Are the Sticky Issues in Nigeria's Science, Technology, and Innovation (STI) Ecosystem Really Sticky? Case of Sankore's Submission

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Abstract. Nigeria's Science, Technology, and Innovation (STI) policies require a critical analysis of their evolution and implementation, with a focus on recurrent sticky issues and trajectory restructuring. Following the launch of the first National Science Technology and Innovation Policy (NSTIP) in 1986, subsequent reviews for 1997, 2003, 2012, and 2022 policies have aimed to improve national innovation potential, diversify the economy, and harmonise with global frameworks such as the United Nations Sustainable Development Goals (SDGs) and the African Union's Agenda 2063. Were these policies well implemented? But what are the sticky issues militating against the adoption and implementation of the most needed NSTIP to the benefit of Nigeria? Can we prioritise the stick issues based on their merits? This policy insight draws the attention of role players in the STI ecosystem to the key issues, ranked in order of priority by key role players during the Sankore Project, Nigeria High-Level STI Ecosystem Validation Workshop. This policy insight embraced a qualitative methodology, drawing on documentary analysis of national policy instruments and comparative case studies, complemented by stakeholder perspectives generated through brainstorming sessions during the Sankore project consultations. This approach enabled the identification of five "sticky issues": weak industry-academia linkages, inadequate innovation funding, policy implementation gaps, fragmented Governance, and talent flight, which continue to constrain Nigeria's STI ecosystem. The paper argues that, at the top of the sticky issues, is the NSTIP policy implementation driven by industry-academia linkages. The policy insight submitted that Nigeria must leverage the Quadruple Helix model to navigate the "sticky issues".

Keywords: STI ecosystem; sticky issues; policy; implementation; Nigeria.

INTRODUCTION

Nigeria, Africa's largest economy by GDP, has long acknowledged the role of STI in development. Yet, its performance in translating STI policy into measurable outcomes has remained modest compared to its peers [1]. Influenced by successive policy initiatives aimed at enhancing economic growth and innovation, the Nigerian STI ecosystem is multidimensional.

Nigeria's formal engagement with STI policy dates back to 1986, when the first National Science and Technology Policy was introduced [2]. Nigeria's formal adoption of the STI policy began in 1986, with the introduction of the first National Science and Technology Policy [2]. Coordination of scien-

tific research was the focal point of the 1986 policy as an institutional framework; its impact encountered implementation challenges. The identification of these challenges prompted the Federal Ministry of Science, Technology and Innovation (FMIST) to review and launch the 2022 National Science, Technology and Innovation Policy (NSTIP).

The development of this policy followed a critical examination of global, regional, and national trends, ensuring alignment with the African Union's Science, Technology and Innovation Strategy for Africa (STISA-2024) and the United Nations Sustainable Development Goals (SDGs) [3, 4]. Thus, portraying a distinct and ambitious framework.

The 2022 policy does not position STI solely as a sectoral initiative but also as a broader enabler of national development. It highlights STI's roles in addressing the challenges of industrialisation, the energy transition, climate resilience, health, and the digital economy. A hallmark of the 2022 policy is its strong focus on research and development (R&D) funding. For a long time, Nigeria's gross domestic expenditure on R&D has remained below 0.2% of GDP, which is below the African Union benchmark of 1% and the global average of 2.2% [5]. To address this gap, the 2022 policy outlined a gradual scale-up of R&D investment, targeting 1% of GDP. However, the fiscal realities have so far limited the government's practical commitment to 0.5% of GDP [6]. Despite the policy reforms, Nigeria's STI ecosystem continues to face deep structural constraints. Funding has been a crucial challenge in implementing STI policy. Even the reduced 0.5% GDP allocation is difficult to attain due to fiscal pressures, including debt servicing, reliance on oil revenues, and competing demands in security and social expenditure [6]. Second, weak implementation capacity has plagued past policies, with gaps in monitoring, evaluation, and accountability mechanisms leading to policy inertia [1].

Third, fragmentation of stakeholders persists, with limited collaboration between government, academia, industry, finance, and society, a phenomenon often referred to as the "quadruple helix gap" [7] (Figure 1). Fourth, human capital limitations, including underfunded universities, inadequate STEM education, and brain drain, further weaken Nigeria's capacity to drive innovation [8].

