Consultancy Study on Development of a National Innovation Index

SFRP/NCC/RD/07/2021

FINAL REPORT

- Executive Summary,
- Key Survey Findings on Innovation in Nigeria,
- Current Nigerian Innovation Landscape,
- Conceptual Framework for Nigerian Innovation Index (NII),
- Pilot NII Measurement,
- Recommendations.

2022 Project

Presented to

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NIGERIAN COMMUNICATIONS COMMISSION

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INNOVATIVE ICT SOLUTIONS

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Synopsis:	This final report contains: a. Executive Summary. b. Synopsis on Innovation and case for a National Innovation Index. c. Approach and Methodology for project implementation. d. Key findings on Innovation in Nigeria (Mostly from field survey, exercise, review of relevant reports and documentations) e. Answers to pertinent questions such as why Nigeria ranked low on the GII, key enablers for accelerating innovation in Nigeria, barriers to commercialization and benefits of indigenous NII. f. Nigeria's Innovation Landscape (SWOT analysis). g. Conceptual framework for National Innovation Index (NII). h. Pilot Computation of NII using the conceptual NII framework for selected states. i. Challenges with NII Measurement using the conceptual framework. j. Recommendations. This document is version controlled.
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List of Abbreviations and Acronyms

AfDB	African Development Bank
BOI	Bank of Industry, Nigeria
CAC	Corporate Affairs Commission
CAPI	Computer-Assisted Personal Interview
CBN	Central Bank of Nigeria
CSO	Civil Society Organization
DNP	Database of Nigerian Professionals
EO5	Executive Order No. 5
ERGP	Economic Recovery and Growth Plan
FCCPC	Federal Competition and Consumer Protection Commission
FDI	Foreign Direct Investment
FMoCDE	Federal Ministry of Communications and Digital Economy
GDP	Gross Domestic Product
GII	Global Innovation Index
i-DICE	Investment in Digital and Creative Enterprises
ICT	Information and Communication Technology
IER	Innovation Efficiency Ratio
IGE | IPI	Swiss Federal Institute of Intellectual Property
INSEAD	Institut Européen d'Administration des Affaires
IP	Intellectual Property
IPTTO	Intellectual Property and Technology Transfer Office
ISN	Innovation Support Network
ISO	International Organization for Standards
ISPON	Institute of Software Practitioners of Nigeria
JICA	Japan International Cooperation Agency
m	Million
MAN	Manufacturers Association of Nigeria
M&E	Monitoring and Evaluation
MDA	Ministry, Department and Agency
MDAs	Ministries, Departments and Agencies
MRIC	Mauritius Research and Innovation Council
MTNDP	Mid-Term National Development Plan
N	Naira
NACI	National Advisory Council on Innovation, South Africa

NAICOM	National Insurance Commission
NASDRA	National space Research and Development Agency
NASS	National Assembly
NBTE	National Board for Technical Education
NCAIR	National Centre for Artificial Intelligence and Robotics
NCC	Nigerian Communications Commission
NCCE	National Commission for Colleges of Education
NCDMB	Nigerian Content Development and Monitoring Board
NCSTI	National Council on Science, Technology and Innovation
NDE	National Directorate of Employment
NDEPS	National Digital Economy Policy and Strategy
NDIESP	National Digital Innovation, Entrepreneurship and Startup Policy
NEITI	Nigeria Extractive Industries Transparency Initiative
NICO	National Institute for Cultural Orientation
NII	Nigeria Innovation Index
NIS	Nigeria Innovation Summit
NITDA	National Information Technology Development Agency
NITI	National Institute for Transforming India
NOA	National Orientation Agency
NODITS	Nigeria's Office for Developing the Indigenous Telecom Sector
NOTAP	National Office for Technology Acquisition and Promotion
NOTN	Nigeria Office for Trade Negotiations
NPC	National Population Commission
NRF	National Research Fund
NSB	Nigeria Startup Bill
NSTI	National Science, Technology and Innovation System
NUC	National Universities Commission
OECD	Organization for Economic Co-operation and Development
ONDI	Office for Nigerian Digital Innovation
PDA	Patent and Design Act
PEBEC	Presidential Enabling Business Environment Council
PTDF	Petroleum Technology Development Fund
R&D	Research and Development
ROI	Return on Investment
SEC	Securities and Exchange Commission

SII	South Africa Innovation Index
SMEDAN	Small and Medium Enterprises Development Agency of Nigeria
SON	Standards Organization of Nigeria
SPV	Special Purpose Vehicle
STI	Science, Technology and Innovation
SVP	Strategic Vision Plan
SWOT	Strength, Weakness, Opportunities and Threats
TARC	Technology Acquisition and Research Coordination
Tech Hub	Technology Hub
TETFund	Tertiary Education Trust Fund
TIC	Technology Incubation Centre
UAE	United Arab Emirates
UK	United Kingdom
USA	United States of America
USPF	Universal Service Provision Fund
VC	Venture Capitalist
WIPO	World Intellectual Property Organization

Executive Summary

Synopsis

Innovation is the practical implementation of ideas which results in improved products or services. It accelerates growth and provides the needed competitive advantage for economic development. Innovation index is a rating which provides insight on the capacity for (i.e. input) and success in (i.e. output) in Innovation. This index is usually determined using pre-defined indicators.

The Global Innovation Index (GII) is a ranking of the innovation ecosystem performance of economies around the globe annually while highlighting innovation strengths, weaknesses and gaps in innovation metrics. The GII indices for Nigeria, shows a steady decline in innovation in Nigeria for the last three consecutive years despite Nigeria's fast growing and evolving innovation ecosystem. This presented a need to develop a national innovation index using a set of indicators peculiar to the Nigerian climate and infrastructure for innovation as well as perform a pilot measurement of innovation in Nigeria using such indicators.

Methodology

A combination of methods was used in project implementation. These included:

a. Review of documentations, reports, indigenous innovation policies and publications pertinent to the project such as WIPO's GII conceptual framework of 2016, JICA's Nigeria startup ecosystem report 2020, GII reports for 2021 & 2022, NSTI policy, NDIESP, MTNDP, NSB, numerous research papers and journals on innovation in Nigeria, etc.
b. Field survey exercise involving quantitative data collection, discussion sessions & interviews with subject matter experts in the Nigerian innovation eco-system and data analysis. A total of 1,136 respondents (cutting across 3 groups: (a) innovators & entrepreneurs; (b)tech hubs, incubators, investors & regulators; and (c)consumers) from the Nigerian innovation ecosystem were sampled from at least one state in each geopolitical zone in the country.
c. Benchmarking of national innovation index models & systems of other countries such as India, USA, UAE, Mauritius and South Africa.
d. Focus Group Discussion session

Key Findings on Innovation in Nigeria

Human Capital, presence of education & research Institutions, good number of enabling policies & regulations, etc. were discovered to be key strengths of the Nigerian innovation ecosystem while poor access to funding & investment, inadequate Infrastructure and declining quality of education & research was discovered to be key weaknesses of the ecosystem. 42% of Consumers rated the quality of Nigerian products and services as 'average'. Funding, access to modern technologies and mentorship were identified by innovators as key factors that can accelerate their rate of innovation. Lack of financial and technical resources was identified as the biggest barriers to commercialization of innovation output. Close to 70% of respondents agreed that Nigeria will experience numerous benefits if a national innovation index is developed and annually used to rate states of the federation

and sectors of the economy on their level of innovativeness. It was also discovered that Nigeria has a very low number of patents in force and low number of new patent applications; total IP registration in Nigeria for the last 5 years stood at 8,152 which is extremely low compared to values from Switzerland: 146, 716; South Africa: 350,379 and USA: 1,804,981.

NOTAP has commissioned a total of 68 IPTTOs across different states in Nigeria in a bid to promote and sustain a culture of IP registration among researchers and innovators in Nigeria. 65% of all IP certifications in the last 5years have been facilitated by NOTAP.

Several laudable initiatives, policies and programs have been put in place to accelerate and sustain innovation in Nigeria, some of these include: the NSTI, NSB, NDEPS, NDIESP, etc. Some SPVs such as ONDI and NODITS have also been established to promote innovation in Nigeria. Despite these innovation promotion measures, Nigeria still ranked low on the GII; this was because Nigeria performed better in innovation inputs than outputs for year 2020 and 2021. Also, lack of reference data for Nigeria on most GII indicators affected Nigeria's GII score negatively. Funding, commercialization, awareness, ecosystem linkages, applied research, patenting, etc. were identified as key enablers that can promote and sustain innovation in Nigeria. A SWOT analysis of the Nigeria innovation ecosystem was also performed.

Conceptual Framework for Determining National Innovation Index (NII)

A conceptual framework for determining national innovation index (NII) of Nigeria was developed. This framework was mirrored from the GII conceptual model but tailored to use indicators that are peculiar to the Nigerian climate. It was also benchmarked with the Indian Innovation index framework, South African innovation scorecard framework and the Bloomberg Innovation Index model. The conceptual NII framework uses enablers (innovation inputs) and performance (innovation output) to determine the national innovation score. Enablers have 5 pillars: Funding & Investments, Human Capital, Technology Eco-system, Business Environment and Regulatory System. Performance has 3 pillars: Knowledge Output, Economic Output and Knowledge Diffusion. A total of 30 indicators (20 enabler indicators and 10 performance indicators were identified for use across these pillars. The enabler score is the mathematical average of scores of all 5 enabler pillars while the performance score is the mathematical average of scores of all 3 performance pillars. The innovation efficiency ratio is the ratio of performance score to enabler score expressed in percentage. The final national innovation score is the mathematical average of enabler score and performance score. The conceptual NII framework was jointly reviewed during the focus group discussion session with innovation ecosystem stakeholders who were present.

Pilot NII Measurement for Selected States

One state per geopolitical zone was selected for the simulated pilot measurement of NII using the developed conceptual framework and indicators. These states are: Adamawa, Enugu, FCT Abuja, Kaduna, Lagos and Rivers. Data values on 10 out the 30 indicators were readily available while 20 indicators were either unavailable or inaccessible.

After NII computation, Lagos state emerged as the most innovative state in Nigeria with a score of 86.61%; Kaduna ranked 2nd with a score of 55.89 and FCT ranked 3rd with a score of 52.88%. Key strengths of Lagos innovation ecosystem include: high concentration of innovators, tech hubs, incubators, educational institutions & research institutions, healthy education budget and good foreign direct investments. The 6 pilot states were ranked as follows: Lagos, Kaduna, FCT, Rivers, Enugu and Adamawa.

Challenges with the Pilot NII Measurement

a. Lack of reference data on several indicators identified in the conceptual framework.
b. Poor data analysis and online publication culture by government MDAs on critical indices on innovation in Nigeria.
c. Prevailing ASUU strike limited the ability to obtain primary data from tertiary institutions on indicators related to academia.

Conclusion

The pilot NII measurement using the conceptual NII framework provided insights on innovation indices across the selected states; it also revealed strengths and weaknesses in the innovation ecosystem in the states – an indication of the potential benefits that Nigeria will derive from adoption and implementation of the conceptual national innovation index framework.

Recommendations

a. Need to strengthen linkages between government, academia and industry to foster innovation in Nigeria.
b. Need for NCC to create awareness on the existence and benefits of the NII.
c. Improve collaboration between NCC and key ecosystem stakeholders to drive and sustain the NII agenda.
d. NCC in collaboration with NITDA, FMoCDE and NEITI should drive awareness and compliance with the Nigeria Open Data Policy (launched by NEITI in December 2016); sector regulators also need to implement and deploy a national open data portal where key socio-economic indices can be reported on and accessed.
e. NCC should institutionalize the NII measurement across all states. The NII report can be published biennially (every 2 years) using data from the preceding year as reference.
f. NCC and other regulators should engage more in collaborative regulation to foster the growth and development of the innovation ecosystem in Nigeria.
g. Need for increased support from government to innovators through funding, infrastructure development and creation of enabling environment.
h. NCC and other ecosystem stakeholders should encourage private sector participation and support for innovation in Nigeria.

1. Background and Introduction

1.1 Synopsis

In the last two (2) decades, the world has experienced several ground-breaking innovations and emerging technologies in diverse sectors such as telecommunications & ICT, financial services, agriculture, automotive, energy, consumer good etc. These innovations have resulted in economic growth and development of countries who are at the fore-front of creating, promoting and sustaining innovations in their countries and regions.

Education, human capital, infrastructure, research and development (R&D), leadership, regulations and funding are some of the key factors that determine the level of innovation outputs within a country.

According to the National Population Commission, NPC (2022), "***the current population of Nigeria is 216,729,557 as of Monday, August 1, 2022, based on Worldometer elaboration of the latest United Nations data***"[1]. The NPC also estimates the median age in Nigeria as **18.1 years** and ranks globally as the 7th most populous nation on earth.

Several tech start-ups and innovators are emerging every day in the Nigeria, this is evident in the number of tech hubs & innovation parks springing up across the country as well as number of telecommunication-based research grants being awarded annually. Despite Nigeria's strong human capital and increasing number of innovators & researchers, just a few of the innovative outputs (products and services) have been commercialized nationally and made available on the global market – a direct indication of the existence of bottlenecks and challenges in the Nigerian innovation value chain.

Several initiatives aimed at supporting and promoting innovation currently exist in Nigeria; quite notably, the Nigerian Communications Commission (NCC) has been at the forefront of promoting innovation in Nigeria via program sponsorships, research grants, provision of infrastructure and regulatory frameworks. This is also evident in NCC's defunct Strategic Vision Plan (SVP) 2015 - 2020 and its current SVP 2021 – 2025. The private sector (notably commercial banks) have also contributed immensely in this sphere; there also exists the Nigerian Innovation Summit (NIS), which helps Nigeria embrace innovation and move in the direction of digital transformation using emerging technologies and trends, R&D, commercialization, entrepreneurship, and investments as the key drivers of an innovation ecosystem. NIS is currently in its 7th year.

[1] National Population Commission, NPC (2022), "*Statistics*" - https://nationalpopulation.gov.ng/statistics/#:~:text=Nigeria%202020%20population%20is%20estimated,(and%20dependencies)%20by%20population; (Nigerian population statistics as at 1st August, 2022).

The Global Innovation Index (GII), an annual report on innovation rankings and assessment for countries published by the World Intellectual Property Organization (WIPO), shows a steady decline in innovation in Nigeria for the last three (3) consecutive years. Nigeria's GII fell from 23.90 in 2019 to 20.10 in 2021 as shown in the figure below.

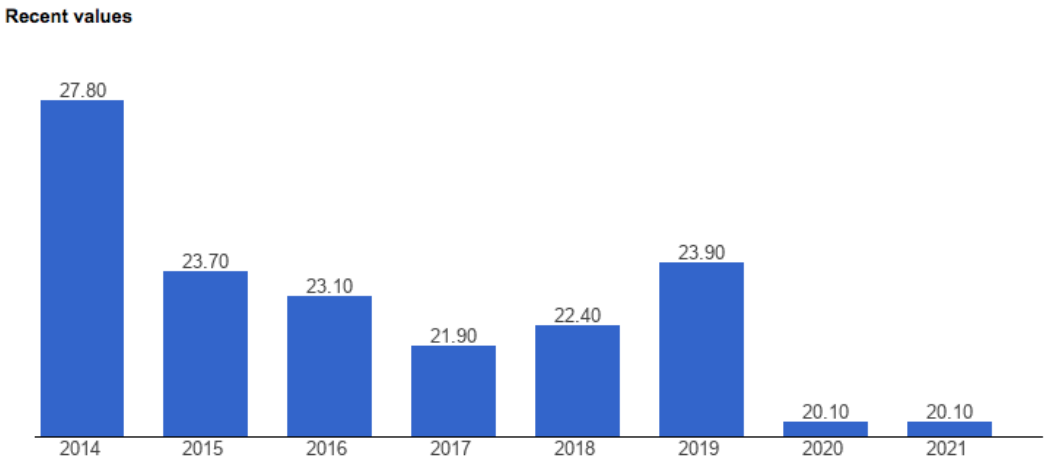

Figure 1: Nigeria's GII ranking 2014 to 2021
Image Source: https://www.theglobaleconomy.com/Nigeria/GII_Index/

The GII report of 2021 ranks Mauritius, South Africa, Kenya and Cape Verde as the most innovative countries in Africa; the world's most-innovative economy in 2021 was Switzerland followed by Sweden, the United States of America (USA), the United Kingdom (UK) and Republic of Korea. Nigeria ranked 118th out of 132 countries in the 2021 rankings[2].

Although, the GII is based on a set of globally applicable indicators for assessing innovation across countries, it is also important to explore indicators that are peculiar and indigenous to the Nigerian innovation ecosystem – hence the need to develop a national innovation index and perform a pilot assessment of innovation in Nigeria using those indicators. Subsequently, using the national innovation index framework, NCC will be able to rank states of the federation and different sectors of the economy by their capacity for, and success in, innovation.

This project focuses on "**Consultancy Study on Development of a National Innovation Index".** This index will be referred to as the Nigerian Innovation Index (NII). Asides being able to rank states of the federation and sectors of the economy, the NII will also provide insights to the areas for strength, weakness, opportunity and threat (SWOT) in the Nigerian innovation landscape.

[2] WIPO (2021), "*Global Innovation Index 2021 (14th Edition)*" - https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf

1.2 Project Aim and Objectives

The aim and objectives of the project include:

a. To identify the factors responsible for Nigeria's low ranking on the Global Innovation Index and suggest possible ways of addressing the issues.
b. To develop a framework for the development of a National Innovation Index for Nigeria in line with global best practices.
c. To develop a standard matrix outlining the indices for measuring the level of indigenous Innovations.

1.3 Project Scope

The scope of work includes but is not limited to the following:

a. Provide a conceptual definition of Innovation and discuss extensively viable and adaptable innovation cycle for the Nigerian Market.
b. Provide answers to the following questions:
    i. What influences the rate of innovation?
    ii. What are the challenges that inhibit growth in the rate of innovation in Nigeria?
    iii. What are the potential benefits that a National Innovation Index will have on Nigeria?
    iv. What are the critical indices for Developing an Innovation Index for Nigeria?
    v. What metrics can be used to map and measure Innovation in Nigeria?
    vi. How can an Innovation Index be helpful towards Nigeria's transformation to a digital economy?

In addition to providing answers to the questions above, we will also provide insights to the level of indigenous innovation in Nigeria by assessing innovation in Nigeria using indices from the NII framework that will be developed. The assessment report will lay the foundation for future measurement of indigenous innovation.

2. Synopsis on Innovation & Case for a National Innovation Index

2.1 Innovation Cycle

2.1.1 Innovation

Simply put, Innovation is the practical implementation of ideas which results in improved products or services. The end-product must be "improvement" on existing products or services; without improvement, no innovation has taken place.

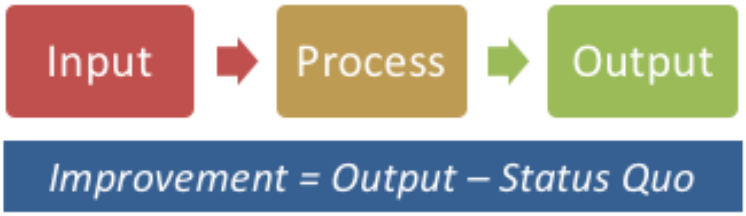

Figure 2: Improvement as outcome from innovation

Innovation accelerates growth and provides the needed competitive advantage for economic development. Most developed and advanced economies of world recognize this importance and have since instituted mechanisms to ensure the sustainability of continuous innovation in their countries.

2.1.2 Types of Innovation

The Organisation for Economic Co-operation and Development (OECD) in its Oslo Manual of 2018, defined four (4) types of innovation as follows:

a. **Product Innovation:** *A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics.*
b. **Process Innovation:** *A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.*
c. **Marketing Innovation:** *A new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.*
d. **Organizational Innovation:** *A new organisational method in business practices, workplace organisation or external relations.*

In the same context, OECD (2018) gave an official definition of innovation as: "***a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)***"[3].

[3] OECD (2018), "*Oslo Manual – Chapter 2: Concepts for Measuring Innovation*" - https://www.oecd-ilibrary.org/docserver/9789264304604-5-en.pdf?expires=1650642856&id=id&accname=guest&checksum=B8F709FDD4D573627515A7B6F5BA8142; *p60*

2.1.3 Benefits of Inventions and Innovation

Inventions and innovation in general bring about the following benefits:

a. Creation of new industries and frontiers.
b. Creation of new value-added products and services.
c. Creation of new employment opportunities.
d. Economic growth and development.
e. Attracts local and foreign investments.
f. Accelerates use and adoption of new and emerging technologies.
g. Encourages continuous research and development.
h. Promotes competition.

