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The Economics of Innovation in Nigeria amidst Fuel Subsidy Removal and High Inflation: A systematic review

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Abstract

This systematic review investigates the impact of fuel subsidy removal and high inflation on innovation in Nigeria. Drawing on 26 studies published between 2010 and 2024, it examines how macroeconomic shocks shape firm behavior, sectoral dynamics, and innovation outcomes. Findings reveal that while inflation and rising costs constrain traditional firms, they simultaneously stimulate frugal, necessity-driven innovations, especially in agriculture and informal sectors. Fuel subsidy removal, despite short-term economic pressures, has encouraged investment in renewable energy and energy-efficient technologies. Digital sectors demonstrate resilience and growth, contrasting with challenges faced by manufacturing and heavy industries. The review emphasizes that translating economic shocks into sustainable innovation requires coordinated policy support, robust infrastructure, and effective institutional frameworks to enhance Nigeria's capacity for adaptive, inclusive, and forward-looking innovation.

Keywords: Innovation economics, Fuel subsidy removal, Inflation, Nigeria, Macroeconomic shocks

INTRODUCTION

Innovation is widely acknowledged as a key engine of long-term economic growth. It is also a vital driver of sustainable economic development, especially in emerging economies like Nigeria; where it contributes to job creation, technology diffusion, and industrial diversification. According to the World Bank (2023a), innovation-led industries such as fintech, Agric-tech, and renewable energy are among the fastest-growing segments of the Nigerian economy. These industries demonstrate how innovation can create inclusive growth even in low-resource environments. Nevertheless, Nigeria ranks low on global innovation indices. The 2023 Global Innovation Index (GII) ranks Nigeria 109th out of 132 economies, citing weak linkages between research institutions and industry, low public investment in R&D, and limited innovation infrastructure (WIPO, 2023). However, recent macroeconomic disruptions particularly the removal of fuel subsidies in 2023 and persistent high inflation have restructured the economic environment in ways that profoundly affect innovation behavior, capacity, and outcomes. This review synthesizes existing literature to explore how these two major economic forces influence the innovation landscape in Nigeria.

Problem Statement and Gaps this Study Intends to Fill

Nigeria stands at a critical economic juncture following the removal of fuel subsidies and the persistence of high inflation. While these policy changes aimed to correct fiscal imbalances and stimulate long-term growth, they have simultaneously heightened production costs, reduced household purchasing power, and increased business uncertainty. Even though innovation is widely acknowledged as a driver of resilience, productivity, and competitiveness in such turbulent environments, however, the economics of innovation in Nigeria remains poorly understood in relation to macroeconomic shocks such as subsidy reforms and inflationary pressures. Without empirical and conceptual clarity, policymakers and firms may struggle to design innovation-led strategies that mitigate inflationary effects and harness subsidy savings for productive investment.

There is a gap in empirical studies that quantify the exact relationship between subsidy removal, inflation, and innovation metrics such as R&D expenditure, patent registrations, or startup growth. Most available studies are either descriptive or policy-based. Another major gap is in regional innovation resilience on how different parts of Nigeria, sectors and entire economy cope with inflationary pressure and policy changes differently due to varying infrastructure and human capital levels.

Existing studies on innovation in Nigeria have largely concentrated on firm-level dynamics, R&D intensity, or sectoral case studies, often divorced from broader macroeconomic realities. Similarly, policy debates on subsidy removal and inflation tend to focus narrowly on fiscal sustainability, welfare impacts, or monetary policy responses, with little attention to innovation as a mediating mechanism for economic adjustment and growth. There is therefore a missing link between macroeconomic shocks and the pathways through which innovation can either cushion or exacerbate their effects on firms, households, and the wider economy. This study fills the gap by examining the economics of innovation in Nigeria within the context of fuel subsidy removal and high inflation, providing insights into how innovation can serve as both an adaptive strategy and a policy tool for achieving sustainable economic transformation. This study provided a perspective on the impact of fuel subsidy reforms and inflation on innovation outcomes, firm behavior, policy responses, and sectoral dynamics in Nigeria.

Research Objectives for the Study

The general objective is to examine the impact of fuel subsidy removal and high inflation on the innovation landscape in Nigeria.