To address these long-standing gaps, the Sankore initiative has been introduced as a targeted intervention to strengthen West Africa's STI landscape. The Sankore project is a £1.9 million, 15-month initiative launched by the UK Foreign, Commonwealth and Development Office (FCDO) in partnership with Nigeria's Federal Ministry of Innovation, Science and Technology (FMIST) and Ghana's Ministry of Environment, Science and Technology (MEST) to strengthen science, technology, and innovation (ST&I) ecosystems in West Africa. Implemented by UNESCO and Results for Development (R4D), the programme supports the operationalisation of Ghana's National Research Fund (GNRF) and Nigeria's National Research Fund (NRF), as well as the establishment of Nigeria's National Research and Innovation Council (NRIC).

Focusing on the commercialisation of innovation in agriculture and energy, the Sankore project also aims to improve policy frameworks, data transparency, and research collaboration, advancing the UK-Africa Technology and Innovation Partnerships (ATIP) Programme and reinforcing UK-Nigeria and UK-Ghana strategic ties.

In its effort to strengthen Nigeria's STI ecosystem, Sankore's initiative identified several persistent challenges, termed "sticky issues." Therefore, the primary objective of this paper is to critically assess the sticky issues that obstruct effective operation within Nigeria's STI ecosystem, as identified through the Sankore submissions. Five primary sticky issues need urgent attention: weak linkages between industry and academia, inadequate innovation funding, policy implementation gaps, fragmented Governance, and challenges related to brain drain and talent retention.

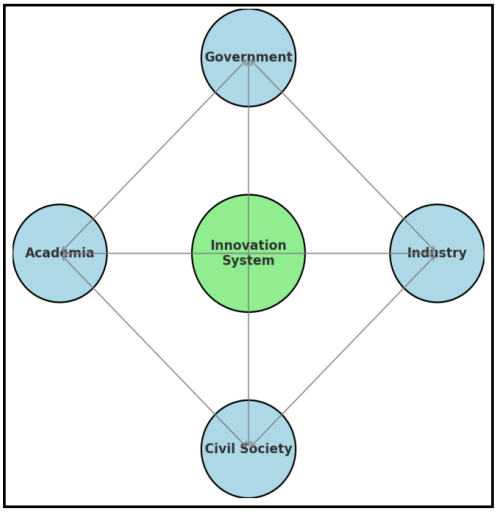

Figure 1 – Quadruple Helix Innovation [7]

This paper adopts a qualitative approach, analysing stakeholder feedback collected from a plenary discussion conducted as part of the Sankore projects. Five sticky issues emerged, with a strong emphasis on the need for enhanced STI policy implementation and improved collaboration among government, industry, academia, and civil society. The integration of stakeholder input underscores the need to discuss and analyse existing gaps in current STI policies.

RESULTS AND DISCUSSION

STI Policy Implementation and Its Transition in Nigeria. The recognition of STI as an enabler of national growth led to the establishment of Nigeria's first-ever National Science and Technology Policy in 1986. The government formulated this policy to provide a model for generating and applying scientific knowledge along a strategic pathway that would enhance citizens' welfare. However, after 10 years of implementation, it became clear that evolving developmental challenges required a more robust framework. As a result, the policy was reviewed in 1997 and structured to run for 25 years with provisions for review every five years [9].

According to the revised policy, coordination, funding, and collaboration were emphasised. Still, it fell short of addressing weak linkages within the National Innovation System (NIS) and failed to adequately leverage emerging opportunities in biotechnology, ICT, and nanotechnology.

A new policy was introduced in 2003 to address these gaps. With attempts to address some weaknesses of its predecessors, it was highly sector-based, had an extensive scope, and poorly implemented broader national economic policies [10]. In an effort to create a more holistic approach, Nigeria engaged the NIS framework in 2005 through the Nigeria/UNESCO STI Strategy Reform. These efforts led to the 2012 STI Policy, which aimed to align economic planning with STI development. The 2012 policy sought to encourage private-sector participation in STI to drive inclusive, people-centred economic advancement.