2.1.4 The Innovation Cycle

The innovation cycle starts with ideation/conceptualization and ends with commercialization. This cycle is non-stop because the need for continuous improvements necessitates a repetitive cycle. This is the reason automotive manufacturers constantly bring out new models of vehicles, electronics and phone manufacturers release new versions of their products, software companies release patches and product updates periodically etc. 'Improvement' is the ultimate goal in the innovation cycle. The figure below shows the typical innovation cycle.

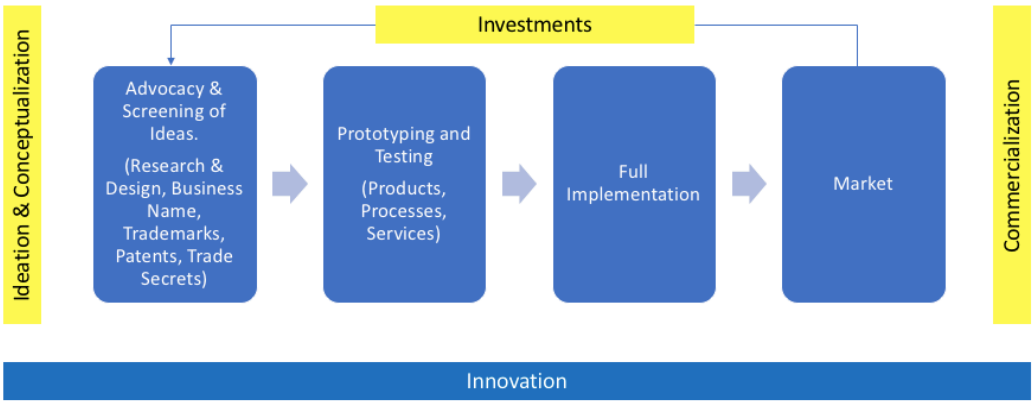

Figure 3: Innovation Lifecycle

In summary, the core stages in the innovation cycle are:

a. Ideation & conceptualization.
b. Advocacy & Screening of ideas.
c. Prototyping and Testing
d. Full Implementation &
e. Commercialization

2.2 Innovation Index

Innovation index is a rating which provides insight on the capacity for (i.e. input) and success in (output) in Innovation.

As shown in chapter 2.1.1, the innovation process requires certain inputs to give outputs; the evaluation, measurement and assessment of innovation must take these factors into consideration.

Indicators provides an empirical means to compute and estimate innovation index. This implies that the measurement of innovation is via pre-defined indices. The internationally recognized innovation index is the Global Innovation Index (GII) which ranks the innovation levels of various economies globally. Over the years, the GII has influenced development of different national indigenous innovation indices especially for emerging economies; little wonder the WIPO (2016) noted that: "***The GII is not meant to be the ultimate and definitive ranking of economies with respect to innovation. Measuring innovation outputs and impacts remains difficult, hence great emphasis is placed on measuring the climate and infrastructure for innovation and on assessing related outcomes.***"[4]

2.3 The Global Innovation Index (GII) Reference Framework

The **Global Innovation Index (GII)** is a ranking of the innovation ecosystem performance of economies around the globe each year while highlighting innovation strengths, weaknesses and gaps in innovation metrics. GII is powered by WIPO and INSEAD**.** Since its inception in 2007, the GII has matured to a robust ranking and rating framework which uses multiple indicators to determine the innovation index of a country.

The GII framework is based on five (5) input pillars and two (2) output pillars. The input pillars are:

a. Institutions
b. Human Capital and Research
c. Infrastructure
d. Market Sophistication
e. Business Sophistication

The output pillars are:

a. Knowledge and technology outputs
b. Creative outputs

[4] WIPO (2016), "*Annex 1: The Global Innovation Index (GII) Conceptual Framework*" - https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016-annex1.pdf;

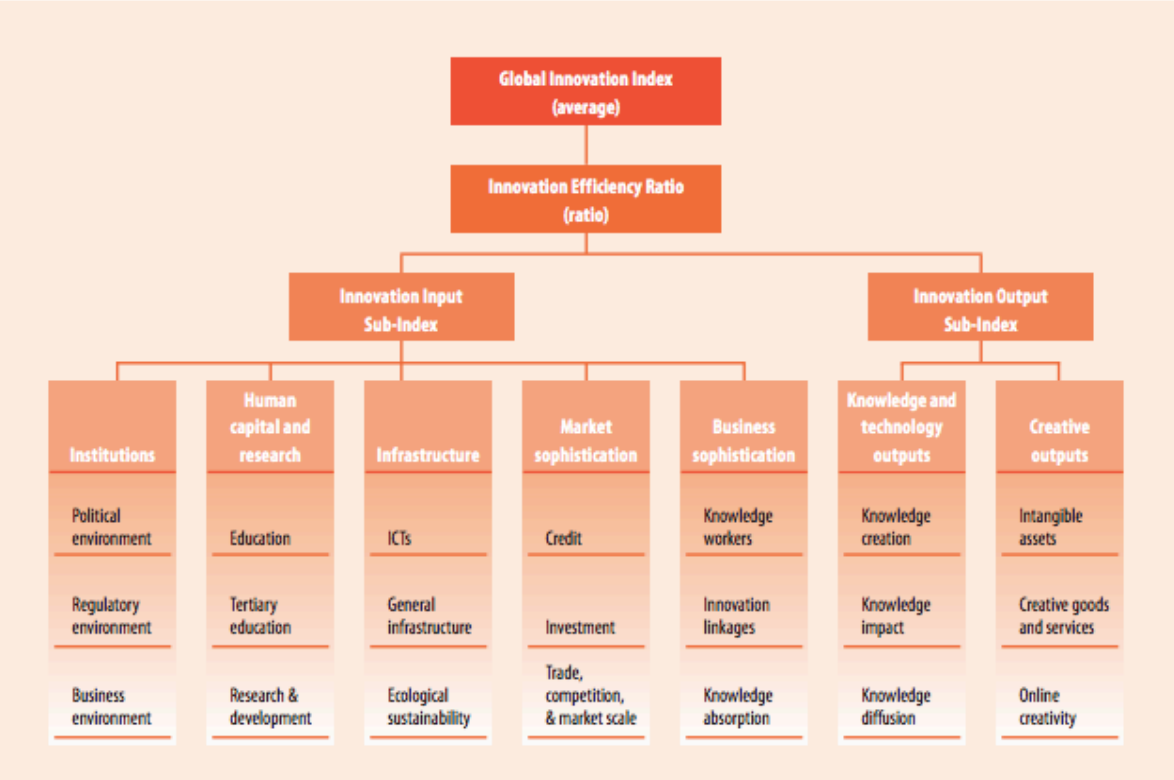

Figure 4: Global Innovation Index reference framework
Image Source: WIPO (2016), "*GII Conceptual Framework*" - https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016-annex1.pdf

2.3.1 Notable Points from the GII Reference Framework

a. Indicators are grouped into input and output indicators.
b. There are five (5) input pillars and two (2) output pillars.
c. Each pillar is further divided into three (3) sub-pillars.
d. Each pillar is further divided into sub-indicators for computational assessment.
e. The current GII framework 2021 was based on a total of eighty-one (81) indicators and presents a Strength-Weakness score board for each country.
f. The efficiency ratio is the output-to-input indices ratio.
g. The efficiency ratio provides insight on how much innovation outputs are achieved for the given inputs.
h. The GII score is the simple average of input and output indices.
i. A strength and weakness analysis based on performance in each index is presented in a score board.

NOTE: The conceptual framework in **chapter 5** for determining National Innovation Index (NII) is modelled around the globally recognized GII framework which uses a combination of innovation enablers and innovation outputs to determine innovation index.

2.4 A Strong Case for an Indigenous National Innovation Index (NII)

The recommendation by WIPO to consider the climate and infrastructure in measuring innovation (as noted in Chapter 2.2 above), presents a strong case for an indigenous National Innovation Index (NII). This is also evident in recent trends buttressing the uniqueness of the innovation landscape and eco-system in Nigeria. Some of these events and trends include:

a. The city of Lagos was ranked 7th out of 29 major cities Africa in the 2021 Knight Frank report on most innovative cities in Africa. (see https://africabusinesscommunities.com/news/nairobi-is-the-most-innovative-city-in-africa-knight-frank-report/).
b. Y-Combinator (YC) latest batch - W22, features 24 African start-ups, including 18 from Nigeria i.e. 75% of the total start-ups. (source: https://techcrunch.com/2022/03/29/yc-w22-batch-nets-24-african-startups-including-18-from-nigeria/).
c. Y-Combinator's growing set of alumni from Nigeria features remarkable names like Flutterwave, Paystack and Kobo360 (others include Cowrywise, Kudi, Healthlane, 54gene and CredPal).
d. Lagos overtook Nairabi in 2021 as Africa's leading start-up hub.(source: https://www.premiumtimesng.com/news/more-news/469338-lagos-overtakes-nairobi-as-africas-leading-startup-hub.html)
e. In 2018, Nigeria became the 4th largest country-community on GitHub – a code repository community. (source: https://technext.ng/2018/10/17/githubuniverse-nigeria-is-fourth-fastest-growing-country-community-on-github/)
f. Between 2018 and 2021, NCC has awarded over N480 million in grants for 45 telecommunication-based research innovations projects to various tertiary institutions across the country.
g. On 7th April, 2022, NCC awarded N233 million in research grants and professional chair. From the total sum, N172.5m was awarded to support 13 proposals that met the stipulated criteria for telecommunication-based research innovations. (Source: https://www.ncc.gov.ng/media-centre/news-headlines/1195-news-release-ncc-awards-n233-million-in-research-grants-professorial-chair-endowments).
h. The Nigeria Innovation Submit 2021 recognized 8 awardees across various sectors (FinTech, EdTech, Heath Tech, Mobility, Energy, Ecosystem Player and Finance) for outstanding achievements in Innovation. (Source: https://innovationsummit.ng/awards/).

i. Deel report on hiring for 2021 shows that companies hiring in Africa for remote work rose to 800%; almost 10% of payroll withdrawals from contracts in Africa are in cryptocurrency while top countries in Africa where hiring is growing include Nigeria, South Africa, and Kenya. (Source: https://www.vanguardngr.com/2022/02/remote-work-companies-hiring-in-africa-rises-to-800-deel-report/).

j. African Development Bank Board approved $170 million in December 2021 for investment in Nigeria's digital and creative start-ups through the "investment in Digital and Creative Enterprises" (i-DICE) Program. (Source: https://www.afdb.org/en/news-and-events/press-releases/african-development-bank-board-approves-170-million-investment-nigerias-digital-and-creative-start-ups-48015).

k. In December 2021, the Federal Ministry of Communication and Digital Economy (FMoCDE) approved NITDA's establishment of the Office for Nigerian Digital Innovation (ONDI). (Source: https://techeconomy.ng/2021/12/pantami-approves-nitdas-creation-of-the-office-for-nigerian-digital-innovation-ondi/).

3. Approach and Methodology

3.1 Stakeholder Identification and Categorization

The table below enumerates the key stakeholders in the Nigerian innovation value-chain. These stakeholders played a critical role in the data collection phase of project implementation.

Table 1: Stakeholder Categorization in the Innovation Value Chain

SN	Group	Role	Stakeholders
1.	Entrepreneurs	a. Innovation	b. Innovators c. Researchers
2.	Government	a. Policy & Regulation b. Funding & Promotion c. Infrastructure d. Capacity Building	a. Policy and Regulation MDAs b. Infrastructure Development MDAs c. Innovation Financing MDAs d. Training and Capacity Building MDAs e. Research and Development MDAs
3.	Innovation Hubs	a. Catalyst b. Capacity Building c. Mentorship d. Workspace e. Collaboration	a. Technology and Innovation hubs b. Incubators c. Accelerators d. Digital Industrial Parks
4.	Academia	a. Research and Development b. Capacity Building	a. Research Institutions b. Tertiary Institutions
5.	Investors	a. Funding & Investment	a. Venture Capitalist (VC) b. Private sector businesses c. Individuals d. Developmental Organizations
6.	Consumers	a. Market	a. Individuals b. Businesses (private and Public) c. Informal Sector

3.2 Implementation Approach

Project implementation was executed in incremental stages. The six (6) stages of project implementation are enumerated below.

a. **Stage 1:** Planning and preparation activities, preliminary review of reference documentation and reports, design and development of survey instruments, engagement with project stakeholders.
b. **Stage 2:** Field survey exercise (quantitative and qualitive survey).
c. **Stage 3:** Quantitative & Qualitative Data Analysis; in-depth review of reference documentations and reports.
d. **Stage 4:** Development of the Conceptual NII Framework, focus group discussion on the developed conceptual framework and presentation to NCC.
e. **Stage 5:** Pilot NII measurement for selected states.
f. **Stage 6**: Consolidation and Reporting.

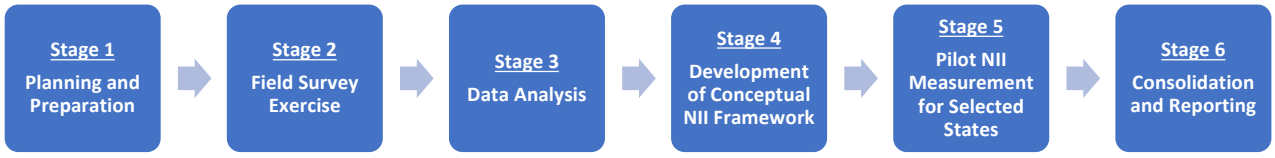

Figure 5: Project Implementation approach showing stages

3.3 Implementation Methods

Five key methods were used for project implementation. These are:

a. Review of reference documentations and reports on the subject matter.
b. Quantitative Survey and Analysis.
c. Qualitative Survey and Analysis.
d. Benchmarking.
e. Simulation Measurement.

The figure below shows top-level summary of the implementation methods.

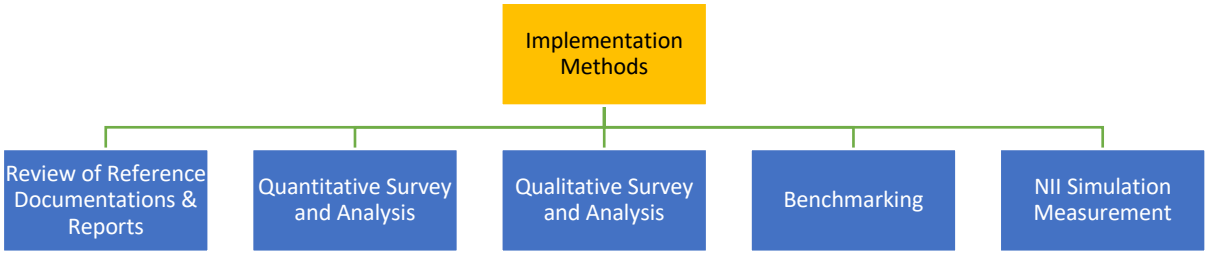

Figure 6: Implementation Methods

3.3.1 Review of Reference Documentations:

The documentations reviewed include but is not limited to:

a. Global Innovation Index Report 2020 by WIPO
b. Global Innovation Index Report 2021 by WIPO
c. GII conceptual framework 2016 by WIPO
d. Ecosystem Report: Nigeria's Start-up Scene 2020 by JICA
e. National Digital Economy Policy and Strategy 2020 – 2030 by FMoCDE
f. Nigeria Digital Innovation, Entrepreneurship & Start-up Policy (NDIESP) by NITDA.
g. National Science, Technology and Innovation (STI) Policy by FMSTI
h. Nigeria's Start-up Bill 2021
i. South Africa Innovation Index Framework Score card 2016
j. UAE National Innovation Strategy 2015
k. India Innovation Index 2021
l. Oslo Manual 2018 by OECD
m. Several newspaper publications, journals and blog posts.

3.3.2 Quantitative Survey and Analysis

A field survey exercise was conducted with respondents selected from the Nigeria innovation ecosystem. The survey instrument used was **questionnaires**. See **Appendix A.1, A.2 and A.3** for the questionnaire designs. Respondents were grouped into three (3) categories as follows:

a. **Group A**: Innovators, Entrepreneurs, Techpreneurs, Start-ups, Researchers.
b. **Group B:** Innovation/Tech Hubs, Incubators, Academia, Research Institutions, Government & Investors.
c. **Group C**: Consumers.

A **Multi-stage and stratified sampling technique** were used to select respondents from each of the categories. A minimum sample size of 1,000 was used for the survey.

Table 2: Sample Size Distribution

SN	State	Group A	Group B	Group C	Total
1.	Adamawa	10	10	100	**120**
2.	Abuja	40	20	150	**210**
3.	Kaduna	20	15	100	**135**
4.	Enugu	15	10	100	**125**
5.	Rivers	15	15	100	**130**
6.	Lagos	50	30	200	**280**
	Total	**150**	**100**	**750**	**1,000**

Group A: Innovators, Entrepreneurs, Techpreneurs, Start-Ups and Researchers
Group B: Tech hubs, Academia, Investors, Government
Group C: Consumers (Individuals and businesses)

Baseline factors considered in sample size determination and state selection:

a. Total of 85 active tech/innovation hubs in Nigeria with Lagos and Abuja as key tech hub locations. (Source: https://briterbridges.com/618-active-tech-hubs).
b. Total of 43 Federal Ministries and 42 Federal Agencies with predominant presence in Abuja. (Source: https://www.osgf.gov.ng/ministries and https://www.osgf.gov.ng/federal-agencies).
c. 4 of the 6 selected states are in the top 5 of the start-up ecosystem, ranked in the following order: Lagos, Abuja, River and Enugu. (Source: https://www.startupblink.com/startupecosystemreport.pdf; Page 188).

Questionnaire design for the different respondent groups is summarized below

SN	Category	Target Respondents	Question Scope
1.	Group A	a. Innovators b. Entrepreneurs c. Techpreneurs d. Start-Ups e. Researchers	a. Basic Demographic b. Innovation metrics c. Access to Technology & Infrastructure d. Factors promoting rate of innovation in Nigeria e. Factors inhibiting innovation in Nigeria f. Benefits of indigenous Innovation index g. Investment metrics h. Commercialization metrics i. Suggestions
2.	Group B	a. Tech hubs b. Academia c. Investors d. Government	a. Basic Demographics b. Strengths and Weaknesses of innovation ecosystem in Nigeria. c. Indices for Measuring innovation. d. Regulations and Policies for Innovation. e. Factors promoting rate of innovation in Nigeria. f. Barriers to innovation in Nigeria. g. Benefits of indigenous Innovation index. h. Suggestions.
3.	Group C	Consumers	a. Basic Demographics b. Awareness of Indigenous Innovation c. Use and Acceptance of indigenous innovation outputs. d. Rating of indigenous innovation e. Areas of Improvement f. Suggestions

The table below enumerates the key respondents sampled during the field survey exercise

Table 3: List of Respondents per Category

SN	Respondent Group	Key Respondents
1.	**Group A:** *Innovators, Entrepreneurs, Techpreneurs, Start-ups, Researchers*	a. Several innovators and technpreneur encountered during visit to tech hubs and incubation centres b. Entrepreneurs (small and medium scale) in ICT and related fields. c. Researchers in Academia and research institutions
2.	**Group B:** *Innovation/Tech Hubs, Incubators, Academia, Research Institutions, Government & Investors*	**Tech hubs, Incubators and Investors:** a. Ventures Park Abuja b. Aiivon Innovation Hub, Abuja c. Box Office Hub d. Experis Immersive Creative Agency e. Harmony Innovation Hub, Abuja f. Civic Innovation Hub, Abuja g. Binary Hills, Enugu h. Genesys Tech Hub, Enugu i. Cloud 10 Tech hub, Kaduna j. Lexington Hub, Kaduna k. Kaduna ICT Hub, Kaduna l. 360 Creative Innovation Hub, Lagos m. Hub One, Lagos n. Co-Creation Hub, Lagos o. Lead Space Hub, Lagos p. The Nest Technology Innovation Park, Lagos q. Cosmo Tech Learning Hub, Adamawa r. Arkgee Computers Limited, Adamawa s. American University of Nigeria Center for t. Appable System, Rivers State u. Kronicles Tech, Rivers State v. Kowork NG, Rivers State **Academia and Research Institutions**: a. Baze University, Abuja b. Federal University of Technology, Minna c. American University of Nigeria, Adamawa d. Yaba College of Technology, Lagos e. Adamawa State Polytechnic f. Institute of Management & Technology (IMT), Enugu g. University of Port Harcourt, Rivers State h. University of Nigeria Nsukka, Enugu i. National space Research and Development Agency (NASDRA) j. Air Force Institute of Technology, Kaduna

		Government MDAs: a. Federal Ministry of Communications and Digital Economy (FMoCDE) b. Nigerian Communications Commission (NCC) c. National Information Technology Development Agency (NITDA) d. Office for Nigerian Digital Innovation (ONDI) e. National Office for Technology Acquisition and Promotion (NOTAP) f. Federal Ministry of Science, Technology and Innovation (FMSTI) g. Federal Ministry of Trade and Investment h. Small and Medium Enterprise Development Agency of Nigeria (SMEDAN) i. Nigerian Export Promotion Council (NEPC) j. National Bureau of Statistics (NBS)
3.	**Group B:** *Consumers*	**Consumer Sectors:** a. Telecoms b. Finance c. Technology (Existing, New and Emerging) d. Manufacturing e. Education and Learning f. Agriculture g. Heath h. Mobility i. Energy j. Consumer goods k. Informal sector: Mobile-money operators, mobile phone repairers, ICT equipment merchants, business men & women, cyber-cafe operators, farmers, etc.