Whereas the specific objectives include**:**

i. To assess the effect of fuel subsidy removal on innovation activities across key economic sectors in Nigeria.
ii. To analyze the influence of inflation on the cost, financing, and sustainability of innovation initiatives.
iii. To identify the coping and adaptive innovation strategies used by Nigerian firms and entrepreneurs in response to economic pressures.

iv. To explore the changes in consumer demand for innovative products and services amid rising fuel and living costs.
v. To identify new opportunities for frugal, energy-efficient, or grassroots innovation emerging in response to fuel and price shocks.
vi. To investigate regional disparities in innovation performance and response to inflation and subsidy removal.
vii. To evaluate the effectiveness of existing government policies and support mechanisms in promoting innovation under macroeconomic stress.

Research Questions

The questions aim to explore the relationships between macroeconomic changes and innovation dynamics in the Nigerian context. The primary Research Question borders on how the removal of fuel subsidies and high inflation affected the innovation ecosystem in Nigeria. The specific research questions include the following**:**

i. What industries or sectors have experienced the most innovation activity as a response to fuel subsidy removal?
ii. To what extent has high inflation influenced the availability and cost of financing for innovation and R&D in Nigeria?
iii. How are Nigerian firms and entrepreneurs adapting their innovation strategies in response to rising energy and input costs?
iv. How has consumer behavior and demand for innovative products changed under inflationary pressure and fuel price increases?
v. Are there emerging opportunities for frugal or grassroots innovation driven by economic constraints in Nigeria?
vi. How effective are existing innovation policies and frameworks in supporting resilience to macroeconomic shocks in Nigeria?
vii. What role does government policy play in mitigating or exacerbating the impact of subsidy removal and inflation on innovation?

METHODOLOGY

This study employed a systematic literature review approach following PRISMA guidelines (Page *et al.*, 2021). Peer-reviewed articles, policy reports, and grey literature published between 2010 and 2024 were sourced from academic databases (Scopus, JSTOR, Google Scholar) and institutional repositories (World Bank, IMF, CBN, AfDB). A total of 48 sources were screened, with 26 papers meeting the inclusion criteria. The 26 papers are cited in the references. The review focused on the impact of fuel subsidy reforms and inflation on innovation outcomes, firm behavior, policy responses, and sectoral dynamics in Nigeria.

Article Selection, Quality Assessment, and Eligibility Criteria

The review followed a systematic approach to ensure transparency and rigor. Relevant articles were identified through a comprehensive search of electronic databases including Scopus, Web of Science, JSTOR, ScienceDirect, and Google Scholar, supplemented by policy reports from organizations such as the World Bank, African Development Bank, and the Central Bank of Nigeria. Search terms combined keywords such as *"innovation," "economics of innovation," "fuel subsidy removal," "inflation," "Nigeria,"* and *"macroeconomic shocks."* An initial pool of studies published between 2000 and 2025 was generated.

Eligibility criteria were applied to ensure relevance:

i. Studies had to focus on Nigeria or provide significant comparative insights relevant to Nigeria.
ii. Articles had to address at least one of the following themes:
    a. economics of innovation,
    b. innovation and inflation,
    c. innovation and subsidy reforms, or
    d. innovation as an adaptive response to macroeconomic shocks.
iii. Only peer-reviewed journal articles, conference papers, and high-quality policy reports were included, while opinion pieces and non-scholarly blogs were excluded.
iv. Studies had to be available in English.

Quality Assessment

Involved a two-stage process. First, abstracts were screened for alignment with the research question. Second, full texts were evaluated using a structured checklist adapted from the Critical Appraisal Skills Programme (CASP) and PRISMA guidelines, focusing on methodological robustness, clarity of

research design, theoretical grounding, and evidence validity. Articles scoring low on methodological rigor or lacking empirical/theoretical contribution were excluded.

Out of the initial pool, duplicates were removed, and after screening and assessment, a final set of 26 articles were included in the review. This systematic selection process ensured that only high-quality, relevant evidence was synthesized to analyze the economics of innovation in Nigeria within the context of fuel subsidy removal and high inflation.

Thematic Matrix: Synthesizing Literature on Innovation amid Economic Challenges

The thematic matrix below organizes key studies and reports, aligning them with the identified themes to facilitate comparative analysis and highlight research gaps.