The 2012 policy highlighted the roles of major institutional stakeholders such as the National Council on Science, Technology and Innovation (NCST&I), the Federal Ministry of Science and Technology (FMST), the National Assembly Committees on Science and Technology, state-level ministries and assemblies, research institutes, academia, and the National Centre for Technology Management (NACETEM). It further proposed the establishment of the National Research and Innovation Council (NRIC) and State STI Councils as important components of Nigeria's STI governance framework [11].

The Nigerian government achieved a notable milestone when it made the 2021 Science, Technology and Innovation (STI) Policy a central driver of its effort to position science, technology, and innovation as the bedrock of long-lasting development and economic restructuring. Following the introduction of the first STI policy in 1986, periodic revisions to the 1997, 2003, and 2012 STI policies have been implemented to address implementation challenges, improve coordination, and align with global trends (Figure 2).

The revision of the 2021 STI policy, endorsed by the Federal Executive Council, reflects the country's readiness to broaden its economy, strengthen its innovation system, and position itself strategically within the global knowledge economy. The core objective of the 2021 STI Policy is to transform Nigeria's NIS by improving linkages between government, academia, industry, and society.

The Nigerian government emphasised research and development (R&D) and the commercialisation of research outcomes in the 2021 policy to promote innovation-led growth. It also acknowledges human capital as the basic resource for innovation and the intentional investments in science, technology, engineering, and mathematics (STEM) education, skills development, and entrepreneurship.

Improving industrial competitiveness is another central objective. The policy outlines strategies to utilise local innovations in advancing key sectors such as agriculture, manufacturing, health, energy, and information and communication technology (ICT). By supporting indigenous innovation, encouraging start-up growth, and safeguarding intellectual property, it lays a foundation for industrial development and employment generation. For a successful policy implementation, a sustainable approach is required.