Data Collection Method

Computer-Assisted Personal Interview (CAPI) tool was used for data collection; this enabled reduction of human errors, increased data collection speed and logging of geolocation of respondents.

Data Analysis

Descriptive and inferential statistics were used to analyse the quantitative data. The analysed data were presented in tables, charts and graphs across different question dimensions. Finding and inferences were deduced through the data analysis.

3.3.3 Qualitative Survey and Analysis

Subject matter experts in the Nigerian innovation ecosystem were selected and interviewed on the project topic. The interviewees spanned across different groups of respondents as shown in the table below. The interview form/script used for the interview session is contained in **Appendix B.**

SN	Stakeholder Group	Target Interviewees
1.	Innovators	a. Innovators & entrepreneurs b. Researchers
2.	Government	a. Nigerian Communications Commission b. National Information Technology Development Agency (NITDA) c. National Office for Technology Acquisition and Promotion (NOTAP) d. Federal Ministry of Communications and Digital Economy (FMoCDE) e. Office for Nigerian Digital Innovation (ONDI) f. Small and Medium Enterprise Development Agency
3.	Innovation Hubs & Investors	a. Ventures Park, Abuja b. Aiivon Innovation Hub, Abuja c. Harmony Innovation Hub d. Genesys Tech Hub e. Kaduna ICT Hub f. Kowork NG, Port Harcourt, Rivers State g. Lead Space Hub, Lagos h. 360 Creative Innovation hub, Lagos i. Co-Creation hub, Lagos j. Passion Incubator hub, Lagos
4.	Academia	a. Baze University, Abuja b. Federal University of Technology, Minna c. American University of Nigeria, Adamawa d. Yaba College of Technology, Lagos e. University of Nigeria Nsukka, Enugu f. National space Research and Development Agency (NASDRA) g. Air Force Institute of Technology, Kaduna h. Enugu State University of Technology
5.	Ecosystem Associations	a. Innovation Support Network (ISN), Abuja
6.	Consumers	a. Selected from sampled Individuals and businesses

The interview sessions were aimed at complementing and consolidating the quantitative data collected. All gathered data were reviewed and analyzed. The conceptual framework was then developed using indicators that are peculiar to the Nigerian innovation ecosystem climate and infrastructure.

3.3.4 Benchmarking NII Frameworks

Benchmarking the conceptual NII framework with models developed by other countries and innovation-measuring organizations was done to identify areas of improvements with the conceptual framework as well as allow for comparative analysis. Key aspects of the NII framework that were benchmarked include:

a. Framework structure
b. Indicator design
c. Score computation model

The benchmarking was done against the following countries and institutions:

Table 4: Reasons for Country and Organization Selection for NII Benchmarking

SN	Benchmark Reference	Reasons for Selection
1.	WIPO	a. WIPO champions the Global Innovation Index (GII) which is globally recognized and accepted.
2.	South Africa	a. An African Country b. Ranked 2nd in Africa in the 2021 GII. c. Shares some socio-economic similarities with Nigeria such as land mass, telecoms sector, industry, life-expectancy, cost of living etc. See: https://www.worlddata.info/country-comparison.php?country1=NGA&country2=ZAF d. Developed the South African Innovation Index (SII) in 2016.
3.	India	a. Shares some socio-economic similarities with Nigeria such as population density, rural-urban ration, cost of living, unemployment rates, etc. See: https://www.worlddata.info/country-comparison.php?country1=IND&country2=NGA b. Steady improvements in India's GII ranking; from 66th position in 2016 to 46th in 2021. c. Developed the India Innovation Index in 2019.
4.	United Arab Emirates (UAE)	a. Developed and commenced implementation of indigenous national innovation strategy since 2015. b. UAE ranked 33rd globally and 1st regionally on the 2021 GII rankings.
5.	Bloomberg	a. Use of unique set of indicators for innovation measurement. b. Independent innovation measuring organization asides WIPO.

3.3.5 Focus Group Discussion

Upon development of the conceptual framework, a focus group discussion session was held on the 26th of August, 2022 with different ecosystem stakeholders. The focus group discussion session was aimed at:

a. Getting more in-depth insights from ecosystem stakeholders on the conceptual NII framework.
b. Discussion-based review of the indicators used in the conceptual NII framework.
c. Constructive criticism of the conceptual NII framework.
d. Obtaining suggestions on best ways of data collection for NII computation.
e. Identifying areas of improvements.

The table below enumerates the attendees of the focus group discussion session.

Table 5: Attendees of the Focus Group Discussion Session

SN	Name of Attendee	Organization	Designation
1.	Prof. Busura O. Sakariyau	Federal University of Technology, Minna	Head of Department, Entrepreneurship Technology
2.	Dr. Obiajunwa Obichi	Young Innovation Leaders (YIL) Fellowship, Lagos	Founder
3.	Mr. Uche Aniche	SSE Angel Network, Port Harcourt, Rivers State	Director, VC and Angel Investor
4.	Mr. Ahmad Bature Muhammad	Office for Nigeria Digital Innovation (ONDI)	Officer, Innovation Ecosystem Engagement
5.	Mr. Adeseye Oguntade	Office for Nigeria Digital Innovation (ONDI)	Lead, Innovation Ecosystem Desk
6.	Mr. Paul	Innovation Support Network (ISN)	Officer
7.	Mr. Ugochukwu Aronu	Xend Finance, Y-Create	Co-Founder
8.	Mr. Amadi Chimezie	Nigerian Communications Commission (NCC)	Assistant Director, Emerging Technology Research
9.	Mrs. Sa'adat El-Rufai	Nigerian Communications Commission (NCC)	Staff, R&D Department
10.	Miss. Badiyya	Nigerian Communications Commission (NCC)	Staff, R&D Department
11.	Engr. Charles Ofoefule	Cagewox Dot Net Limited	Project Delivery & Management

4. Key Findings on Innovation in Nigeria

Several findings have been made from analysis of gathered quantitative and qualitative data as well as review of reference documentations on innovation in Nigeria. The following section enumerates key findings on the subject matter.

4.1 Key Stakeholders Identified

Three (3) categories of stakeholders were identified in the Nigerian innovation ecosystem. They are:

a. **Innovation Output Producers:** These are individuals and organizations who create or produce innovation outputs i.e. innovators, researchers, etc.

b. **Innovation Ecosystem Regulators**: These are institutions tasked with the responsibility of policy formulation and innovation eco-system regulation.

c. **Innovation Promoters:** These are individuals and organizations responsible for promoting innovation in Nigeria through initiatives such as funding, infrastructure provision, innovation acceleration, start-up incubation, etc.

This category are strategic actors for catalysing innovation process. They are sub divided into three (3) categories:

1. Catalysts and Commercialization Agents
2. Processors and Early Adopters
3. Sensitization Agents

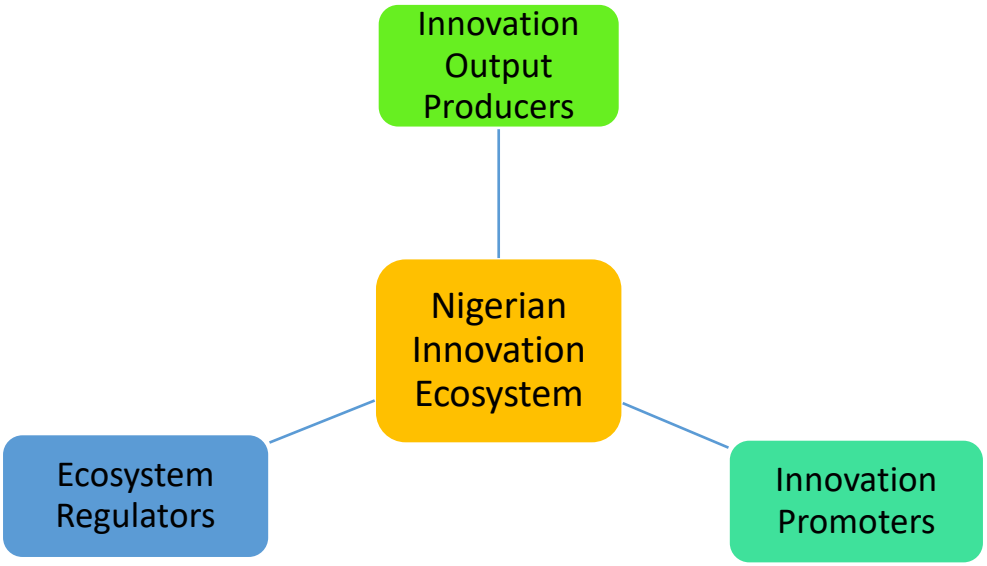

Figure 7: Innovation Ecosystem Stakeholder categories

The table below enumerates the categories of stakeholder in the Nigerian innovation ecosystem.

Table 6: Stakeholders in the Nigerian Innovation Ecosystem

SN	Category	Stakeholders
1.	**Innovation Output Producers**	Innovative Individuals and organizations such as a. Techpreneurs, Entrepreneurs b. Researchers (Academia) c. Startups d. Private companies, Manufacturers e. Government organizations
2.	**Ecosystem Regulators**	a. National Assembly (NASS) b. NCC for telecommunications and ICT sector c. CBN for formal and informal financial sector d. SEC for Nigerian capital market e. NAICOM for Insurance sector f. NUC, NBTE and NCCE for tertiary education g. MAN, FCCPC & SON for the manufacturing sector h. Standards Organization of Nigeria (SON)
3.	**Innovation Promoters**	**Catalysts and Commercialization Agents** a. Federal Ministry of Science, Technology and Innovation b. FMoCDE c. Office of Nigeria Digital Innovation (ONDI) d. Nigerian Communication Commission (NCC) e. Universal Service Provision Fund (USPF) f. National Information Technology Development Agency (NITDA) g. National Office for Technology Acquisition and Promotion (NOTAP) h. National Board for Technology Incubation (NBTI) i. Corporate Affairs Commission (CAC) j. Presidential Enabling Business Environment Council (PEBEC) k. Nigerian Office for Trade Negotiations (NOTN) l. Tertiary Education Trust Fund (TETFund) m. Nigerian Content Development and Monitoring Board (NCDMB) n. Africa Development Bank (AfDB) o. Nigerian financial institutions p. Investors q. Tech hubs, Incubators, etc **Processors and Early Adopters** a. Small and Medium Enterprise Development Agency (SMEDAN) b. National Directorate for Employment (NDE) **Sensitization Agents** a. National Orientation Agency (NOA) b. National Institute of Cultural Orientation (NICO) c. Civil society organizations (CSOs)

4.2 Findings from Field Survey Exercise

The field survey data for the study was gathered from three (3) groups of respondents.

a. **Group A**: Innovators, Entrepreneurs, Techpreneurs, Start-ups, Researchers.
b. **Group B:** Innovation/Tech Hubs, Incubators, Academia, Research Institutions, Government & Investors.
c. **Group C**: Consumers.

A total of **1,136** respondents were sampled (i.e. 136 more than the projected 1,000 respondents). The tables and charts below show the subcategories for the respondents.

4.2.1 Respondent Distribution, Categories and Demographics

Table 7: Respondent Distribution by State and Group

	Adamawa	Abuja	Enugu	Kaduna	Lagos	Rivers	Total	%
Group A	12	42	16	22	59	25	**175**	**15.41**
Group B	15	21	15	13	74	18	**156**	**13.73**
Group C	108	168	105	102	200	121	**805**	**70.86**
Total	**135**	**231**	**136**	**137**	**333**	**164**	**1,136**	**100.00**
%	**11.88**	**20.33**	**11.97**	**12.06**	**29.31**	**14.43**	**100.00**	

The figure below shows the respondent distribution.

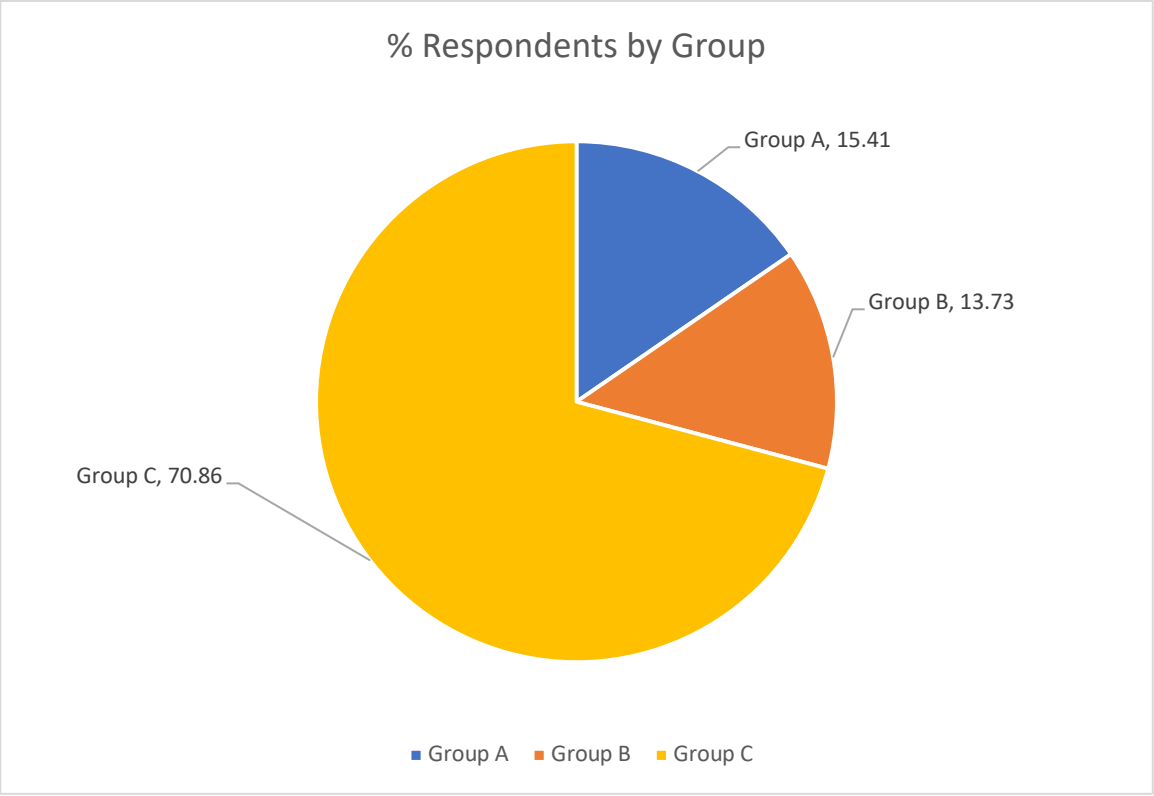

Figure 8: Respondent Distribution by Categories

The figure below shows the distribution of respondents by state of location.

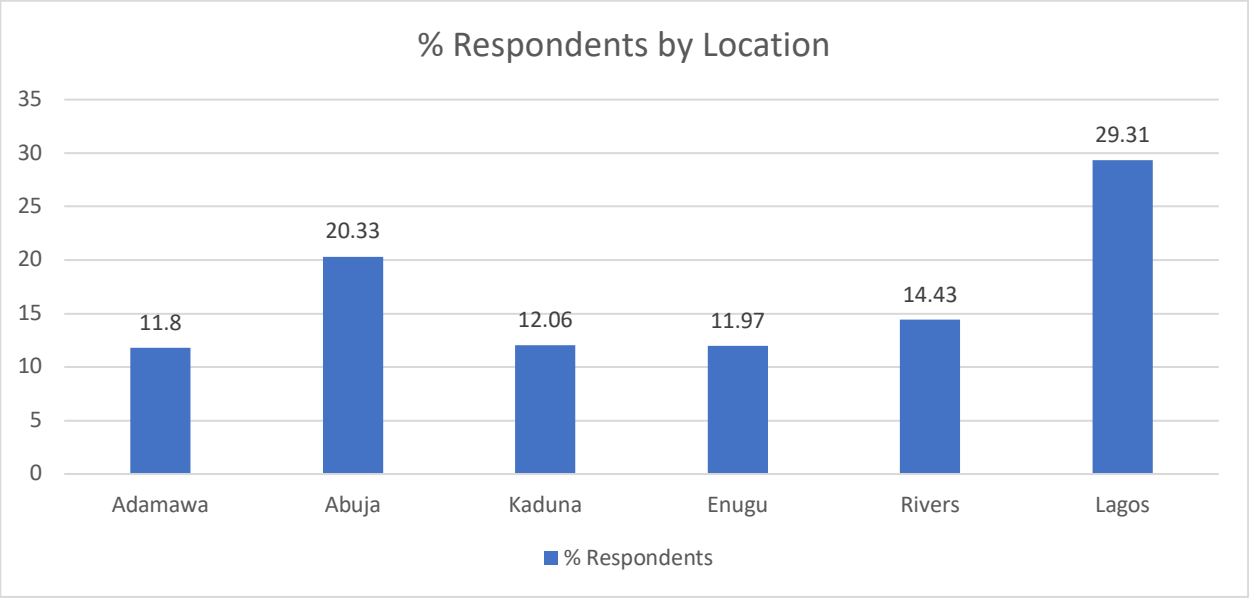

Figure 9: Respondent Distribution by Location

The geo-location maps for respondents across these locations are shown below:

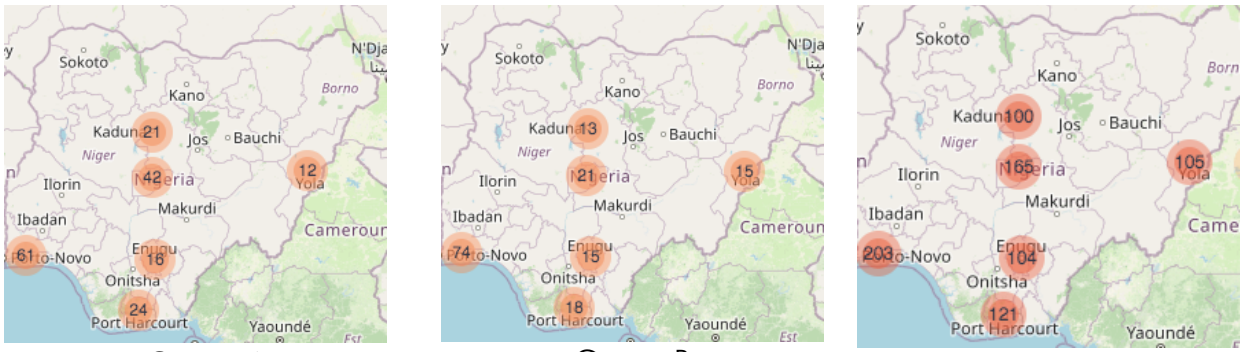

Figure 10: Geo-location Map of Respondents

Analysis of sub-categories of respondents for the different groups are shown below.

