ralph Shodeinde Street Telephone: (+234) 1 77 46 352	Employers organization and supporting association. Private
Nigeria Labour Congress (NLC) http://www.nlcng.org/	Plot 829/821, Labour House, Central Business District, Abuja - Nigeria 29, Olajuwon Street, off Ojulegba Road. P.O. Box 620, Yaba, Lagos - Nigeria Telephone: (+ 234)-9-627 6042 gsec@nlcng.org	Trade union. Private

Co-Creation Hub https://cchubnigeria.com/	294 Herbert Macaulay Way, Sabo, Yaba, Lagos. Telephone: (+234) (01) 2950555 Mail: info@cchubnigeria.com	Innovation hub. Private
Federal Institute of Industrial Research Oshodi http://www.fiiro.org/	Federal Institute of Industrial Research Oshodi 3, FIIRO Road, Near Cappa Bus Stop Off Agege Motor road, Oshodi P.M.B 21023, Ikeja, Lagos Telephone: (+234) 08023415016 Mail: info@fiiro.gov.ng	Research institute. Government
Ministry of interior http://www.interior.gov.ng/	Old Secretariat Area I Garki Abuja FCT Abuja, Nigeria Telephone: (+234) 09-6713526	Government
Ministry of Foreign Affairs https://foreignaffairs.gov.ng/	Tafewa Balewa building, Federal Secretariat, CBD, Abuja, Nigeria Telephone: (+234) 084-666-876 Mail: info@nigeriaforeignministry.com	Government
Nigeria Investment Promotion Commission (NIPC) https://www.nipc.gov.ng/	Nigerian Investment Promotion Commission (NIPC) Plot 1181 Aguiyi Ironsi Street Maitama District, Abuja, Nigeria Telephone: +234 (0)9 2900059 Mail: infodesk@nipc.gov.ng	Government
Federal Ministry of Power, Works & Housing http://www.pwh.gov.ng/index	Federal Ministry of Power, Works & Housing Headquarters, Mabushi, Abuja.	Government
University of Nigeria, Nsukka http://www.unn.edu.ng	Nsukka Road, Nsukka, Nigeria Professor Benjamin Chukwuma Ozumba Vice Chancellor benjamin.ozumba@unn.edu.ng Professor James Chukwuma Ogbonna Deputy Vice Chancellor (Academic) james.ogbonna@unn.edu.ng	University

Extended list of possible key actors and contacts.

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