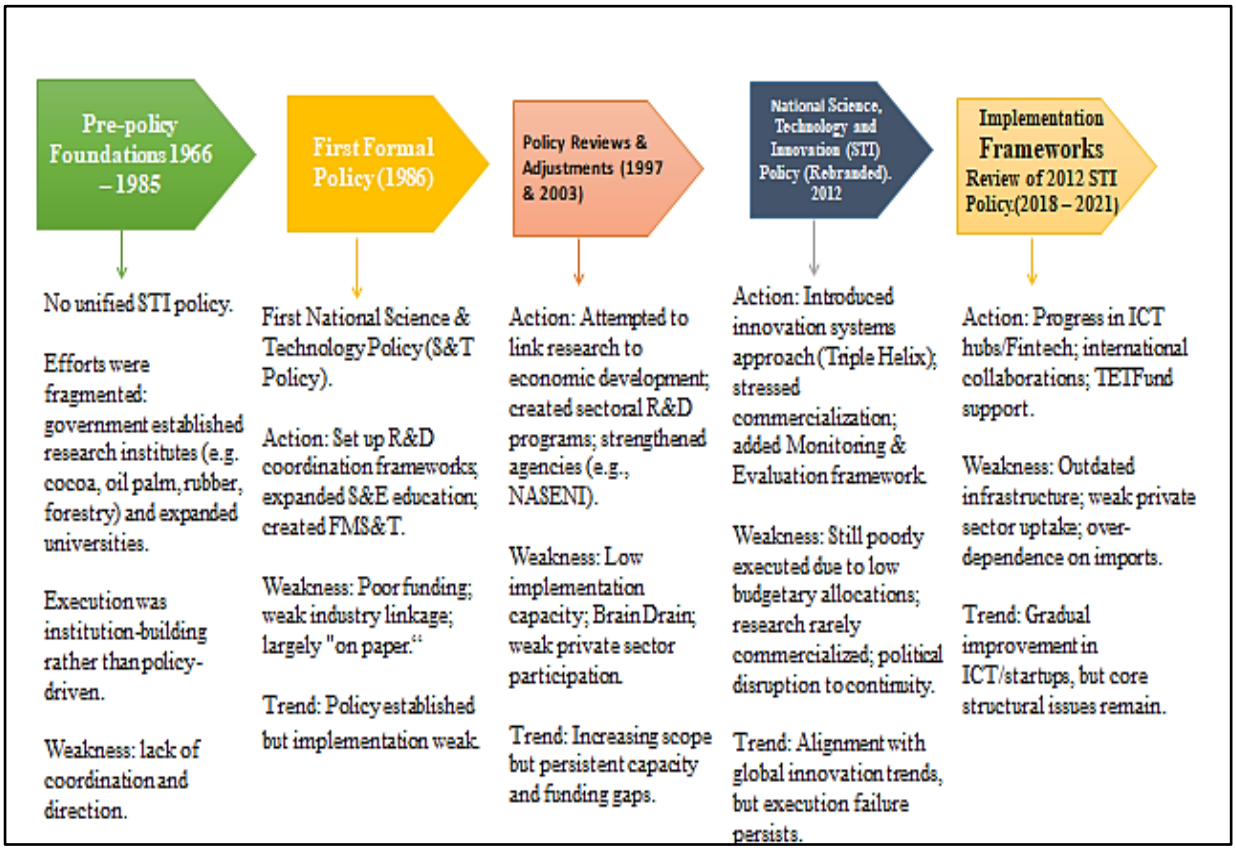

Figure 2 – Overview of the evolution of STI policy

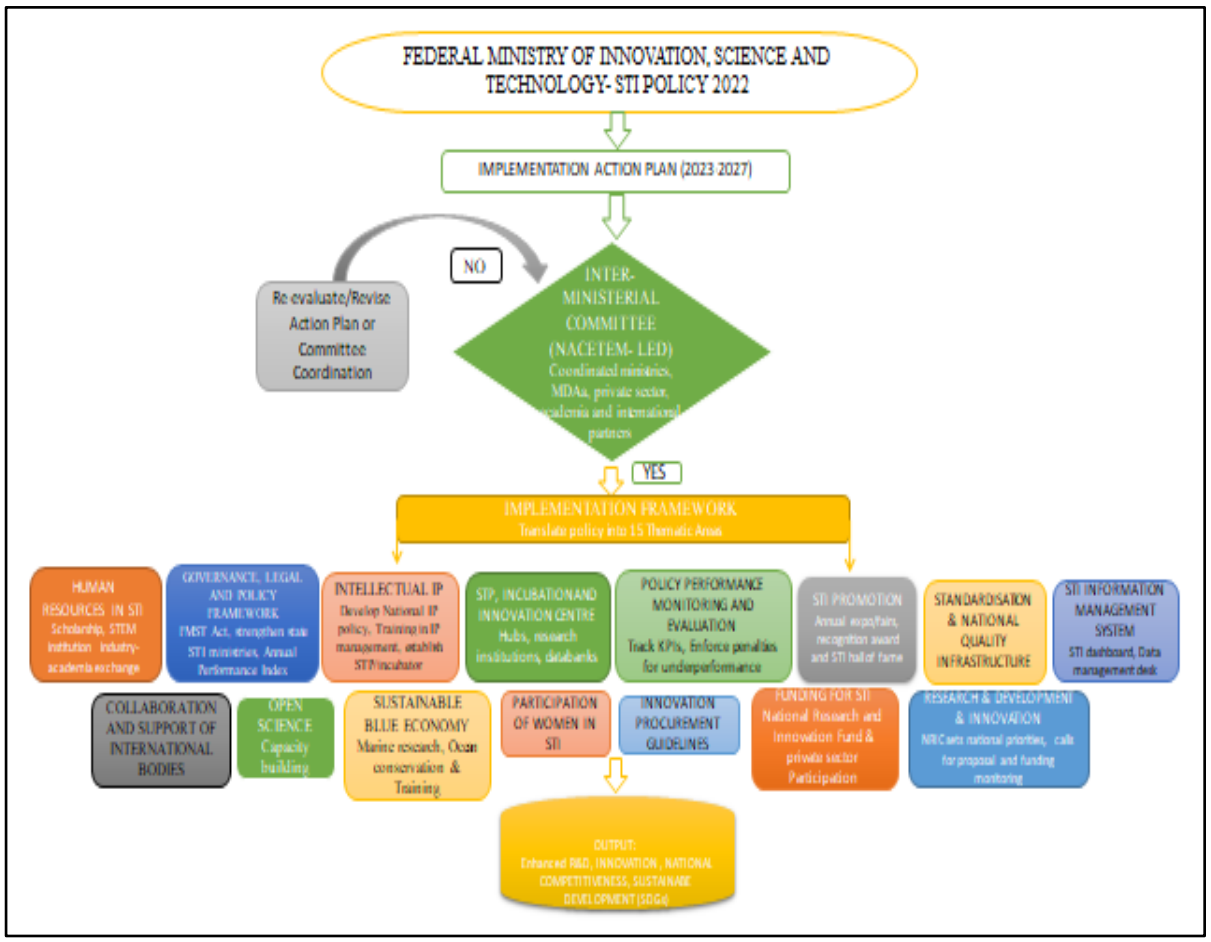

Figure 3 – Implementation mechanism of 2022 STI policy

The creation of a National Research and Innovation Fund (NRIF) is intended to make available a sustainable funding mechanism for innovation activities. Similarly, the establishment of the Science, Technology and Innovation Council (STIC), chaired by the President, is designed to strengthen coordination and encourage political will in achieving the policy's mandate. The policy further incorporates provisions for technology transfer, public-private partnerships, and effective monitoring and evaluation systems to ensure transparency and measurable progress.

The 2021 STI policy aims to diversify the economy away from reliance on oil revenues, stimulate innovation-driven enterprises, and create employment opportunities. It also aims to enhance Nigeria's global standing, accelerate progress toward the Sustainable Development Goals (SDGs), and support the long-term development priorities outlined in Nigeria's Agenda 2050 and the African Union Agenda 2063.

Sticky Issues in Nigeria's STI Ecosystem. These sticky issues are superficial and embedded within the system and require intentional policy action alongside coordinated stakeholders' engagement. The most prevalent issues among them are weak connections and collaboration between academia and industry, insufficient innovation funding, gaps in policy implementation, fragmented governance structures, and an increase in the loss of skilled professionals associated with the inability to retain talent.

1) Weak Linkages Between Academia and Industry. Academic-Industry collaboration is the synergistic exchange between the higher education sectors and industry, designed to solve real-world technical problems, advance joint research and Development (R&D), and facilitate the acquisition and transfer of scientific and technological knowledge.

This partnership is crucial for enhancing a nation's research ecosystem and accelerating economic, industrial and societal progress [12]. To achieve a win–win–win scenario, every stakeholder must engage with this initiative through a new approach that meets the goals of both parties [13].

Academic-industry connections aid in obtaining and influencing additional funding for higher education, fostering innovation and ensuring that students possess the skills and expertise required for effective contributions to the workplace [14]. Collaboration between industry and academia is increasingly a priority in the development, planning, and administration of science and technology policy.