Table 8: Group A Respondents

Group A: Sub Categories	(%)
Entrepreneur	35.80
Researcher	18.18
Techpreneur	25.57
Others	20.45
Total	**100.00**

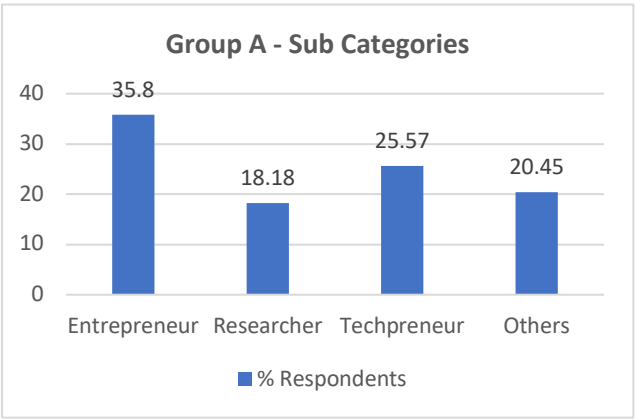

Figure 11: Group A respondent Distribution

Table 9: Group B Respondents

Group A: Sub Categories	(%)
Academia	23.08
Government MDA	13.46
Innovation/Tech Hub	23.08
Investor	15.38
Research Institutions	25.00
Total	**100.00**

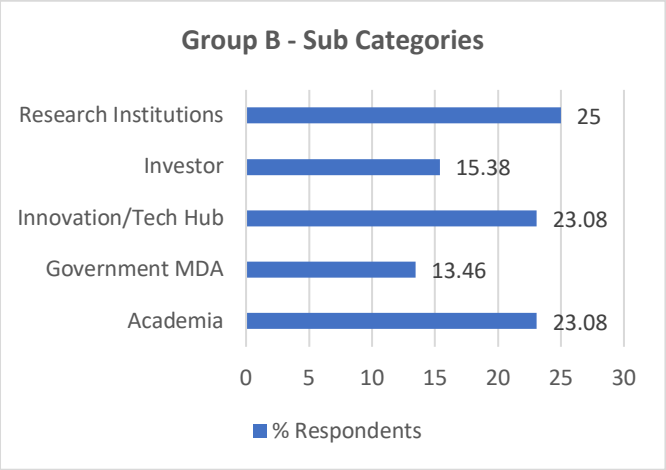

Figure 12: Group B respondent Distribution

The Demographics for gender, age and highest qualification of consumers sampled is shown below:

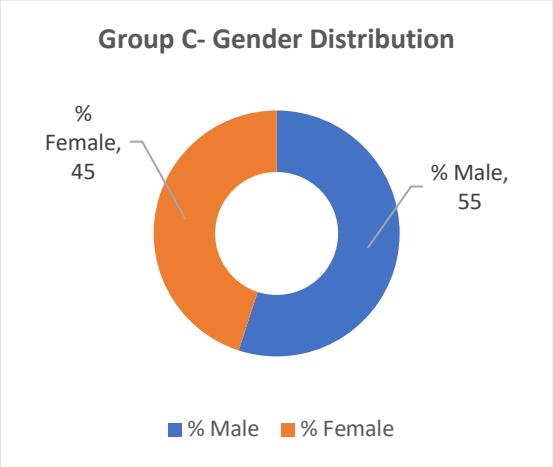

Figure 13: Group C - Gender Distribution

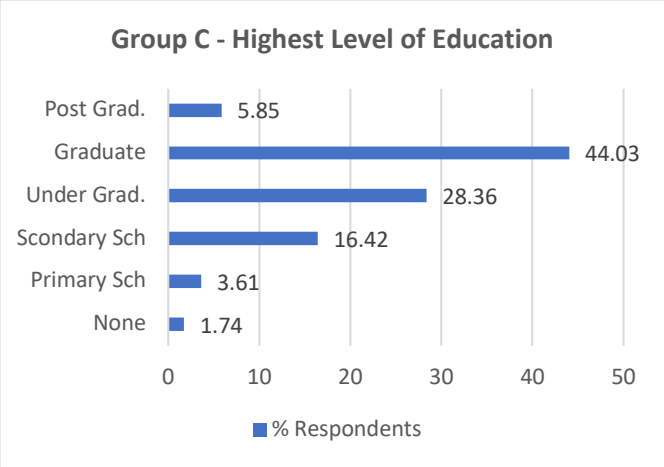

Figure 14: Group C: High Level of Education

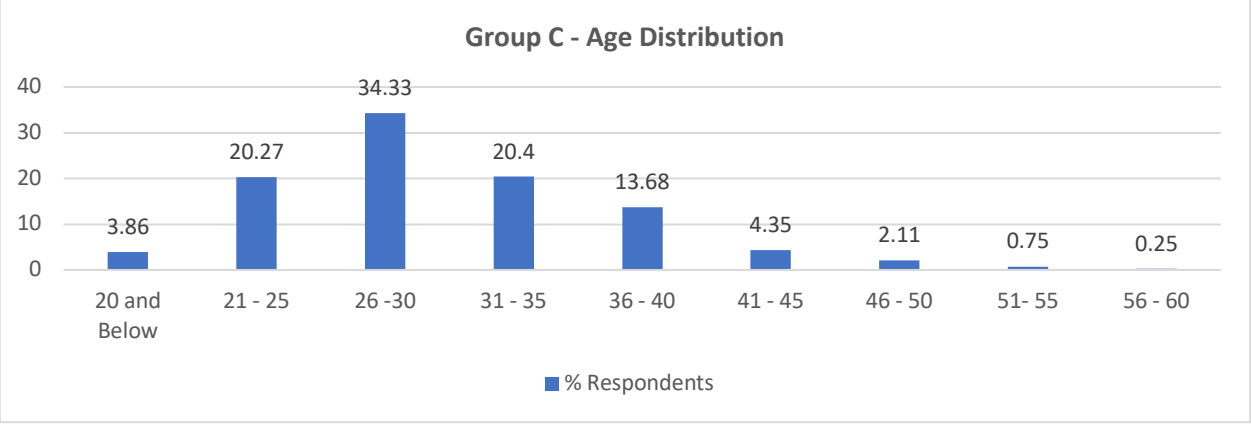

Figure 15: Group C - Age Distribution

4.2.2 Survey Results on Strengths of Nigerian Innovation Eco-System

Innovation/Tech Hubs, Academia, Research Institutions, Government MDAs & Investors rated the following as top 5 strengths of the Nigerian innovation ecosystem.

a. Human Capital
b. Education & Research Institutions
c. Funding & Investment
d. Creative Goods & Services
e. Knowledge

The data table below shows the response distribution.

Table 10: Responses for Key Strengths of the Nigerian Innovation Ecosystem

Question: Which of these is the key strength of the Nigerian innovation eco-system?		
SN	Response	Frequency (%)
1.	Human Capital	20.51
2.	Education & Research Institutions	20.51
3.	Funding & Investment	17.31
4.	Creative Goods & Services	9.62
5.	Knowledge	8.33
6.	Others	7.69
7.	Infrastructure	7.05
8.	Market Demand	4.49
9.	Market Scale	4.49
	Total	100.00

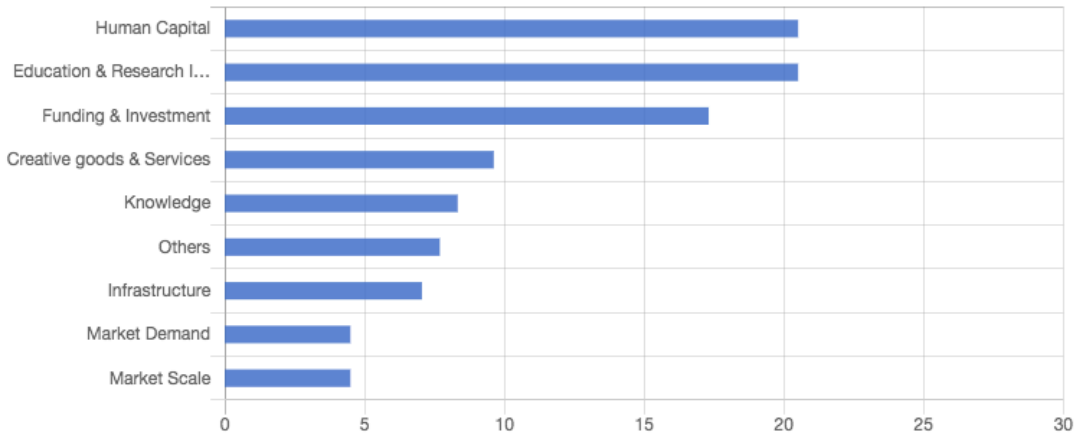

Figure 16: Survey Result on Key Strengths of the Nigerian Innovation Ecosystem

Respondents revealed that Human capital, Education & Research institution, Funding & Investment are the key strengths of the Nigerian Innovation Ecosystem

During a conversation (In August 2022) with Dr. Chris Uwaje (Founder, Tech Policy Adviser, Global Speaker, Former President of ISPON and Fellow of the Nigerian Computer Society), he noted that "***Human Capital remains one of the powers that Nigeria has as regards innovation… Multinationals and global corporations has discovered this and are hiring many Nigerians for various positions in their organization***".

4.2.3 Survey Results on Weaknesses of Nigerian Innovation Ecosystem

Innovation/Tech Hubs, Academia, Research Institutions, Government MDAs & Investors rated the following as top 4 weaknesses of the Nigerian innovation ecosystem.

a. Funding & Investment
b. Infrastructure
c. Quality of Education & Research
d. Knowledge

Table 11: Weakness of the Nigerian Innovation eco-system

Question: Which of these is the key weakness of the Nigerian innovation eco-system?		
SN	Response	Frequency (%)
1.	Funding & Investment	32.69
2.	Infrastructure	16.67
3.	Quality of Education & Research	13.37
4.	Knowledge	10.26
5.	Human Capital	7.05
6.	Others	7.05
7.	Creative Goods & Services	5.13
8.	Market Demand	3.85
9.	Market Scale	3.85
	Total	100.00

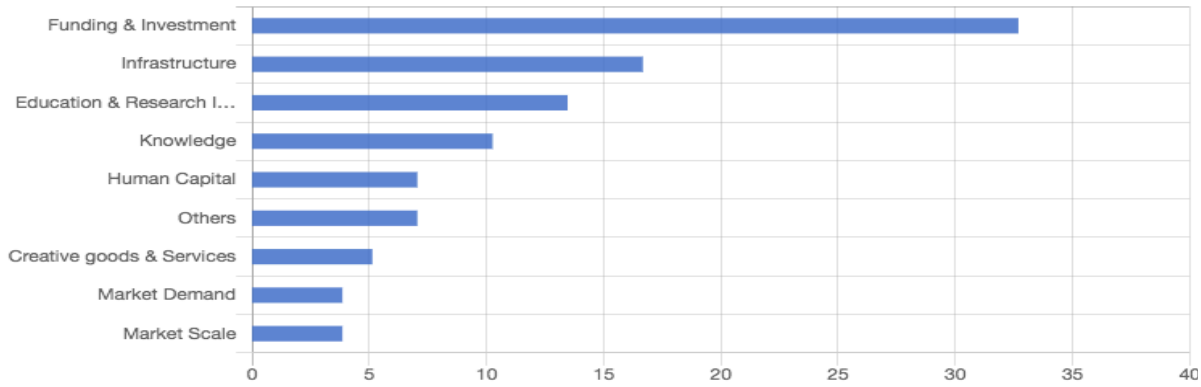

Figure 17: Survey Result on Key Weaknesses of the Nigerian Innovation Ecosystem

Respondents revealed that Lack of adequate Funding & Investments, Infrastructure and Quality of Education & Research are major weaknesses of the Nigerian Innovation ecosystem. About 77% of innovators sampled have not received any form of funding or investment since inception; friends and families are the major source of funding for most innovators and 'funding' remains the biggest challenge to creating innovative outputs.

The importance of funding in promoting, accelerating and sustaining innovation in a country cannot be overemphasized. In Nigeria, it is the bane of many innovators. The tables and graphs below provide more insight to the issue of lack of funding.

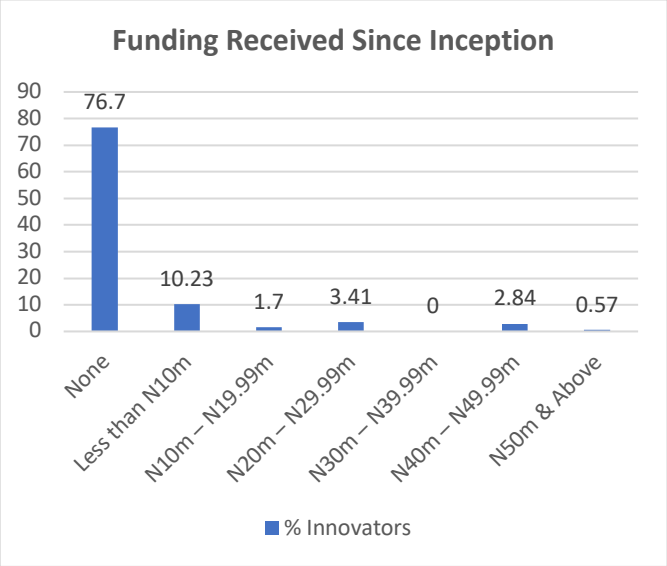

Figure 18: Funding received by Innovators since inception

Table 12: Funding received by Innovators since inception

Funds Received	Frequency (%)
None	76.70
Less than N10m	10.23
N10m – N19.99m	1.70
N20m – N29.99m	3.41
N30m – N39.99m	0.00
N40m – N49.99m	2.84
N50m & Above	0.57
Total	100.00

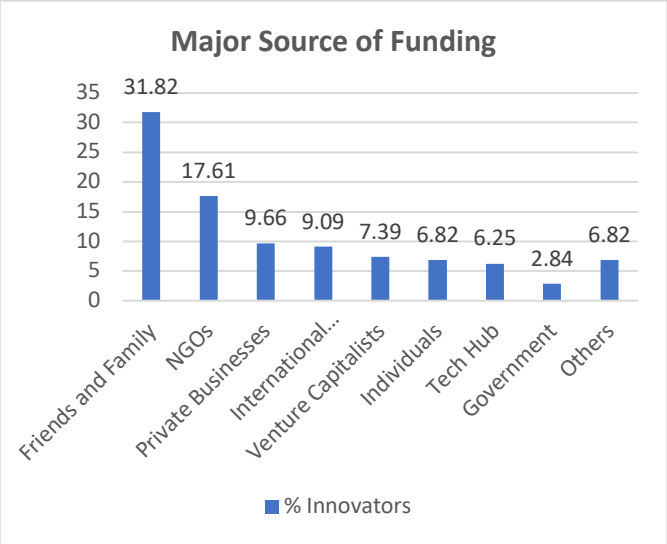

Figure 19: Major Source of Funding received by Innovators

Table 13: Major Source of Funding received by Innovators

Source of Funds	Frequency (%)
Friends & Family	31.82
NGOs	17.61
Private Businesses	9.66
Int. Organizations	9.09
VCs	7.39
Individuals	6.82
Tech Hub	6.25
Government	2.84
Others	6.82
Total	100.00

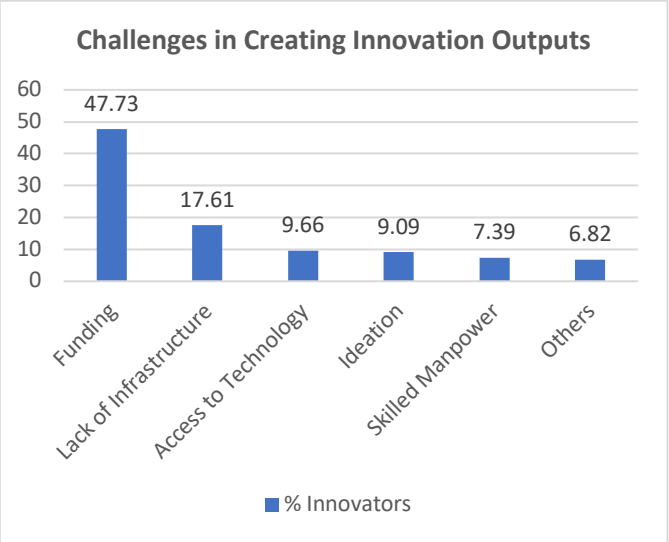

Figure 20: Challenges in creating innovation outputs

Table 14: Challenges in creating innovation outputs

Challenges	Frequency (%)
Funding	47.73
Lack of Infrastructure	17.61
Access to Technology	9.66
Ideation	9.09
Skilled Manpower	7.39
Others	6.82
Total	100.00

4.2.4 Consumer Rating of Indigenous Products and Services

Although 85% of sampled consumers use made in Nigeria products and services, over 40% of them rated Nigerian products and services are just 'average'.

Table 15: Consumer Rating of Nigerian Products and Services

Rating	Frequency (%) Made in Nigeria Products	Frequency (%) Made in Nigeria Services
Excellent	9.83	8.08
Above Average	28.86	27.86
Average	42.16	42.91
Below Average	15.80	17.91
Very Poor	3.36	3.23
Total	100.00	100.00

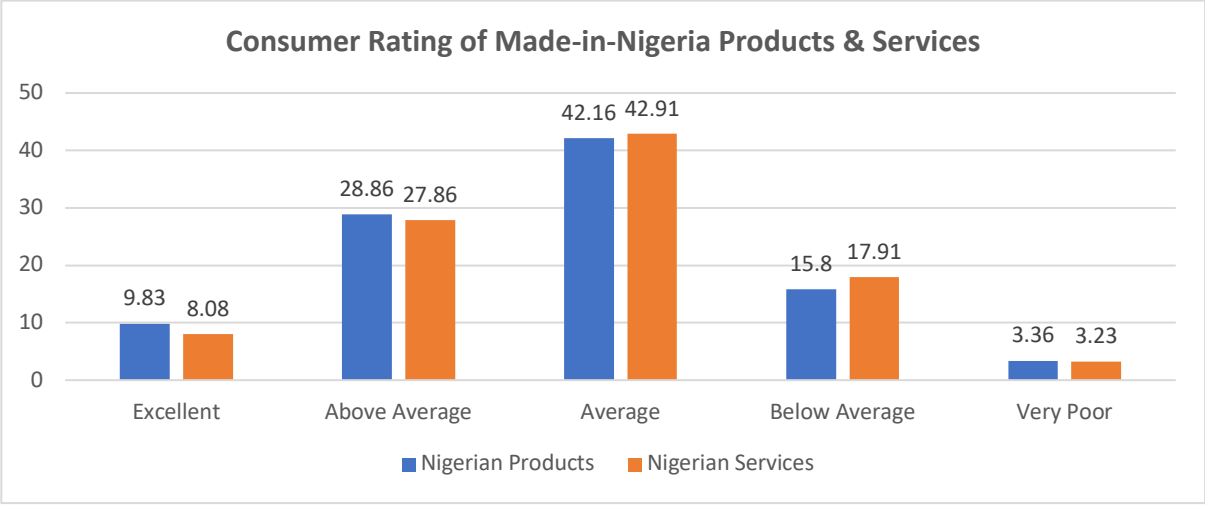

Figure 21: Consumer Rating of Nigerian Products and Services

'**Improving quality of products & services**' and '**reducing prices**' were the top two recommendations made by consumers for promoting the use and adoption of indigenous products and services.

Figure 22: Consumer recommendation to increase adoption of indigenous products & Services

Table 16: Consumer recommendation to increase adoption of indigenous products & Services

Recommendation	(%)
Improve Quality	55.97
Reduce Price	19.65
More products & Service Offerings	14.18
Increase Marketing	9.08
Others	1.12
Total	100.00

4.2.5 Survey Results on Accelerating Innovation Output

70% of innovators sampled have played in the Nigerian innovation space for 1 to 6 years; 57% are currently at the full implementation stage of the innovation lifecycle. 78% jointly revealed that funding, access to technology, work tools, mentorship and skillset are the major inputs needed to accelerate their rate of innovation.