However, several structural weaknesses still impede effective collaboration in Nigeria. Author [15] identified several key weaknesses contributing to the disconnect between Nigerian Academia and Industry, including: an academic assessment model that underemphasises project-based assessment favoured by industry; the pervasive lack of industrial experience among academicians; and insufficient attention given to Science, Technology, Engineering, Arts, and Mathematics (STEAM) Education.

Furthermore, a critical communication gap exists: industries fail to articulate their technical and personnel needs to academia clearly, and, in turn, academia fails to inquire about the specific research and human capital requirements of industries.

The primary motivations driving collaboration between academia and industry are distinct yet complementary and can be categorised across five key dimensions, as outlined by authors [16]. "Necessity" compels both sectors to align with government and institutional strategic policies. "Reciprocity" sees academia seeking access to complementary knowledge and cutting-edge facilities while creating graduate employment, while industry gains access to student talent for internships and hiring. "Efficiency" is a key financial driver: academia seeks research grants and individual benefits for academics, while industry focuses on profit from commercialising university technology, cost-cutting through licensing, and improving competitiveness.

"Stability" pushes academia to contribute to a knowledge-based society and achieve publication, while it motivates industry to expand business, outsource R&D, and reduce risk. Finally, "Legitimacy" drives academia to respond to societal pressure and contribute to the local economy, while it helps industry improve its corporate image. Furthermore, the industry uniquely seeks to maintain control over exclusive technologies.

2) Inadequate Innovation Funding. To effectively implement the STI policy in Nigeria, it is important to develop robust, innovative funding mechanisms. This mechanism includes the government, the private sector, and development partners. The inclusion of the private sector is

pertinent to the provision of blended funding for STI policy implementation. The funding mechanism can consider a project-based funding approach and the use of the Public-Private-Partnership model. Such frameworks will guarantee sufficient resources for infrastructure and programmes.