Table 17: Length of operation in the Nigerian Innovation Space

Length of Operation	Frequency (%)
Less than 1year	10.8
1 -3 years	38.07
4 – 6 years	32.95
7 - 9 years	12.5
10 years and above	5.68
Total	100.00

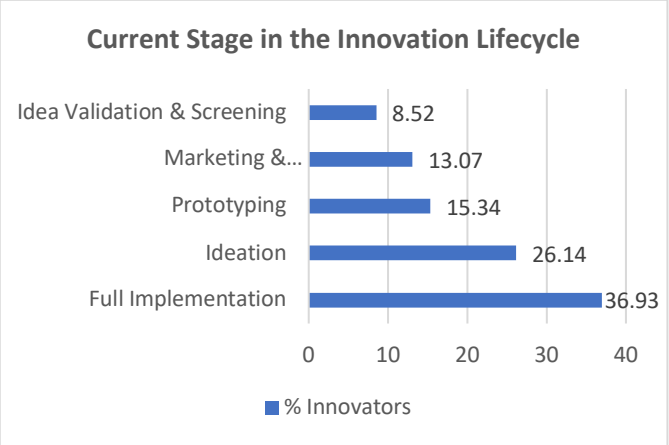

Figure 23: Current Stage of Innovation

Table 18: Current Stage of Innovation

Factors	(%)
Full Implementation	36.93
Ideation	26.14
Prototyping	15.34
Marketing & Commercialization	13.07
Idea Validation & Screening	8.52
Total	100.00

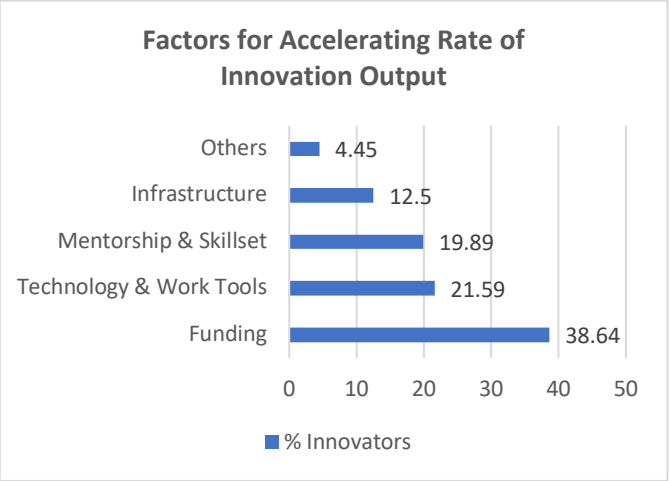

Figure 24: Factors for accelerating Innovation Output

Table 19: Factors for accelerating Innovation Output

Factors	(%)
Funding	38.64
Technology & Work Tools	21.59
Mentorship & Skillset	19.89
Infrastructure	12.50
Others	4.45
Total	100.00

4.2.6 Survey Results on Barriers to Commercialization

Survey results showed that the top barriers to commercialization of innovation outputs are listed accordingly in order of most occurrence: Lack of Financial resources, Lack of technical resource, Problem of Low demand and Inadequate managerial and business skills.

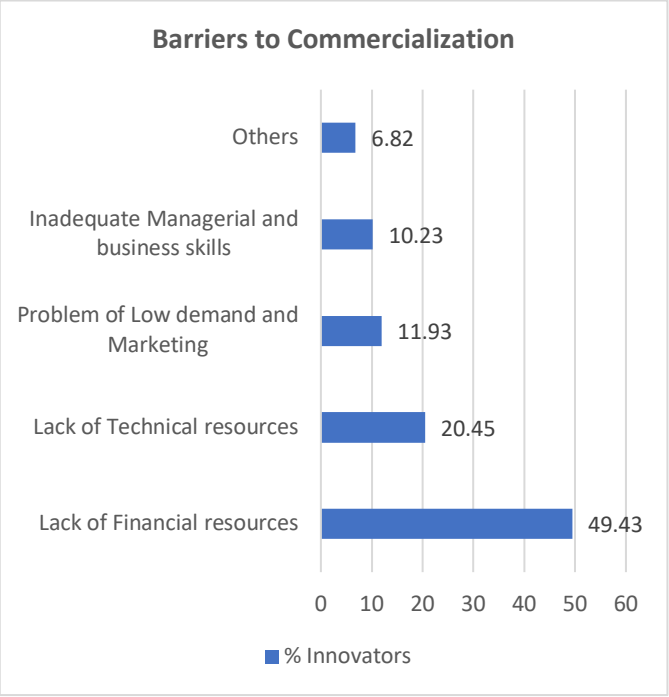

Figure 25: Barriers to Commercialization

Table 20: Barriers to Commercialization

Barrier	(%)
Lack of Financial resources	49.43
Lack of Technical resources	20.45
Problem of Low demand and Marketing	11.93
Inadequate Managerial and business skills	10.23
Others	6.82
Total	100.00

4.2.7 Survey Results on Innovative Sectors of the Economy

About 40% of sampled innovators are innovating in the Technology (tech) space, which is the sector where most innovators are innovating around. 31% of consumers and 25% of institutions (academia, research, private and government MDAs) ranked 'Technology' as the most innovative sector of the economy.

Table 21: Most innovative sectors

Sector of Innovation	Frequency (%)
Technology	40.91
Manufacturing	11.93
Telecoms	8.52
Consumer Goods	8.52
Education	7.95
Agriculture	5.68
Health	5.11
Finance	3.41
Mobility	2.87
Energy	1.70
Others	3.41
Total	**100.00**

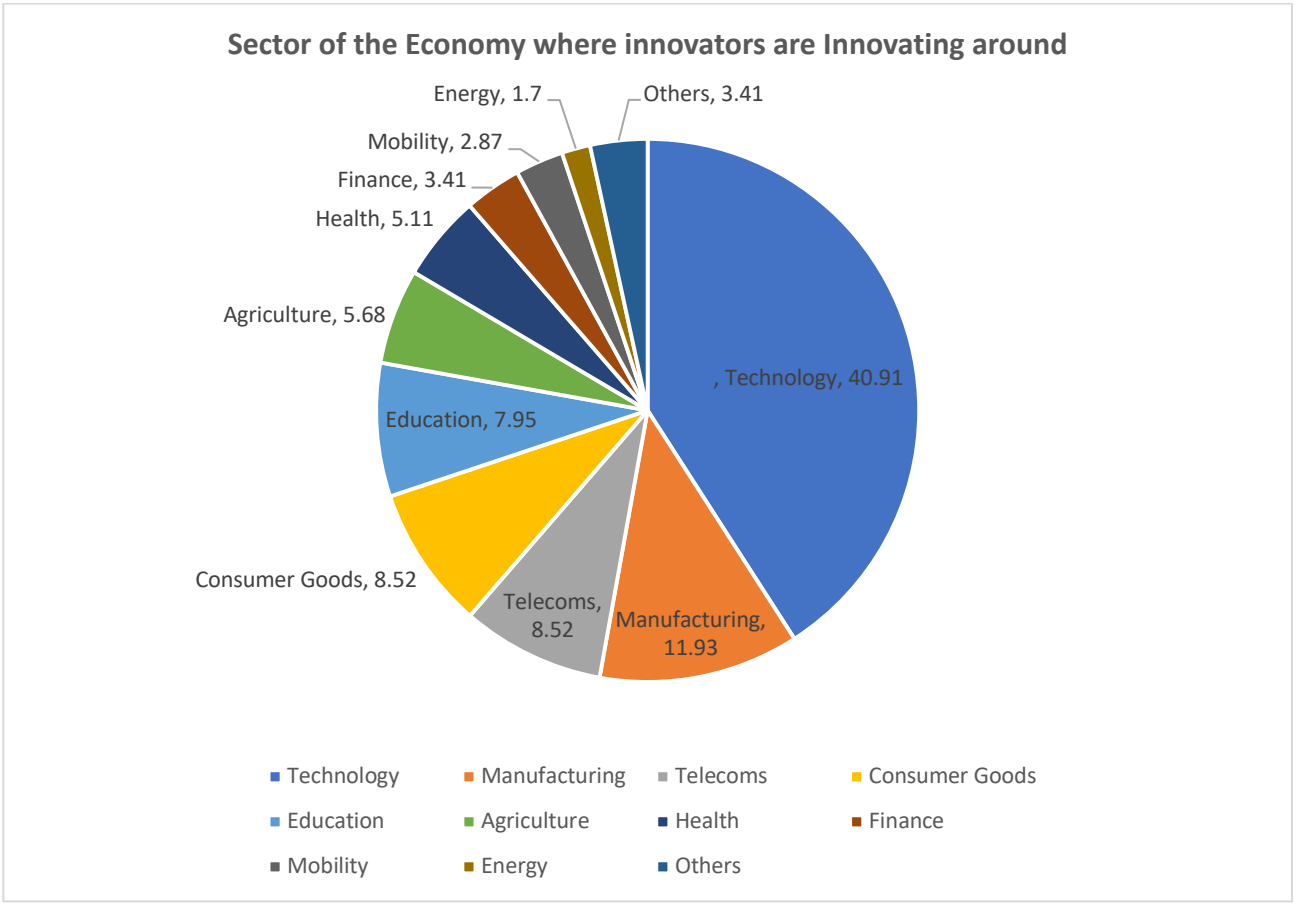

Figure 26: Sector of the Economy where innovators are Innovating around

Table 22: Most Innovative Sectors

	Group B: Innovation/Tech Hubs, Academia, Research Institutions, Government & Investors.	**Group C**: Innovation/Tech Hubs, incubators, Academia, Research Institutions, Government & Investors.
Most innovative sector of the economy (Top 5 responses)	a. Technology (25.4%) b. Agriculture (14.7%) c. Others (11.4%) d. Telecoms (8.5%) e. Manufacturing (8.3%)	a. Technology (30.8%) b. Education (17.3%) c. Finance (10.9%) d. Agriculture (9.6%) e. Telecoms (8.3%)

The top innovative sectors of the Nigerian economy include: Technology (tech), Agriculture, Telecoms, Education, Finance and Manufacturing sector.

4.2.8 Survey Results on Status of Factors that Promote Innovation in Nigeria

Table 23: Status of factors that promote innovation in Nigeria

		Frequency (%)				
SN	**Statement**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
1.	Human capital needed for innovation is available in Nigeria	37.05	22.59	16.57	22.59	37.05
2.	Infrastructure and work tools needed to promote innovation is available and accessible	10.84	14.76	17.17	23.19	34.04
3.	Technology to aid the innovation process is available and accessible	27.71	21.99	16.27	15.96	18.07
4.	Adequate funding is within reach to innovators in Nigeria	11.45	12.95	18.67	27.71	29.22
5.	Having a formal education is necessary to thrive in the innovation process	11.45	11.75	23.49	26.81	26.51
6.	Telephony and Data costs are affordable	12.05	9.34	22.59	22.59	33.43
7.	Intellectual Property is protected in Nigeria	18.67	28.61	20.78	15.96	15.96
8.	Government policies and regulations protect and promote innovation in Nigeria	14.16	22.59	24.70	18.98	19.58
9.	It is easy to register a business in Nigeria	13.86	21.69	20.78	15.66	28.01
10.	Taxes and Tax laws are favourable for start-ups, innovators and entrepreneurs	14.46	8.73	15.06	21.08	40.66
11.	Nigerians adopt and use made in Nigeria product and services	22.59	24.70	18.98	18.37	15.36
12.	Nigeria is politically and economically stable for innovation and creativity	11.45	16.87	17.77	21.69	32.23

Over 50% of respondent agree or strongly agree that Human Capital needed for innovation is available in Nigeria. Over 50% of respondents disagree or strongly disagree that Technology needed for innovation and adequate funding are available.

4.2.9 Survey Results on Potential Impacts of an Indigenous Innovation Index

Table 24: Potential Impacts of an Indigenous Innovation Index

SN	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	Promote competition within the Nigerian eco-system	39.16	31.93	12.95	11.14	4.82
2.	Provide more insight to strengths and weakness in the Nigerian innovation eco-system	37.65	33.43	15.06	8.43	5.42
3.	Attract more foreign investment and funding	37.95	32.83	13.55	11.75	3.92
4.	Attract more support and funding from government	38.25	33.73	13.86	9.64	4.52
5.	Create awareness on innovation outputs in Nigeria	38.86	32.53	14.46	10.84	3.31
6.	Drive adoption and use of indigenous products, processes and services	41.27	34.64	12.35	8.43	3.31
7.	Increase Nigeria's rating in the Global Innovation Index	37.95	32.83	15.66	9.64	3.92
8.	Promote economic development	37.65	31.93	13.55	12.05	4.82
9.	increase digital literacy and digital inclusion	35.24	30.42	17.17	12.35	4.82
10.	Create more job opportunities	33.43	34.34	11.75	11.45	9.04
11.	Encourage more innovation-driven research and development	39.16	31.93	12.95	11.14	4.82

No fewer than 68% of respondents agreed or strongly agreed that having an indigenous national index will bring about numerous benefits such as: increase consumer adoption of indigenous products, promote competition, create awareness on innovation outputs, attract foreign investments, increase Nigeria's ranking on the GII, and promote economic development amongst other.

4.2.10 Potential Benefits of an Indigenous National Innovation Index

Some potential benefits of having an indigenous National Innovation Index in Nigeria include but is not limited to the following:

a. Provide deeper insight to strengths and weaknesses of the Nigerian innovation ecosystem.
b. Provide an avenue to rank states of the federation and sectors of the economy by their level of innovativeness.
c. Promote competition in the Nigerian Innovation ecosystem.
d. Provide reference data that will be useful in the WIPO GII assessment.
e. Increase Nigeria's ranking in the global innovation index.
f. Attract more support and funding from government.
g. Attract more domestic and foreign investments.
h. Creation of more awareness on innovation outputs in Nigeria.
i. Encourage more market-driven research innovations in tertiary & research institutions.
j. Strengthen linkages between government, academia and the industry.
k. Ultimately promote economic development.
l. Awaken commitment of state governments and state-owned institutions towards promoting innovation.
m. Increase private sector participation in the innovation process.
n. Stir more patent applications and IP protection registrations.
o. Encourage increased commercialization of research and development outputs through investments.

4.3 Patent Registration and Intellectual Property (IP) Protection in Nigeria

Patenting in Nigeria is governed by the Patents and Design Act (PDA) Cap. 344 of the law of the Federal Republic of Nigeria (Act of 1970). The Federal Ministry of Trade and Investment is responsible for patent registration in Nigeria. NOTAP has been mandated to assist in the patenting of all inventions and innovations carried out by government funded research institutes and others in the private sector. About 60% of all patent certifications in Nigeria are facilitated by NOTAP. In 2022, a total of 374 patent certification issuances have been facilitated by NOTAP.

Data from the Ministry of Trade and Investment on trademark, patent certifications and design registrations in Nigeria for the last 5 years is shown below:

Trademark Certifications	Patents Completed	Design Registrations
6,154	2,152	241
Source: Ministry of Trade and Investment: Online available at: https://www.iponigeria.com/AboutUs		

4.3.1 Benefits of Patent Registration through NOTAP

a. The entire patent registration process is done free of charge.
b. Assistance in packaging relevant documents to facilitate the patent registration process.
c. Continuous follow-up until patent certification is granted.
d. Education of innovators on the need for annual patent renewal to prevent IP infractions and litigations.

4.3.2 Intellectual Property and Technology Transfer Office (IPTTO) Initiative

NOTAP establishes IPTTO in Nigerian tertiary institutions to promote interaction and strengthen the linkage between University/Research Institutions and Industries. According to NOTAP (2022), "***the IPTTO is designed to develop a robust intellectual Property Rights portfolio through patenting, copyright, technology licensing; to support the Institution's initiative in developing patent culture. The IPTTO also sets into motion the formal system of incentives and reward that encourages individual researcher to be involved in partnerships***"[5]. During an interview (in July 2022) with Mrs. Caroline Anie-Osuagwu, Director of Technology Acquisition and Research Coordination (TARC) department in NOTAP, she revealed that: "***Most innovators and researchers in Nigeria do not take patent seriously"***. She further buttressed that: "***Researchers in Nigeria are too quick to publish papers without protecting their intellectual property which eventually leads to IP theft by international companies***".

[5] NOTAP (2022), "*Establishment of IPTTOs*"- https://notap.gov.ng/new_dev/establishment-of-ipttos/

In its commitment to encourage demand-driven research in Nigeria, NOTAP announced in May 2022 that it shall commence ranking of IPTTOs in Nigeria. Currently, there are a total of 68 IPTTOs spread across different tertiary institutions in Nigeria. The current insecurity in different regions (especially south east and north east regions) of the country has negatively affected NOTAP's pace in establishing more IPTTOs in Nigeria. The table and figure below show the distribution of these IPTTOs.

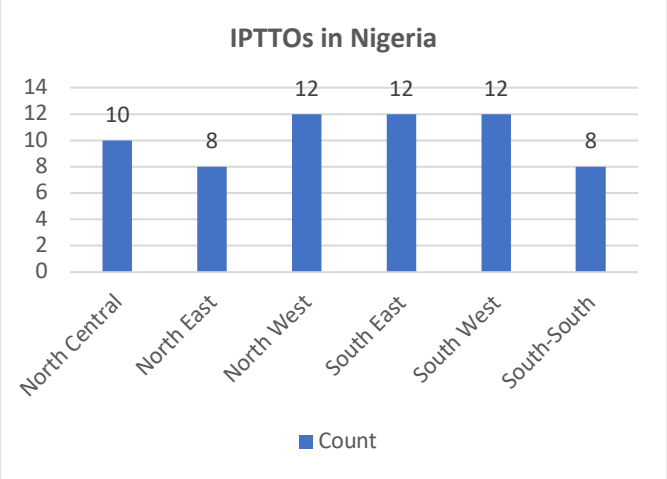

Figure 27: IPTTO Distribution in Nigeria

Table 25: IPTTOs in Nigeria

Region	Count
North Central	10
North East	8
North West	12
South East	12
South West	12
South-South	8
Total	**68**

4.3.3 Comparative Analysis of Patent Certifications

The table below provides insights on comparative IP filings and patent certifications in force for Nigeria and three (3) other countries.

Table 26: Comparative Analysis of IP Regime of Nigeria and selected countries

SN	Parameter	Nigeria	Switzerland	USA	South Africa
1.	Continent/Region	Africa	Europe	North America	Africa
2.	GII rank for 2020 (131 Economies)	117th	1st	3rd	60th
3.	GII rank for 2021 (132 Economies)	118th	1st	3rd	61st
4.	Regional Rank (2021)	16th in Africa	1st in Europe	1st in North America	2nd in Africa
5.	IP Registrations and Certifications (Last 5 years)	8,547 (As at 2022)	146,716 (As at 2021)	1,804,981 (2016 - 2020)	350, 379 (2016 – 2020)
6.	Patents in Force as at 2020	1,954	250, 143	3,348,531	78,787
Data Sources: US Patent and Trademark Office (USPTO); online available at https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm Switzerland Patent Statistics: https://www.ige.ch/en/services/publications/statistics/patent WIPO: https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=ZA Federal Ministry of Trade and Investment, Nigeria: https://www.iponigeria.com/AboutUs					
Observation: There is a direct relationship between IP filings an GII ranking					

4.3.4 Challenges with Patent Registration and IP Protection in Nigeria

Some of the major challenges with patent registration and IP protection in Nigeria include:

a. Low awareness on importance and procedures for patent registration in Nigeria.
b. Low incentives and motivation for researchers and innovators.
c. Publication of research papers before or without patenting.
d. Low demand-driven research.

4.4 Innovation Commercialization Outlook in Nigeria

Commercialization of research and innovation outputs is the last stage in the innovation lifecycle. It involves converting the output of innovation into viable products and services for consumers. The ability to move products and services to market is essential to promote competition and provide consumers with options. For the innovators, investors and researchers, it sets the stage for returns on investment (ROI). The catalyst & commercialization agents play the most important role in the commercialization stage of the innovation lifecycle.

Public acceptance and patronage of indigenous innovation outputs in Nigeria are influenced by quality of the products & services, price and awareness. The figure below shows what the different stakeholders' inputs in the commercialization process should be.