It suffices to mention that the 2021 Nigerian STI Policy introduced novel mechanisms such as the National Research and Innovation Fund (NRIF). This NRIF was designed to fund strategic, competitive research projects that tackle both domestic and global challenges. Similarly, the National Research and Innovation Council (NRIC) was mandated to oversee the coordination of STI initiatives across different sectors and ministries. The aim was to ensure that all STI-focused projects align with national development priorities. The 2022 STI policy had made the President of the Federal Republic of Nigeria the Chairman of the NRIC. The activation of these policy instruments is central to reducing the bottlenecks that suppress innovation, discourage risk-taking, and slow technological progress.

3) Policy Implementation Gaps. The coordinated implantation of STI policies in Nigeria is very weak. The secretariat of the STI policy implementation is the FMIST. However, the need for a steering committee to implement STI policies in Nigeria has not received the required attention. The consistency in developing well-crafted STI policies is linked to the government's interest and to emerging capacities in STI policy design.

For instance, the Nigerian government never enacted the 2012 STI policy into law. The assessment of implementation revealed low performance due to a lack of political will, poor institutional capacity, inadequate monitoring and evaluation frameworks, and insufficient stakeholder buy-in, leading to a mismatch between stated goals and tangible outcomes. The gap between the policy and the tangible deliverables/practices suggests a trust deficit in government interventions and perpetuates systemic inefficiencies. Addressing this requires deliberate accountability mechanisms, strengthened institutions, and performance-based monitoring systems. Nigeria's Science, Technology and Innovation (STI) Policy has undergone multiple revisions (Figure 2).

About four years ago, the Federal Ministry of Science, Technology and Innovation (FMSTI), the National Centre for Technology Management (NACETEM), and UNESCO collaboratively developed Nigeria's Science, Technology and Innovation (STI) Policy implementation plan.

The plan was widely regarded as one of the most comprehensive frameworks ever designed for Nigeria's STI system, detailing funding mechanisms, institutional roles, and timelines for achieving policy objectives [17, 18]. However, despite its technical strength and the ministerial committee's endorsement, the plan was not officially ratified by the federal authorities. This delay has created a significant implementation gap, leaving the policy without the legal and financial backing required for full execution [19]. In addition, changes in ministerial leadership and the NIS's limited response to evolving national priorities have rendered parts of the draft plan outdated, underscoring the need for revision in line with current realities.

Nevertheless, selected agencies, such as NACETEM, have continued to implement some components of the plan in line with their core mandates, including STI indicator data collection, evidence-based policy, and human capital development [18].

4) Fragmented Governance. An inconsistent and poorly coordinated governance structure has been identified as a key constraint to the effective implementation of STI policies in many developing countries, such as Nigeria. Authors [20] opined that policy incoherence stems from the multiplicity of actors within the NIS, leading to weak coordination among stakeholders (government, academia, and industry). The fragmented nature of Governance has led to duplication of efforts and even low accountability in Sub-Saharan Africa's STI ecosystems.

In the same vein, authors [21] reported that the STI governance structure in Nigeria suffers from overlapping institutional mandates and poorly defined roles; this could be an advantage when harnessed innovatively. However, it has led to weak coordination and delayed policy implementation. The authors [22] argued that any fragmented NIS in Africa stretches scarce resources.

In Nigeria's STI landscape, this fragmentation is evident in the unratified STI Policy Implementation Plan, jointly developed by the then Federal Ministry of Science, Technology and Innovation (FMSTI) and the National Centre for Technology Management (NACETEM), with UNESCO support, between 2020 and 2021. Although the plan was technically robust and endorsed by the ministeri-

al committee, it was never officially ratified, leaving implementation fragmented and largely informal among individual agencies [18, 23].

The lack of a unified coordination mechanism has led some organisations, such as NACETEM, to unofficially adopt elements of the plan. In contrast, others remain unaligned, resulting in inconsistent implementation and a widening policy gap. Addressing this challenge requires establishing a central coordinating framework, clearer role definitions, integrated monitoring systems, and periodic policy reviews to align implementation with current realities [20, 22].