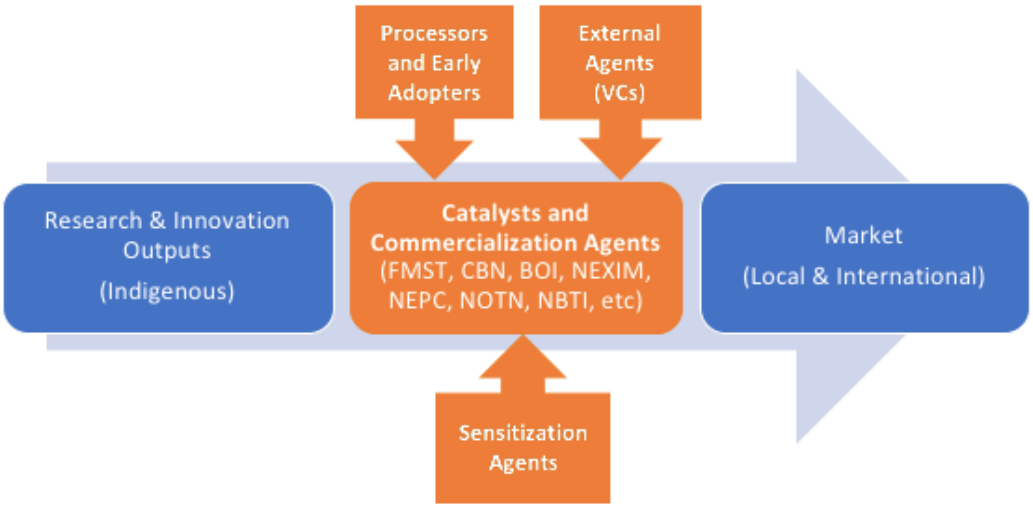

Figure 28: Key Actors in the Commercialization Process

4.4.1 Challenges of Commercialization in Nigeria

a. **Problem of Funding**: Bulk of the indigenous commercialization initiatives in Nigeria are championed by the government and largely depends on budgetary allocations. There is very little contribution from the private sector. For Tech startups, majority of the funding for commercialization are from friends, families and notably international VCs.

b. **Access to Technology for Scaled Production**: Most of the interviewed innovators who are innovating in the hardware space revealed that majority of their components and prototypes (example: Printed Circuit Boards) are fabricated abroad due to unavailability of cutting-edge technologies for such modern production techniques.

c. **Inadequate Infrastructure:** Asides funding, infrastructure plays a huge role in enabling commercialization, especially for emerging economies like Nigeria. Issues such as erratic power supply, poor water supply, bad roads, inadequate production plants and facilities etc. negatively impacts on the rate of commercialization.

d. **High Cost of Production**: Nigeria is predominantly an important dependent country. Cost of electricity, raw materials, components, import duties adversely affects the cost of production. Many investors are discouraged when presented with cost for scaled production of innovation outputs.

e. **Low Awareness on Indigenous Innovation Outputs**

f. **Low Sensitization of Consumers:** There is low consumer awareness on existing indigenous innovation outputs.

g. **Low Demand-drivers:** which is a direct result of lack of market information.

h. **Very Few Early adopters:** Most of the early adopters fall within the category of government and investors. Linkage with the industry for early adoption is not as strong as required.

i. **Quality of Innovation Output**: This is relatively low when compared to outputs from other countries or regions. This is attributed to the stifled access to new and emerging technologies and toolkits.

j. **Problem of Insecurity**: The problem of insecurity in Nigeria cannot be overemphasized. This affects provision and expansion of infrastructure as well discourages current & potential foreign investments and partnerships.

4.5 Laudable Initiatives and Regulations on Innovation

Over the years, several initiatives, policies and regulations have been put in place to promote innovation in Nigeria. These are enumerated below.

a. **National Science, Technology and Innovation (NSTI) Policy**
First introduced in 1986, the aim was to use science and technology to better the lives of Nigerian. The Federal Executive Council, in February 2022, approved the revised NSTI policy. The defunct NSTI was put in place in 2012. The goal of the revised policy is to stimulate growth and development vis science, technology and innovation in Nigeria.

b. **National Digital Economy Policy and Strategy 2020 – 2030 by FMoCDE**
The National Digital Economy Policy and Strategy (NDEPS) as was put in place to position Nigeria as a leading player in the global digital economy and provide a catalyst to facilitate the diversification of the economy and the attainment of the key national objectives of improving security, reducing corruption and expanding the economy. The National Digital Economy Policy and Strategy was launched in 2019 by the FMoCDE and has 8 pillars namely:

1. Developmental Regulation
2. Digital Literacy and Skills
3. Solid Infrastructure
4. Service Infrastructure
5. Digital Services Development and Promotion
6. Soft Infrastructure
7. Digital Society and Emerging Technologies
8. Indigenous Content Development and Adoption

c. **Nigeria Startup Bill (NSB)**
The bill was recently passed in July 2022. The Nigeria Startup Bill project is a joint initiative by Nigeria's tech startup ecosystem and the Presidency to harness the potential of our digital economy through co-created regulations. The bill will ensure that Nigeria's laws and regulations are clear, planned and work for the tech ecosystem. It is expected to contribute to the creation of an enabling environment for growth, attraction and protection of investment in tech startups. The figure below shows major areas of the NSB.

Figure 29: Provisions of the Nigeria Startup Bill

Source: https://medium.com/@startupbill_ng/governance-structure-within-the-startup-bill-86b52a2255e

d. **Executive Order No. 5 (EO5)**
Signed in 2018, the EO5 was put in place for planning and execution of projects, promotion of Nigerian Content in contracts and science, engineering and Innovation fields. This eventually led to the launch of the Database of Nigerian professionals (DNP) by NOTAP in 2022. Online available at https://dnp.notap.gov.ng

e. **Approval and Establishment of Office for Nigerian Digital Innovation (ONDI)**
The Office for Nigerian Digital Innovation (ONDI) is a special purpose vehicle (SPV) of NITDA created to streamline the coordination and support of activities on policy implementation, enforcement of regulatory guidelines and interventions targeted at the development and growth of the Nigerian technology ecosystem for greater impact on job creation and economic growth. ONDI has the following focus areas:

1. Strategic Human Capacity Development.
2. Catalysing funding and ecosystem support.
3. Research and Insights.
4. Monitoring and Compliance.
5. Partnerships.
6. Implementation of Innovation policies and guidelines.

f. **Establishment of National Centre for Artificial Intelligence and Robotics (NCAIR).**

The NCAIR is an arm of NITDA setup to drive and support the research, development, and adoption of emerging technologies in Nigeria.

g. **Establishment of Nigeria Office for Developing the Indigenous Telecoms Sector (NODITS)**

NODITS is a special purpose vehicle setup on 5th July, 2021 with a mandate to drive the development and patronizing of indigenous content in the telecommunications sector by ensuring the creation of top quality indigenous content to propel the sector.

h. **National Digital Innovation, Entrepreneurship and Start-up Policy (NDIESP)**

The National Digital Innovation, Entrepreneurship and Start-up Policy (NDISEP) comprises of five priority thrusts namely:

1. Advancing Human Capital,
2. Unlocking Access to Capital,
3. Enabling Infrastructure,
4. Boosting Demand, and
5. Promoting Innovative Entrepreneurship

It was launched by NITDA in 2021 as part of a plan to implement the National Digital Economy Policy and Strategy to set in motion the strategy for achieving a digital Nigeria.

i. **Economic Recovery and Growth Plan (2017 -2020)**

The Economic Recovery and Growth Plan (ERGP) is a medium-term plan for year 2017 to 2020, developed by the Administration of President Muhammadu Buhari for restoring economic growth while leveraging the ingenuity and resilience of the Nigerian people – the nation's most priceless assets. ERGP had three (3) broad strategic objectives:

1. Restore growth through macroeconomic stability and economic diversification;
2. Build a globally competitive economy through investment in infrastructure, improvement in business environment and promotion of digital-led growth and;
3. Invest in the Nigerians.

j. **Mid-Term National Development Plan (2021 – 2025)**

The Mid-Term National Development Plan (MTNDP) replaced the ERGP and was launched in 2021. The MTNDP has the following strategic objectives:

1. Establish a strong foundation for a diversified economy, with robust MSME growth, and a more resilient business environment.
2. Invest in critical physical, financial, digital and innovation infrastructure.
3. Build a solid framework and enhance capacities to strengthen security and ensure good governance.
4. Enable a vibrant, educated and healthy populace.

k. **National Research Fund (NRF) by TETFund**

The TETFund National Research Fund (NRF) Programme was introduced in 2009 as a special intervention. The Fund is aimed at promoting the conduct of applied research and innovation by academics in public tertiary institutions. The main objective is to drive the socio-economic development of Nigeria in an increasingly globalized and highly competitive knowledge-driven world economy. TETFund has awarded hundreds of grants to researchers in Nigerian Tertiary institutions worth billions of Naira since its inception.

l. **Telecommunication-based Research Innovation Grants by NCC**

The NCC telecommunication-based research innovation grants are aimed at promoting research, development and innovation activities in tertiary institutions for creation of commercially viable products. From year 2015 to 2020, NCC awarded 31 telecommunications-based research innovation grants valued close to N300 million to 21 Nigerian tertiary institutions. On the 8th of April 2022, it announced the award of N233 million in research grants and professorial chair endowments; N172.5m of this sum (i.e. 74%) was earmarked for telecommunications-based research on new and emerging technologies.

m. **Nigeria Innovation Summit (NIS)**

The Nigeria Innovation Summit is an annual event of stakeholders in the Nigerian innovation ecosystem. The event's attendees are typically government MDAs, business organizations, academia, start-ups, young entrepreneurs, etc. NIS helps Nigeria embrace innovation and move in the direction of digital transformation via emerging technologies and trends, R&D, commercialization, entrepreneurship, and investments as the key drivers of an innovation ecosystem.

4.6 Factors Responsible for Nigeria's Low Ranking on the GII

Nigeria ranked 118 out of 132 economies in the 2021 Global Innovation Index (GII). Several factors caused this low ranking. WIPO (2021) reported that Nigeria performed better in innovation inputs than outputs for year 2020 and 2021[6]. The final GII depends on both innovation inputs and outputs as it is the mathematical average of the innovation input and output indices. The reasons for Nigeria's low performance on the GII ranking tilt more towards the innovation output indicators amongst other factors. The following points highlights factors responsible for Nigeria's low ranking on the GII.

a. **Low Patent Churn out:** This is evident in the very low number of patents in force, low number of new patent applications and certifications in Nigeria.
b. **Poor Intellectual Property (IP) Regime:** Low number of IP registrations and filings.
c. **Lack of Data:** A close observation of the 2021 GII report for Nigeria reveals numerous missing data point. Also, the data references used on the GII for Nigeria were largely from external sources because of data not being sufficiently captured by relevant institutions in Nigeria. At the National Council on Science, Technology and Innovation (NCSTI) session held in September 2021, the Minister of State for Science, Technology& Innovation, Barr. Mohammed Abdullahi, pointed out that "***Nigeria has made great strides in inventions and innovations but the data has not been sufficiently captured by relevant institutions in the country***"[7].
d. **Low number of high-tech and ICT services exports.**
e. **Low Level of Commercialization of innovation outputs.**
f. **Political and Environmental instability:** Largely due to current security challenges in Nigeria such as banditry, insurgency, kidnapping etc. This impacts negatively on propensity for FDI.
g. **Long school life expectancy year:** due to incessant strikes in tertiary institutions.
h. **Low ranking of Nigerian Universities on the Global scale.**
i. **Low volume of domestic credits to private sector businesses.**
j. **Low number of ISO 9001 quality certifications for Nigerian businesses & manufacturers.**
k. **Production and Manufacturing complexities** due to high costs and lack of access to modern technologies.

4.7 Nigerian Innovation Landscape

The SWOT analysis below provides insights into the Nigerian innovation landscape.

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[6] WIPO (2021), "*Global Innovation Index - Nigeria*" - https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021/ng.pdf

[7] Science Nigeria (2021), "*How Lack of Data Marred Nigeria's Innovation Index*" - https://sciencenigeria.com/how-lack-of-data-marred-nigerias-innovation-index/; published on: 28th September, 2021; author: Nkechi Isaac.

Table 27: Nigerian Innovation Landscape

Strengths	Weaknesses
a. Healthy number of existing and emerging innovation promoting policies, initiatives and regulations. b. Rich combination of ecosystem stakeholders comprising of innovation output producers, ecosystem regulators and innovation promoters. c. Predominant young population of innovators. d. Large number of tertiary education institutions and research institutions e. Multi-sector research programs cutting across telecommunication, oil & gas, agriculture, health, etc. f. Ease of registering new businesses. g. Tax waivers for small and medium scale businesses. h. Strong ecosystem of small and medium enterprise (SME). i. Strong start-up ecosystem. j. Strong tech hubs, incubators and industrial parks presence. There are at least 98 hubs/incubators based in Nigeria. k. Talented human capital resources. (Nigeria has the 3rd largest number of software developers in Africa). l. Research grants programs for academia by TETFund, NCC, NITDA, PTDF, etc.	a. Inadequate ecosystem funding; the major source of funding comes from budgetary allocations by Government. b. Inadequate solid and service infrastructure such as electricity, good roads, water, housing, etc. c. Slow transition and adoption of new and emerging technologies such as 5G, AI, Blockchain, Cloud Computing, etc. d. Poor access to latest cutting-edge technologies for smart manufacturing and production. e. Very low awareness on indigenous innovation outputs. f. Low level of commercialization of research and innovation outputs. g. Low number of applied researches; most research programs by academia are basic research and often to advance academic qualifications of researchers. h. Low private sector participation. (most significant hackathons, grants etc. have come from government). i. Weak linkage between government, industry and academia for collaborations. j. Low number of patent registrations, patents in force and weak IP regime. k. Unavailability of joint venture which can also be a source of innovation
Opportunities	**Threats**
a. Investment opportunities in commercialization of viable research and innovation outputs. (ROI, export potentials b. Transition to digital economy via the Science, Technology and Innovation (STI) sector.	a. Problem of insecurity in Nigeria b. Economic instability (continuous devaluation of the Naira and high inflation rates). c. Continuous emigration of skilled and experienced workforce in STI. d. Sustainability concerns for innovation promoters such incubators and tech hubs. e. Intellectual property thefts by foreign institutions due to early research paper publications without patenting.

4.8 Enablers for Increasing Rate of Innovation in Nigeria

Several enablers are critical in accelerating the rate of innovation in Nigeria. Given the weaknesses and threats of the Nigerian innovation landscape, instituting and sustaining these enablers is essential to ensure continuous innovation in Nigeria and ultimately, a digital economy. The table below summarizes the key enablers for increasing and sustaining the rate of innovation in Nigeria.

Table 28: Key Enablers for Accelerating and Sustaining Innovation in Nigeria

SN	Enabler	Action Points
1.	Funding & Investment	a. Provision of adequate funding, grants and incentive to researchers and innovators in Nigeria. b. Encourage private sector participation and investments in the STI sector.
2.	Commercialization	a. Institute an effective and resilient commercialization framework to commence and sustain commercialization of research and innovation outputs. b. Promote market competition by continuous commercialization.
3.	Awareness	a. Increase number of trade fairs and exhibitions for indigenous innovation outputs. b. Create more awareness on viable innovation outputs.
4.	Ecosystem Linkages	a. Promote more collaboration between government, industry and academia in research and innovation. b. Encourage more innovation output processors and early adopters.
5.	Applied Research	a. Promote more applied research in tertiary institutions and research institutes. b. Create more demand-driven research programs.
6.	Patents and IP Regime	a. Establish more Intellectual property and technology transfer offices (IPTTO). b. Provide more incentives for Patents and IP protection.
7.	Monitoring and Compliance	a. M&E activities to ensure policy and regulatory compliance. b. Promote standards compliance among innovators, manufacturers etc. c. Mentorship programmes.
8.	Digital Literacy	a. Promote education and digital literacy and skills at grassroot level.

5. Conceptual Framework for Nigeria Innovation Index (NII)

The GII uses five (5) input and two (2) output pillars for determination of a country's innovation index. A total of 81 indicators were used for the 2021 GII[8]; however, not all GII indicators are peculiar to the Nigerian innovation ecosystem. The following sections highlights key aspects of the conceptual framework for development of Nigeria innovation index (NII).

5.1 Pillars and Indicators of the Conceptual Framework

The NII will be based on **Enablers** (input pillars) and **Performance** (output pillars). The figure below shows the proposed indicators for Nigeria innovation index (NII).

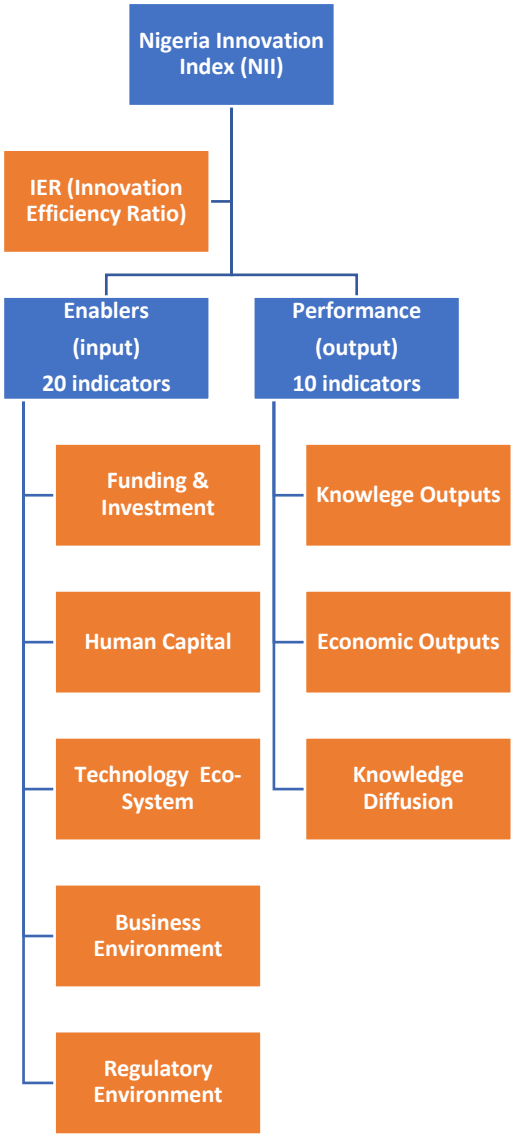

Figure 30: Proposed Conceptual Framework for National Innovation Index (NII)

[8] WIPO (2021), "*Global Innovation Index 2021 (14th Edition)*" - https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf

The NII uses five (5) enabler pillars and three (3) performance pillars. A total of 30 indicators (**20 enabler indicators and 10 performance indicators)** have been identified for use in the conceptual NII framework. The table below highlights the enabler indicators.

Table 29: Enabler Indicators for the Conceptual NII Framework

SN	Enabler Pillars	Indicators	Total Indicators
1.	**Funding and Investment**	a. Volume of funding and investment to the STI sector as a ratio of national GDP. b. Expenditure in Education as a ratio of total annual budget. c. Actual amount spent on Education. d. Volume of Government Grants to SMEs as ratio of total budget. e. Total Foreign Direct Investment (FDI) to the sector.	5
2.	**Human Capital**	a. Number of public tertiary institutions. b. Number of public technical colleges. c. Number of specialized research institutions. d. Number of public training Institutions. e. Number of PhD enrolments in STI fields in tertiary institutions. f. Employment rate in STI sector. g. Number of individual techpreneurs and entrepreneurs.	7
3.	**Technology Ecosystem**	a. Number of tech hubs and incubators. b. Number of companies developing solutions with new and emerging technologies. c. Availability of high-tech infrastructure for manufacturing and production.	3
4.	**Business Environment**	a. Ease of doing business. b. Number of start-ups. c. Number of New business registrations.	3
5.	**Regulatory Environment**	a. Number of innovations enabling. policies and regulations in place b. Number of IP protection offices.	2
		Total	**20**

The table below highlights the performance indicators in the conceptual NII framework

Table 30: Performance Indicators for the Conceptual NII Framework

SN	Performance Pillars	Indicators	Total Indicators
1.	**Knowledge Outputs**	a. Number of R&D and innovation outputs. b. Number of Patents in Force. c. Number of New IP (patents, trademarks and design) Registrations. d. Number of papers published in STI fields.	4
2.	**Economic Output**	a. Sector Contribution to GDP. b. Employment indices in STI sector.	2
3.	**Knowledge Diffusion**	a. Number medium to high tech indigenous products. b. Number of distinct innovation output products and services exported. c. Number of distinct innovation outputs commercialized. d. Digital literacy indices.	4
		Total	**10**

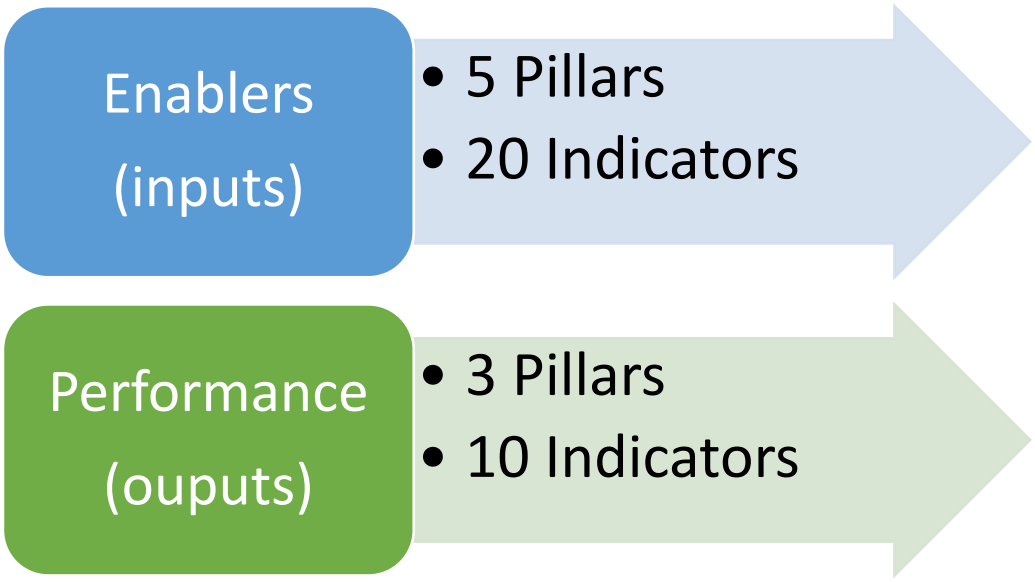

Figure 31: Number of Pillars and Indicators for Enabler and Performance dimensions

5.2 Computational Formula for the Conceptual NII Framework

Computation of the innovation score is achieved through the following:

a. ***Enabler Score*** = *Mathematical Average of the 5 Enabler pillars*

b. ***Performance Score*** = *Mathematical Average of the 3 performance pillars*

c. $$\boldsymbol{Innovation\ Efficiency\ Ratio} = \frac{\text{Enabler Score}}{\text{Performance Score}}\ x\ 100\%$$

d. $$\boldsymbol{National\ Innovation\ Score} = \frac{\text{Enabler Score} + \text{Performance Score}}{2}$$

The Computational tables for determination of NII using the conceptual framework are shown below.

Table 31: Score Collation Table

		Enabler Pillars					Performance Pillars		
SN	**State**	**Funding & Investment**	**Human Capital**	**Technology Eco-System**	**Business Environ.**	**Regulatory Environ.**	**Knowledge Output**	**Economic Output**	**Knowledge Diffusion**
1.	**Adamawa**								
2.	**Enugu**								
3.	**FCT Abuja**								
4.	**Kaduna**								
5.	**Lagos**								
6.	**Rivers**								

Table 32: Score Averages Table

			A	B	C	D
SN	**State**	**Region**	**Enabler Score**	**Performance Score**	**Innovation Efficiency Ratio (%)**	**Innovation Score**
1.	**Adamawa**	**North East**				
2.	**Enugu**	**South East**				
3.	**FCT Abuja**	**North Central**				
4.	**Kaduna**	**North West**				
5.	**Lagos**	**South West**				
6.	**Rivers**	**South-South**				
		Final Average				

Table 33: Innovation SWOT Analysis Table

SN	State	Strength	Weakness	Opportunities	Threats
1.	**Adamawa**				
2.	**Enugu**				
3.	**FCT Abuja**				
4.	**Kaduna**				
5.	**Lagos**				
6.	**Rivers**				

5.3 Benchmark of Innovation Index Models

Benchmarking against innovation index models of other countries and innovation measuring organizations was done to ensure effectiveness and reliability of the conceptual NII framework. The table below shows the comparative analysis of the conceptual NII with other frameworks.

Table 34: Benchmark of Innovation Index Models

SN	Country/ Organization	Total Indicators/Pillars	Innovation Input Pillars	Innovation Output Pillars
1.	Nigeria	30 indicators 8 pillars: 5 input pillars & 3 output pillars	a. Funding & Investment b. Human Capital c. Technology Ecosystem d. Business Environment e. Regulatory Environment	a. Knowledge Output b. Economic Output c. Knowledge Diffusion
2.	South Africa	25 indicators 8 pillars: 6 input pillar & 2 output pillars	a. Human Resources b. Open, excellent research system c. Finance and Support d. Firm/Company Investment e. Linkage and Entrepreneurship f. Intellectual Assets	a. Innovations b. Economic Effects
3.	India	36 indicators 7 pillars: 5 input pillars & 2 output pillars	a. Human Capital b. Investment c. Knowledge Workers d. Business Environment e. Safety and Legal Environment	a. Knowledge Output b. Knowledge Diffusion
4.	WIPO (GII) 2021	81 indicators 7 pillars: 5 input pillars & 2 output pillars	a. Institutions b. Human Capital and Research c. Infrastructure d. Market Sophistication e. Business Sophistication	a. Knowledge and technology output b. Creative output
5.	Bloomberg 2021	7 Pillars: 5 input pillars & 2 output pillars	a. R&D intensity b. Manufacturing c. High-tech density d. Tertiary efficiency e. Research Concentration	a. Productivity b. Patent Activity

6. Pilot Computation using the Conceptual NII Framework

The pilot measurement of national innovation index (NII) for the selected states was computed by measuring the values of the identified indicators in the conceptual framework. The following sections provides insight on the socio-economic attributes of the selected states, data sources and measurement-status of the indicators, assumptions for computation, the NII computation results and analysis.

6.1 Socio-economic Attributes of the Selected State

Table 35: Socio-economic Attributes of Selected States

SN	Socio-Economic Attribute	Adamawa	Enugu	FCT	Kaduna	Lagos	Rivers
1.	**Geo-political Zone**	North East	South East	North Central	North West	South West	South-South
2.	**Year of Creation**	1991	1991	1976	1967	1967	1967
3.	**Local Government Areas (LGAs)**	21	17	6	23	20	23
4.	**State Capital**	Yola	Enugu	Abuja	Kaduna	Ikeja	Port Harcourt
5.	**Major Cities & Towns**	Yola, Mubi, Michika, Ganye, etc.	Nike, Emene, Nsukka, Udi, etc.	AMAC, Gwagwalada, Abaji, Bwari, etc.	Kaduna, Zaria, Kafanchan, Kachia, etc.	Ikeja, Apapa, Yaba, Lekki, etc	Port Harcourt, Onne, Bonny, Eleme, etc
6.	**Estimated Population (2019)**	4.25 million	4.39 million	2.7 million	8.32 million	12.77 million	7.03 million
7.	**Land Mass (Km^2)**	39,742	7,161	7,315	46,053	1,172	11,077
8.	**Approximate Population Density**	107 per Km^2	613 per Km^2	369 per Km^2	180 per Km^2	6,871 per Km^2	635 per Km^2
9.	**Average House hold Size (persons)**	6.7	5.3	7.5	7.5	5	5
10.	**GDP (2020)**	$3.8 Billion	$4.1 Billion	$5.4 Billion	$9.3 Billion	$28.9 Billion	$18.7 Billion
11.	**GDP Per Capita (2020)**	$833	$879	$1,292	$1,056	$2,174	$2,396
12.	**Annual Budget (2021)**	N140 Billion	N169.85 Billion	N329 Billion	N237 Billion	N1.163 Trillion	N448 Billion
13.	**IGR (First Half 2021)**	N6.09 Billion	N14.14 Billion	N69.2 Billion	N26.4 Billion	N267.2 Billion	N57.3 Billion
14.	**Predominant Occupation**	Craftmanship, Farming	Farming, Trading, Civil Services	Civil Service, Farming	Farming, Civil Service	Trading, Fishing, Farming	Fishing, Trading, Farming
15.	**Sea Port**	No	No	No	No	Yes	Yes
16.	**Domestic Airport**	Yes	Yes	Yes	Yes	Yes	Yes
17.	**International Airport**	No	Yes	Yes	No	Yes	Yes

Data Sources: official websites of referenced states; National Bureau of Statistics; Federal Ministry of Information & Culture; Nigeria Galleria: https://www.nigeriagalleria.com/Nigeria/States_Nigeria; etc.

6.2 Statuses and Data Sources of NII Indicators

6.2.1 Statuses and Data Sources for Enabler Indicators

Data for a total of 10 out of the 20 identified enabler indicators (i.e.) were available for measurement; data for the other 10 indicators were either unavailable or required data aggregation and granular data analysis from the ideal primary data sources, most of which revealed that they required more time and/or skilled manpower to gather, analyze and report on such data dimensions.

Table 36: Statuses and Ideal Data Sources for Enabler Indicators

SN	Enabler Pillars	Indicators	Ideal Data Source
1.	**Funding and Investment**	a. Volume of funding and investment to the STI sector as a ratio of national GDP. b. Expenditure in Education as a ratio of total annual budget. c. Actual amount spent on Education. d. Volume of Government Grants to SMEs as ratio of total budget. e. Total Foreign Direct Investment (FDI) to the sector.	State Ministry of Finance, State Budget Office, Ministry of Trade and Investment, National Bureau of Statistics, Official Website of the State
2.	**Human Capital**	a. Number of public tertiary institutions. b. Number of public technical colleges. c. Number of specialized research institutions. d. Number of public training Institutions. e. Number of PhD enrolments in STI fields in tertiary institutions. f. Employment rate in STI sector. g. Number of individual techpreneurs and entrepreneurs.	State Ministry of Education Tertiary Institutions Ministry of Trade and Investment National Bureau of Statistics
3.	**Technology Ecosystem**	a. Number of tech hubs and incubators. b. Number of companies developing solutions with new and emerging technologies. c. Availability of high-tech infrastructure for manufacturing and production.	FMSTI, NITDA, Innovation Support Network (ISN), Manufacturers Association of Nigeria (MAN)
4.	**Business Environment**	a. Ease of doing business b. Number of start-ups c. Number of New business registrations	Presidential Enabling Business Environment Council (PEBEC), Corporate Affairs Commission (CAC), Ministry of Trade and Investment, SMEDAN, National Bureau of Statistics
5.	**Regulatory Environment**	a. Number of innovations enabling policies and regulations in place b. Number of IP protection offices.	NCC, NITDA, NOTAP
NOTE: *Green colour denotes indicators with available data values.* *Red colour denotes indicators with unavailable data values.*			

6.2.2 Statuses and Ideal Data Sources for Performance Indicators

None of the performance indicators had readily available data values at state level; a few are currently being reported at the national level such as sector contribution to GDP and number of patents in force. This presents the need for more data aggregation and granular data analysis at state level of reporting. The table below highlights statuses and ideal data sources for the performance indicators.

Table 37: Statuses and Ideal Data Sources for Performance Indicators

SN	Enabler Pillars	Indicators	Ideal Data Source
1.	**Knowledge Outputs**	a. Number of R&D and innovation outputs. b. Number of Patents in Force c. Number of New IP (patents, trademarks and design) Registrations d. Number of papers published in STI fields.	FMSTI, NOTAP, Ministry of Trade and Investment, Nigerian Tertiary Institutions, Research Institutions Ministry of Education
2.	**Economic Output**	a. Sector Contribution to GDP. b. Employment indices in STI sector	National Bureau of Statistics, FMSTI
3.	**Knowledge Diffusion**	a. Number medium to high tech indigenous products. b. Number of distinct innovation output, products and services exported. c. Number of distinct innovation outputs commercialized d. Digital literacy indices	FMSTI, Ministry of Trade and Investment, Manufacturers Association of Nigeria (MAN), FMoCDE, NCC, NITDA
NOTE: *Green colour denotes indicators with available data values.* *Red colour denotes indicators with unavailable data values.*			

6.2.3 Assumptions in Pilot NII Computation

a. Indicators with unavailable data values were not used in the pilot NII computation.
b. Computation will be based on 2021 data values for identified indicators.
c. The highest attainable score for an indicator is 100%.
d. The lowest attainable score for an indicator is 0%.
e. FDI value was based on total for a state as against STI sector.
f. Regional values were used to for "Number of IP protection offices" for selected state.
g. "Budget" as against "expenditure" was used for the Education indicator.
h. "Number of Training Center" is based on the Industrial Training Fund (ITF) Skills Training Center (ISTC)
i. Score per indicator was computed by using the data value of the highest scoring state for that indicator as the denominator. The formula below describes this:

$$\boldsymbol{Indicator\ Score\ (ref\ state)} = \frac{\text{Data Value (ref state)}}{\text{Data Value (highest scoring state)}}\ x\ 100\%$$

6.2.4 Raw Data Values for Selected States

The raw data values for the selected states across indicators with available data values is enumerated in the table below:

Table 38: Raw Data Values for Indicators across Selected States

SN	Indicator	Adamawa	Enugu	FCT	Kaduna	Lagos	Rivers
1.	**Budget in Education as a ratio of total annual budget (%)**	17.4	6.5	12.9	25.0	10.0	6.7
2.	**Actual amount spent on Education**	N24 .0 Billion	N12.2 Billion	N42.8 Billion	N59.6 Billion	N146.9 Billion	N30.5 Billion
3.	**Total Foreign Direct Investment (FDI) to the sector.**	$0.00	$0.00	$833.4 million	$1.5 Million	$1.731 Billion	$1.0 Million
4.	**Number of public tertiary institutions**	6	6	4	8	7	11
5.	**Number of public technical colleges.**	1	2	2	3	5	4
6.	**Number of specialized research institutions.**	0	3	8	6	5	0
7.	**Number of public training Institutions.**	0	0	1	0	1	0
8.	**Number of tech hubs and incubators**	3	5	13	4	38	9
9.	**Number of innovations enabling policies and regulations in place (State)**	0	0	0	1	1	1
10.	**Number of IP protection offices (regional)**	8	12	10	12	12	8

6.2.5 Indicator Scores for Selected States

The computed scores for the selected states across indicators with available data values are enumerated in the table below:

Table 39: Indicator Scores for Selected States

SN	Indicator	Adamawa	Enugu	FCT	Kaduna	Lagos	Rivers
1.	Budget in Education as a ratio(%) of total annual budget	69.60	26.00	51.60	100.00	40.00	26.80
2.	Actual amount spent on Education	16.34	8.30	35.13	40.57	100.00	20.76
3.	Total Foreign Direct Investment (FDI) to the sector.	0.00	0.00	48.14	0.09	100.00	0.06
4.	Number of public tertiary institutions	54.55	54.55	36.36	72.73	63.64	100.00
5.	Number of public technical colleges.	20.00	40.00	40.00	60.00	100.00	80.00
6.	Number of specialized research institutions.	0.00	37.50	100.00	75.00	62.50	0.00
7.	Number of public training Institutions.	0.00	0.00	100.00	0.00	100.00	0.00
8.	Number of tech hubs and incubators	7.89	13.16	34.21	10.53	100.00	23.68
9.	Number of innovations enabling policies and regulations in place (State)	0.00	0.00	0.00	100.00	100.00	100.00
10.	Number of IP protection offices (regional)	66.67	100.00	83.33	100.00	100.00	66.67
NII Cumulative (%)		**23.51**	**27.95**	**52.88**	**55.89**	**86.61**	**41.80**
Pilot NII Rank		**6th**	**5th**	**3rd**	**2nd**	**1st**	**4th**

Lagos topped the NII chart on 7 out of 10 Indicators, Kaduna topped the charts on 3 out of 10 indicators, Rivers and FCT topped the chart on only 2 indicators, Enugu topped the chart for just one indicator; Adamawa did not top that chart on any indicator. Cumulatively, Lagos is the most innovative state in Nigeria with an NII score of 86.61%, Kaduna ranked 2nd with an NII score of 55.89 and FCT ranked 3rd with an NII score of 52.88%

6.2.5.1 NII Ranking

Table 40: Pilot NII Ranking and Score for Selected States

State	Pilot NII Score (%)	Pilot NII Rank
Lagos	86.61	1.
Kaduna	55.89	2.
FCT	52.88	3.
Rivers	41.80	4.
Enugu	27.95	5.
Adamawa	23.51	6.

6.2.5.2 Strength and Weakness Analysis of Pilot States

Table 41: Strength and Weaknesses of selected States

State	Strengths	Weaknesses
Lagos	• *Volume of Budget & Spending on Education* • *Foreign Direct Investments* • *Good concentration of Innovation & Tech Hub* • *Number of Technical Colleges* • *State-driven ICT and innovation enabling policies*	• *Percentage of budget for education*
Kaduna	• *Percentage of budget for education* • *Number of public tertiary institutions* • *Number of specialized research institutions*	• *Volume of foreign direct investments* • *Number of Tech hubs* • *Number of public training institutions*
FCT	• *Number of specialized research institutions* • *Number of public training institutions*	• *Number of state-driven innovation promotion policies*
Rivers	• *Number of public tertiary institutions* • *Number of public technical colleges*	• *Volume of foreign direct investments* • *Number of public training institutions* • *Number of specialized research institutions* • *Number of Innovation and Tech Hubs*
Enugu	• *Number of public tertiary institutions* • *Number of public technical colleges*	• *Volume of foreign direct investments* • *Number of public training institutions* • *Amount budgeted for and spent on education* • *Number of Innovation and Tech Hubs*
Adamawa	• *Percentage of budget for education* • *Number of pubic tertiary institutions*	• *Volume of foreign direct investments* • *Number of public training institutions* • *Number of specialized research institutions* • *Number of Innovation and Tech Hubs* • *Number of public technical colleges*

6.2.5.3 Analysis by Indicator Positions

Table 42: Analysis by state and Indicator Rank

State	Number of Indicators where scored First Position	Number of indicators where scored Last Position
Lagos	7	0
Kaduna	3	1
FCT	2	1
Rivers	2	2
Enugu	1	3
Adamawa	0	6

6.2.5.4 Breakdown by Pillars

Table 43: Breakdown of Scores by Pillars

State	Funding & Investment	Human Capital	Technology Ecosystem	Business Environment	Regulatory Environment
Lagos	80.00	81.54	100.00	Not Available	100.00
Kaduna	46.89	51.93	10.53	Not Available	100.00
FCT	44.96	69.09	34.21	Not Available	41.67
Rivers	47.62	45.00	23.68	Not Available	83.34
Enugu	11.43	33.01	13.16	Not Available	50.00
Adamawa	28.64	18.64	7.89	Not Available	33.34

6.3 Challenges Encountered in the Pilot NII Measurement

The following challenges were encountered while gathering data for computation of the pilot NII scores using the conceptual NII framework.

a. Lack of reference data on several indicators identified in the conceptual framework.
b. Poor data analysis and online publication culture by government MDAs on critical indices on innovation in Nigeria.
c. Prevailing ASUU strike limited the ability to obtain primary data from tertiary institutions on indicators related to academia.
d. Absence of an open data portal in Nigeria for access to reference data on socio-economic indices.

7. Conclusion and Recommendations

7.1 Conclusion

Lack of data across several indicators posed the biggest barrier to measurement of innovation using the conceptual NII framework; However, the pilot NII measurement using identified indicators (with available data values) in the conceptual NII framework provided insights on innovation indices across the selected states; it also revealed the impacts of the indicators on the final NII score of a state as well as the strengths and weaknesses in the innovation ecosystem in each selected state.

There is no doubt that the adoption and implementation of the conceptual NII framework developed promises numerous benefits for Nigeria, such as attraction of local and foreign investments, promotion of competition, job creation, increased awareness on innovation outputs, improved ranking of Nigeria on the WIPO GII.

7.2 Recommendations

List of key recommendation include the following:

a. Need to strengthen linkages between government, academia and industry to foster innovation in Nigeria.
b. Need for NCC to create awareness on the existence and benefits of the NII.
c. Improve collaboration between NCC and key ecosystem stakeholders to drive and sustain the NII agenda.
d. NCC in collaboration with NITDA, FMoCDE and NEITI should drive awareness and compliance with the Nigeria Open Data Policy (launched by NEITI in December 2016); sector regulators also need to implement and deploy a national open data portal where key socio-economic indices can be reported on and accessed.
e. NCC should institutionalize the NII measurement across all states. The NII report can be published biennially (every 2 years) using data from the preceding year as reference.
f. NCC and other regulators should engage more in collaborative regulation to foster the growth and development of the innovation ecosystem in Nigeria.
g. Need for increased support from government to innovators through funding, infrastructure development and creation of enabling environment.
h. NCC and other ecosystem stakeholders should encourage private sector participation and support for innovation in Nigeria.

References

National Population Commission, NPC (2022), "*Statistics*" online available at: https://nationalpopulation.gov.ng/statistics/#:~:text=Nigeria%202020%20population%20is%20estimated,(and%20dependencies)%20by%20population; accessed on 1st August, 2022.