5) Brain Drain and Talent Retention. One of the main concerns for the effective implementation of the Nigerian STI policy is brain drain, driven by ongoing skilled professional migration. The effect is a weak national innovation capacity and low institutional performance. In the work of authors [24], the exodus of research personnel was attributed to inadequate funding, poor working conditions, limited research facilities and infrastructure, and weak career progression systems. For instance, the migration of engineers, researchers, and scientists is leading to a decline in R&D productivity, which has reduced the pool of technical expertise, a key factor in policy execution [8].

Source [18] highlights that effective talent retention in STI ecosystems requires robust infrastructure and merit-based career progression. Furthermore, there is a need for financial incentives, functional and relevant research infrastructure, and opportunities for local and international partnerships that allow Nigerian experts to work globally while contributing locally.

Table 1 showcases STI Policy implementation experience from other countries, including their achievements and challenges.

Table 1 – Experiences in STI Policy Implementation: Achievements and Challenges

Country	Policy/Initiative	Outcomes	Key Lessons Learned	References
South Korea	Creation of the National S&T Council to improve the efficiency of government R&D activities through inter–ministerial coordination of R&D policy and investment. Formulation and implementation of a rolling Five–Year S&T Innovation plan since 1997. Increase in R&D investment over the years to 4.8% of the GDP in 2020 (from 2.0% in 1999). The government planned to spend $25.5 billion (5.1% of the annual budget) on R&D for the 2023 fiscal year. A strong governance architecture led by a Presidential Advisory Council on Science and Technology (PACST) and the Ministry of Science and ICT (MSIT) through its Science, Technology, and Innovation Office.	Emerged as a global leader in ICT, electronics, and automotive industries; R&D >4% of GDP; rapid industrial growth	Sustained R&D investment, strong Governance, and alignment of education with industry needs drive innovation.	[25]
Singapore	A tripartite, overarching 'Home' strategy comprising 'Home for Business', 'Home for Innovation', and 'Home for Talent' was part of the innovation strategy. The country has a Research, Innovation and Enterprise (RIE) 2025 plan in which the government intends to spend another $25 billion to support innovation. National Artificial Intelligence Strategy, making the country a leading choice for	Emerged as a leader in innovation and technology in South-East Asia and ranks 2nd in the Bloomberg Innovation Index.	Singapore's success in innovation stems from strong government leadership, sustained funding, support for SMEs, investment in skills, and early adoption of frontier technologies, making it a global hub for	[25]

Country	Policy/Initiative	Outcomes	Key Lessons Learned	References
	global events in areas such as robotics, space science and ICT. The government acts as an early adopter of relatively unproven new technologies in sectors such as mobility, energy, and, more recently, public healthcare.		talent and business.	
Czech Republic	Top-down STI reforms (early 2000s)	Low innovation uptake; poor buy-in from local stakeholders; resources wasted	Exclusion of grassroots actors leads to policy failure; STIs must be context-sensitive and inclusive.	[26]
Finland	Post-1990s STI reforms; Tekes (Innovation Agency) & Science and Technology Council	Became a global ICT hub; Nokia as flagship; strong innovation capacity and competitiveness.	Crisis-driven STI reforms, strategic investment in ICT, and collaboration foster global competitiveness.	[27]
South Africa	White Paper on Science and Technology (1996)	Some success in the biotech and ICT sectors, but overall systemic outcomes are limited due to fragmentation.	Fragmented Governance and underfunding (R&D ~0.8% GDP) undermine strong policy frameworks.	[28]
Switzerland	Switzerland spends more than 3% of its GDP on R&D (amounting to $25.5 billion in 2019), with the private sector accounting for approximately two-thirds of this spending. The country has a dedicated agency, Innosuisse, whose mandate is to fund science-based innovation. Education is fundamental to its success. Eight Swiss Universities of Applied Sciences and the Arts act as a bridge between the universities and the industry. The work of its universities frequently helps to create start-ups. The country formulates education, research and innovation policy every four years. The 2021-2024 policy focuses on digitalisation, sustainable development and equal opportunities.	The country has a reputation as the world's most innovative economy, ranking third in the Bloomberg Innovation Index and topping the World Intellectual Property Organisation's innovation index for eight consecutive years. It is known for its highly skilled workforce, innovation, strong financial sector, and high standard of living.	Switzerland shows that strong R&D investment, academia-industry collaboration, clear policies, and start-up support are vital for a competitive innovation-driven economy.	[25]