WIPO (2021), "*Global Innovation Index 2021*", online available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf; Accessed on 4th April, 2022.

OECD (2018), "*Oslo Manual – Chapter 2: Concepts for Measuring Innovation*", online available at: https://www.oecd-ilibrary.org/docserver/9789264304604-5-en.pdf?expires=1650642856&id=id&accname=guest&checksum=B8F709FDD4D573627515A7B6F5BA8142; accessed on 7th April, 2022.

Nigeria Innovation Summit (2022), "*About the Summit*", online available at: https://innovationsummit.ng/about/; accessed on 20th April, 2022.

WIPO (2021), "*Global Innovation Index 2021 - Executive Summary*"; online available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021_exec.pdf; Accessed on 20th April, 2022.

Startup Blink (2021), "*Startup Ecosystem Index 2021*", online available at: https://www.startupblink.com/startupecosystemreport.pdf; accessed on 19th April, 2022

Premium Times (2021), "*Lagos overtakes Nairobi as Nigeria's leading startup hub*", online available at: https://www.premiumtimesng.com/news/more-news/469338-lagos-overtakes-nairobi-as-africas-leading-startup-hub.html; published on 22nd June, 2021; accessed on 8th April, 2022

Techcrunch (2022), "*YC W22 batch nets 24 African startups, including 18 from Nigeria*", online available at: https://techcrunch.com/2022/03/29/yc-w22-batch-nets-24-african-startups-including-18-from-nigeria/; published on 29th March, 2022; accessed on 8th April, 2022

Technext (2018), "*#GitHubUniverse: Nigeria is Fourth Fastest Growing Country-Community on GitHub*", online available at: https://technext.ng/2018/10/17/githubuniverse-nigeria-is-fourth-fastest-growing-country-community-on-github/; published on17th October, 2018; accessed on 21st April, 2022.

Harvard Business School. (1999), "*The New Challenge to America's Prosperity: Findings from the Innovation Index*", online available at: https://www.hbs.edu/ris/Publication%20Files/Downloads_Porter_index1_el_be68d54c-4990-45da-88c0-ee754c99ffdb.pdf; Author: Professor Michael E. Porter; accessed on 15th July, 2022.

UAE (2015), "*UAE National Innovation Strategy*", online available at: https://www.moei.gov.ae/assets/download/1d2d6460/National%20Innovation%20Strategy.pdf.aspx; accessed on 15th July, 2022.

TechEconomy.ng (2021), "*Pantami approves creation NITDA's creation of Office of Nigeria Digital Innovation (ONDI)*", online available at: https://techeconomy.ng/2021/12/pantami-approves-nitdas-creation-of-the-office-

for-nigerian-digital-innovation-ondi/; published on 20th December , 2021; Author: Yinka Okeowo; accessed on: 20th June, 2022.

NOTAP (2022), "*NOTAP to Commence Ranking of IPTTOs to Encourage Demand-driven Research*"; online available at: https://notap.gov.ng/new_dev/notap-to-commence-ranking-of-ipttos-to-encourage-demand-driven-research/; published in May 2022; accessed on 10th July, 2022.

Federal Ministry of Trade and Investment (2022), "*We Can Protect Your Ideas, Inventions, Designs, And Trade Secrets*"; Online available at: https://www.iponigeria.com/AboutUs; Published by Trademarks, Patents And Designs Registry, Commercial Law Department, Ministry of Trade and Investment; published in 2022; accessed on 10th July, 2022.

US Patent Trademark Office (2022), "*U.S. Patent Statistics Chart Calendar Years 1963 - 2020*"; Online available at: https://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm; published in 2022; Author: Patent Technology Monitoring Team (PTMT); accessed on 11th July, 2022.

IGE | IPI (2022), "*Patent Statistics*", Online available at: https://www.ige.ch/en/services/publications/statistics/patent; published in 2022; accessed on 11th July, 2022.

Ndagi Abdulmalik (2020), "*Commercialization of Research Output for National Development: The Role of Technology Incubator in Nigeria*"; Online available at: http://www.internationalpolicybrief.org/images/2020/JUNE/IJORMSSE/ARTICLE3.pdf; published on International Journal of Operational Research in Management, Social Sciences and Education (IJORSSE); Vol. 6 p-ISSN 2536-6521; published in April 2020.

WIPO (2021), "*Global Innovation Index - Nigeria*"; Online available at https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021/ng.pdf; accessed on 20th July, 2022.

NITI (2020), "India Innovation Index"; Online available at: https://www.niti.gov.in/sites/default/files/2021-01/IndiaInnovationReport2020Book.pdf; published in 2021; accessed on: 20th July, 2022.

Channels TV (2022), "FEC Approves Science Technology and Innovation Policy"; online available at: https://www.channelstv.com/2022/02/23/fec-approves-science-technology-and-innovation-policy/; author: Gloria Ume-Ezeoke; published on: 23rd February, 2022; accessed on 15th July, 2022.

Tech Hive Advisory (2022), "Review of National Digital Innovation and Entrepreneurship Policy (NDIEP)"; online available at: https://techhiveadvisory.org.ng/review-of-national-digital-innovation-and-entrepreneurship-policy/; published on: 8th March, 2021; accessed on: 12th July, 2022.

Premium Times (2021), "*Nigeria: Chronicling digital innovation and regulation*"; online available at: https://www.premiumtimesng.com/opinion/481651-nigeria-chronicling-digital-regulation-and-innovation-by-abbas-badmus.html; published on 29th August, 2021; author: Abbas Badmus; accessed on: 20th July, 2022.

Vanguard (2021), "*Our 20 TIC entrepreneurs now sell products outside Nigeria – NBTI*"; online available at: https://www.vanguardngr.com/2021/03/our-20-tic-entrepreneurs-now-sell-products-outside-nigeria-nbti/; published on 3rd March 2021; author: Emmanuel Elebeke; accessed on 20th July, 2022.

NCC (2020), "*National Digital Economy Strategy and Policy 2020 - 2030*"; online available at: https://www.ncc.gov.ng/docman-main/industry-statistics/policies-reports/883-national-digital-economy-policy-and-strategy; published on 1st June 2020; author: FMoCDE; accessed on: 25th June 2022.

WIPO (2016), "*Annex 1: The Global Innovation Index (GII) Conceptual Framework*"; online available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016-annex1.pdf; published in 2016; accessed on 10th June, 2022.

Science Nigeria (2021), "*How Lack of Data Marred Nigeria's Innovation Index*", online available at: https://sciencenigeria.com/how-lack-of-data-marred-nigerias-innovation-index/; published on: 28th September, 2021; author: Nkechi Isaac; accessed on 20th July, 2022.

JICA (2020), "*Eco-system Report: Nigeria's Startup Scene*", online available at: https://www.jica.go.jp/nigeria/english/office/topics/gh13tc000000sz4y-att/220328_01.pdf; accessed on 10th June, 2022.

MRIC (2021), "*R&D Indicators Facts Sheets: Issue 2*"; online available at: https://9843d706-9eaa-44a6-9914-8c85a3203bbc.filesusr.com/ugd/f94712_d6deceaa81a848ee9129ecbafec40dfa.pdf; published in 2022; author: Mauritius Research and Innovation Council (MRIC); accessed on 25th July, 2022.

NACI (2016),"*South African Innovation Framework Scorecard*"; online available at: http://www.naci.org.za/wp-content/uploads/2016/10/Composite-Innovation-Indicators-for-South-Africa-discussion-document.pdf; published in 2016; accessed on 20th July, 2022.

Bloomberg (2021), "*Bloomberg Innovation Index 2021*"; online available at: https://ec.europa.eu/newsroom/rtd/items/713430/en; published in 2021; accessed on 17th July, 2022.

National Bureau of Statistics (2020), "*Demographic Statistics Bulletin*"; online available at: https://nigerianstat.gov.ng/download/1241121; published in 2020; accessed on 20th August, 2022.

Global Data Lab (2021), "Average House Hold Size -Nigeria"; online available at: https://globaldatalab.org/areadata/hhsize/NGA/; accessed on 20th August, 2022.

Owogram (2022), "*Top 10 Richest states in Nigeria*"; online available at: https://www.owogram.com/richest-states-in-nigeria/; accessed on 24th August, 2022.

Kingmakers (2021), "*Gross Domestic Product (GDP)*"; online available at: https://stateofstates.kingmakers.com.ng/GDP/Default.aspx; accessed on 24th August, 2022.

The Cable (2021), "*Kaduna, Enugu… 24 States attract zero foreign investments in 2021*", online available at: https://www.thecable.ng/kaduna-enugu-24-states-attracted-zero-foreign-investments-in-2021; published on 4th April, 2022; data source: National Bureau of Statistics; accessed on 24th August, 2022.

BudgIT (2021), "*State of States 2021 Edition*", online available at: https://yourbudgit.com/wp-content/uploads/2021/09/State-of-States-report-2021-web.pdf; accessed on 25th August, 2022.

National Bureau of Statistics (2021), "*Internally Generated Revenue At State Level – Galf Year 2021*", online available at: https://www.nigerianstat.gov.ng/pdfuploads/Internally_Generated_Revenue_At_State_Level_H1%202021.pdf; accessed on 25th August, 2022.

Appendix

Appendix A.1: Questionnaire for Innovators

Code: Type A

Aim and Objectives
To determine:

a. *factors that promote innovation from an innovator's standpoint.*
b. *factors that inhibit or limits innovation outputs.*
c. *indicators peculiar to the Nigerian environment for measuring innovation.*
d. *the Importance of an indigenous innovation index in Nigeria.*

Target Respondents:
Innovators, Start-Ups, Techpreneurs, Researchers and Entrepreneurs

Section A: Demographics

1. What is your state of location?

2. What is your Gender?

☐ Male ☐ Female

3. What is your age bracket in years?

☐ 20 and below ☐ 21 -25 ☐ 26 - 30 ☐ 31 - 35 ☐ 36 -40
☐ 41 – 45 ☐ 45 – 50 ☐ 51- 55 ☐ 56 – 60 ☐ Above 60

4. What category do you belong to?

☐ Techpreneur ☐ Entrepreneur ☐ Researcher ☐ Others

5. What is your highest level of formal education?

☐ None ☐ Primary School ☐ Secondary School
☐ Undergraduate ☐ Graduate ☐ Post Graduate

6. What sector are you currently innovating on?

☐ Telecoms ☐ Finance ☐ Technology ☐ Health
☐ Manufacturing ☐ Education ☐ Agriculture ☐ Mobility
☐ Energy ☐ Consumer Goods ☐ Others (Please specify)

7. How long have you been in the Nigerian innovation space?

☐ Less than 1year ☐ 1 -3 years ☐ 4 – 6 years ☐ 7 -9 years
☐ 10 years and above

8. What is your current stage in the innovation lifecycle?

☐ Ideation ☐ Idea Validation & Screening ☐ Prototyping
☐ Full Implementation ☐ Market & Commercialization

Section B

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
9.	Human capital needed for innovation is available in Nigeria					
10.	Infrastructure and work tools needed to promote innovation is available and accessible					
11.	Technology to aid the innovation process is available and accessible					
12.	Adequate funding is within reach to innovators in Nigeria					
13.	Having a formal education is necessary to thrive in the innovation process					
14.	Telephony and Data costs are affordable					
15.	Intellectual Property is protected in Nigeria					
16.	Government policies and regulations protect and promote innovation in Nigeria					
17.	It is easy to register a business in Nigeria					
18.	Taxes and Tax laws are favourable for start-ups, innovators and entrepreneurs					
19.	Nigerians adopt and use made in Nigeria product and services					
20.	Nigeria is politically and economically stable for innovation and creativity					

21. In the last 12 months how many funding or investment streams have you received for your innovation project?

☐ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 & above

22. How much is needed to fully implement and commercialize your work?

☐ None ☐ Less than N5m ☐ N5m – N9.99m

☐ N10m – N14.99m ☐ N15m – N19.99m ☐ N20m – N24.99m

☐ N25m and above

24. How much in funding have you received since inception?

☐ None ☐ Less than N10m ☐ N10m – N19.99m

☐ N20m – N29.99m ☐ N30m – N39.99m ☐ N40m – N49.99m

☐ N50m and above

25. Which one of these groups support and promote innovation process in Nigeria the most?

☐ Friends & Family ☐ Individuals ☐ Private Businesses ☐ NGOs

☐ Tech Hubs ☐ Government ☐ International Organizations

☐ VCs ☐ Others (Please specify)

26. Which of these groups provides the most funding for innovation projects to Nigerian innovators?

☐ Friends & Family ☐ Individuals ☐ Private Businesses ☐ NGOs

☐ Tech Hubs ☐ Government ☐ International Organizations

☐ VCs ☐ Others (Please specify)

27. What is your biggest challenge in creating innovative outputs?

☐ Ideation ☐ Lack of Infrastructure ☐ Access to Technology

☐ Funding ☐ Others (Please specify)

28. Which of these is the most important input to accelerate your rate of innovation?

☐ Funding ☐ Mentorship & skillset ☐ Technology & Work Tools

☐ Infrastructure ☐ Others (Please specify)

29. What do you as the consider the biggest barrier to commercialization of innovative outputs in Nigeria?

☐ Inadequate managerial and business Skills

☐ Lack of financial resources

☐ Lack of technical resources

☐ Problem of low demand and marketing

☐ Others (Please specify)

Developing and using an indigenous index to measure innovation in Nigeria will:

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
30.	Promote competition within the Nigerian eco-system					
31.	Provide more insight to strengths and weakness in the Nigerian innovation eco-system					
32.	Attract more foreign investment and funding					
33.	Attract more support and funding from government					
34.	Create awareness on innovation outputs in Nigeria					
35.	Drive adoption and use of indigenous products, processes and services					
36.	Increase Nigeria's rating in the Global Innovation Index					
37.	Promote economic development					
38.	increase digital literacy and digital inclusion					
39.	Create more job opportunities					
40.	Encourage more innovation-driven research and development					

Appendix A.2: Questionnaire for Institutions and Investors

Code: Type B

Aim and Objectives
To determine:

a. *the strengths and weaknesses in the Nigerian innovation eco-system.*
b. *adequacy of innovation-promoting regulations and policies in Nigeria.*
c. *viability of innovation outputs in Nigeria.*
d. *the recommended indices for measuring innovation in Nigeria.*
e. *the Importance of an indigenous innovation index in Nigeria.*

Target Respondents:
Innovation/Tech Hubs, Academia, Research Institutions, Government & Investors

Section A: Demographics

1. What is your state of location?

2. What category do you belong to or represent?
   ☐ Innovation/Tech Hub ☐ Academia ☐ Research Institution
   ☐ Investor ☐ Government MDA

3. How long have you been involved in the Nigerian innovation space?
   ☐ Less than 1year ☐ 1 -3 years ☐ 4 – 6 years ☐ 7 -9 years
   ☐ 10 years and above

4. What sector do you consider the most innovative sector in Nigeria?
   ☐ Telecoms ☐ Finance ☐ Technology ☐ Health
   ☐ Manufacturing ☐ Education ☐ Agriculture ☐ Mobility
   ☐ Energy ☐ Consumer Goods ☐ Others (Please specify)

5. Which of these is the key strength of the Nigerian innovation eco-system?
   ☐ Human Capital ☐ Infrastructure ☐ Funding & Investment
   ☐ Education & Research Institutions ☐ Market Scale
   ☐ Market Demands ☐ Knowledge ☐ Creative goods & Services
   ☐ Others (Please specify)

6. Which of these is the key weakness of the Nigerian innovation eco-system?
   ☐ Human Capital ☐ Infrastructure ☐ Funding & Investment
   ☐ Education & Research Institutions ☐ Market Scale
   ☐ Market Demands ☐ Knowledge ☐ Creative goods & Services
   ☐ Others (Please specify)

Section B

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
7.	Human capital needed for innovation is available in Nigeria					
8.	Infrastructure and work tools needed to promote innovation is available and accessible					
9.	Technology to aid the innovation process is available and accessible					
10.	Adequate funding is within reach to innovators in Nigeria					
11.	Having a formal education is necessary to thrive in the innovation process					
12.	Telephony and Data costs are affordable					
13.	Intellectual Property is protected in Nigeria					
14.	Government policies and regulations protect and promote innovation in Nigeria					
15.	It is easy to register a business in Nigeria					
16.	Taxes and Tax laws are favourable for start-ups, innovators and entrepreneurs					
17.	Nigerians adopt and use made in Nigeria product and services					
18.	Nigeria is politically and economically stable for innovation and creativity					

19. What do you consider as the biggest barrier to commercialization of innovative outputs in Nigeria?

☐ Inadequate managerial and business Skills

☐ Lack of financial resources

☐ Lack of technical resources

☐ Problem of low demand and marketing

☐ Others (Please specify)

20. Are you willing to invest in Nigerian-made products, processes or services?

☐ Yes ☐ No ☐ I don't Know

Developing and using an indigenous index to measure innovation in Nigeria will:

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
21.	Promote competition within the Nigerian innovation eco-system					
22.	Provide more insight to strengths and weakness in the Nigerian innovation eco-system					
23.	Attract more foreign investment and funding					
24.	Attract more support and funding from government					
25.	Create awareness on innovation outputs in Nigeria					
26.	Drive adoption and use of indigenous products, processes and services					
27.	Increase Nigeria's rating in the Global Innovation Index					
28.	Promote economic development					
29.	increase digital literacy and digital inclusion					
30.	Create more job opportunities					
31.	Encourage more innovation-driven research and development					

32. What indices are peculiar to the Nigerian environment for measuring innovation?

Appendix A.3: Questionnaire for Consumers

Code: Type C

Aim and Objectives
To determine:

a. *the awareness level of consumers on indigenous innovation outputs.*
b. *the use and acceptance of indigenous innovation outputs.*
c. *Rating and quality of indigenous innovation outputs.*
d. *areas of improvements for innovation.*

Target Respondents:
Consumers

Section A: Demographics

1. What is your state of location?

2. What is your Gender?
   ☐ Male ☐ Female

3. What is your age bracket in years?
   ☐ 20 and below ☐ 21 -25 ☐ 26 - 30 ☐ 31 - 35 ☐ 36 -40
   ☐ 41 – 45 ☐ 45 – 50 ☐ 51- 55 ☐ 56 – 60 ☐ Above 60

4. What is your highest level of formal education?
   ☐ None ☐ Primary School ☐ Secondary School
   ☐ Undergraduate ☐ Graduate ☐ Post Graduate

Section B

5. What sector do you consider the most innovative sector in Nigeria?
   ☐ Telecoms ☐ Finance ☐ Technology ☐ Health
   ☐ Manufacturing ☐ Education ☐ Agriculture ☐ Mobility
   ☐ Energy ☐ Consumer Goods ☐ Others (Please specify)

6. Do you use made in Nigeria products and services?
   ☐ Yes ☐ No

7. How would you rate the quality of made in Nigeria products?
   ☐ Excellent ☐ Above Average ☐ Average ☐ Below Average
   ☐ Very Poor

8. How would you rate the quality of services from Nigerian service companies?
   ☐ Excellent ☐ Above Average ☐ Average ☐ Below Average
   ☐ Very Poor

9. Made in Nigeria products and services can compete with global products and services.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree

☐ Strongly disagree

10. What do you consider as the most effective way of promoting use and adoption of made in Nigeria products and services?

☐ More products & services offerings ☐ Reduce Price

☐ Improve Quality ☐ Increase Marketing

☐ Others (Please specify)

		Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
11.	Made in Nigeria products and services can compete with global products and services					
12.	The "Made-in-Nigeria" market is very competitive					
13.	Private sector support and funding is adequate to improve innovation in Nigeria					
14.	Government support and funding is adequate to improve innovation in Nigeria					

15. What are your suggestions on ways to improve innovation in Nigeria?

Appendix B: Interview Questions

1. What factors promote rate of innovation in Nigeria?
2. What are the challenges that inhibit growth in the rate of innovation in Nigeria?
3. Are government policies and regulations enough to accelerate innovation in Nigeria?
4. What initiatives from government and private sector will accelerate and sustain innovation in Nigeria.
5. How adequate is private sector participation and support in the innovation space?
6. What are the potential benefits that a National Innovation Index will have on Nigeria?
7. What indices are peculiar to the Nigerian environment for measuring innovation inputs?
8. What states are most innovative in Nigeria?
9. What sectors of the Nigerian economy are most innovative?
10. How can an Innovation Index be helpful towards Nigeria's transformation to a digital economy?

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