CONCLUSIONS

Utilising the Quadruple Helix Model to Strengthen Nigeria's National Innovation System. Given the ranking of the sticky issues, it is germane that Nigeria deliberately and strategically embraces and implements the Quadruple Helix model. The NSTIP should drive this model, while the government, industry, academia, and civil society contribute and collaborate on a unified course to advance the NIS. Policymakers should have the Federal Ministry of Innovation, Science and Technology (FMIST) lead this course through the NRIC. The NRIC provides a platform for relevant Honourable Ministers within the STI ecosystem to submit their contributions.

On the global stage, the Nigerian government should leverage the STI policy to deepen international collaboration through research partnerships, technology transfer agreements, and participation in global innovation summits. The government should encourage public–private partnerships and structure its procurement processes to act as an early adopter of locally developed innovations.

Operationalising IMCRI as a Focal Point for STI Implementation in Nigeria. The Federal Ministry of Innovation, Science, and Technology (FMIST) should institutionalise the Innovation, Monitoring, Coordination, and Research Interface (IMCRI) as the national coordinating hub for implementing Science, Technology, and Innovation (STI) policy. The government may grant the IMCRI legal status to oversee the monitoring, evaluation, and harmonisation of STI activities across Ministries, Departments, and Agencies (MDAs), thereby reducing institutional fragmentation and enhancing coordination of efforts [18].

Working collaboratively with NACETEM, NOTAP, NITDA, and NASENI, IMCRI can be positioned to coordinate data collection and track R&D performance. The body can also facilitate the publication of annual national STI indicators in collaboration with NACETEM to guide evidence-based policymaking, thereby strengthening linkages among government, academia, and industry to achieve impactful innovation outcomes.

Development of Key STI Indicators. The IMCRI needs to consider developing and functionalising unique key performance indicators (KPIs) to track progress in STI policy implementation.

These indicators may involve:

a) Data on R&D availability and funding distribution across institutions.

b) Number of active public–private partnerships (PPPs) and joint innovation projects.

c) Number of new products, services, and patents generated from local research.

d) Percentage of industries allocating a fixed portion of annual net income to R&D collaboration with universities and research institutes [5, 29].

e) Personnel and human resource development indicators, such as the number of postgraduate researchers trained through funded innovation programmes.

Regularly publishing these indicators is pertinent to creating accountability and transparency, ensuring evidence-based policy feedback and adaptive planning [6, 10].

Legislative Backing for Enforcement. To strengthen the operationalisation of the IMCRI, the National Assembly should provide robust legislative support to mainstream the NIS and attract industry participation. Legislators should sponsor a National Science, Technology and Innovation Fund and Research Collaboration Bill; this can compel industries to dedicate a statutory percentage (e.g., 0.5–1 % of annual net income) to R&D partnerships with Knowledge Institutes (universities and research institutes); this aligns with global best practices and the African Union's STISA-2034 framework, which calls on member states to increase national R&D investment. The legislation can equally foster linkages between industry and academia.

Strengthening Intellectual Property (IP) Frameworks. The FMIST, IMCRI, NOTAP, NACETEM, FMTI and the Association of Inventors and Innovators of Nigeria must strengthen existing synergy and energise the commercialisation of innovations and inventions; this is pivotal to harmonising and deepening the impact of Nigeria's Intellectual Property (IP) policies. These policies should ensure innovators retain ownership rights while facilitating technology transfer and commercialisation of research outputs [1].

Monitoring, Evaluation, and Reporting Mechanism. There is a need for IMCRI to design a National STI Monitoring and Evaluation Dashboard to track projects in real time. Policymakers can use the dashboard to assess the impact of policies and support decision-making in the policy environment. The system will present data on R&D activities, funding flows, innovation outputs, and partnerships. The system will be relevant in positioning the IMCRI as the central evidence hub for STI performance reporting. The mechanism can support national planning instruments such as the Medium-Term National Development Plan (MTNDP) and the Nigeria Agenda 2050 [23].

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