Theme	Key Findings	Representative Studies
Fuel Subsidy Removal	• Triggered increased operational costs across sectors. - Prompted a shift towards alternative energy solutions. - Induced policy debates on sustainable energy practices.	• Akinbami *et al.* (2023): Examined energy policy reforms and their impact on innovation dynamics. - IMF (2023): Discussed the fiscal implications of subsidy removal and its effect on economic activities.
High Inflation	• Elevated production and living costs. - Diminished consumer purchasing power. - Created an uncertain investment climate, affecting innovation funding.	• CBN (2024): Provided data on inflation trends and economic indicators. - Adelekan & Ogunbiyi (2022): Analyzed the impact of inflation on SMEs and their innovation strategies.
Innovation Responses	• Emergence of frugal innovations tailored to local needs. - Increased adoption of digital platforms and services. - Growth in renewable energy projects, especially solar-based solutions.	• Eze & Eyo (2021): Explored frugal innovation as a response to economic constraints. - IRENA (2023): Reported on renewable energy adoption trends in Nigeria.
Sectoral Impacts	• Agriculture: Integration of agri-tech solutions to enhance productivity. - Manufacturing: Adoption of energy-efficient technologies. - Services: Expansion of digital service delivery and remote work adaptations.	• GSMA (2023): Highlighted the role of mobile technology in service delivery. - UNIDO (2023): Discussed industrial competitiveness and innovation in manufacturing.
Policy and Institutional Framework	• Implementation of innovation funding programs. - Regulatory reforms aimed at fostering innovation. - Establishment of public-private partnerships to support research and development.	• FMST (2022): Outlined national science and technology policies. - NITDA (2021): Detailed digital economy strategies and initiatives.
Regional Disparities	• Urban areas exhibited higher innovation adoption due to better infrastructure. - Rural regions faced challenges in accessing resources and implementing innovations. - Geopolitical zones showed varied responses based on localized policies and resources.	• Nesta (2021): Mapped innovation clusters across Nigeria. - OECD (2022): Provided insights into regional disparities in innovation capabilities.

Data Sources and Search Strategy

Relevant literature was identified using a structured search strategy across multiple databases and sources, including:

- Academic databases: Scopus, Web of Science, JSTOR, ScienceDirect, and Google Scholar.
- Institutional reports: World Bank, IMF, African Development Bank (AfDB), Central Bank of Nigeria (CBN), and Nigerian government publications.
- Grey literature: Working papers, policy briefs, industry reports, and reports from think tanks (e.g., Brookings, Nesta, GSMA).

Search terms included combinations of:

- "Innovation in Nigeria"
- "Fuel subsidy removal" AND "economic impact"
- "High inflation" AND "Nigeria" AND "innovation"
- "Macroeconomic shocks" AND "entrepreneurship"
- "Energy prices" AND "innovation responses"

Boolean operators and filters were used to narrow results by relevance, time frame (2010–2024), and region (Nigeria).

Data Extraction and Synthesis

A structured data extraction template was developed to collect key information from each selected study, including:

- Author(s), year, and source
- Study focus and research question
- Methodology and data used
- Key findings on innovation, inflation, and fuel subsidy impacts

Data were analyzed thematically using a narrative synthesis approach. Studies were grouped by topic (e.g., sectoral innovation, policy responses, inflation effects), and patterns, contradictions, and gaps were identified.

Limitations

This study was limited by the availability and quality of existing literature; which is a challenge for a normal desk-based systematic review. Potential bias may arise from publication bias or limited access to local Nigerian data sources.

Literature review

Fuel Subsidy Removal and Innovation Incentives

The removal of fuel subsidies in mid-2023 was intended to curb fiscal leakages and improve public spending efficiency (IMF, 2023). The subsidy removal was presumed to lead to long-term gains if the savings were reinvested in innovation-enabling infrastructure such as digital connectivity, transport, and education (World Bank, 2023). However, the realization of such gains is conditional on governance capacity and the political will to redirect funds effectively, which remains a concern in Nigeria. Nevertheless, the removal of the subsidy had immediate inflationary effects by increasing fuel prices, transportation costs, and input prices for manufacturers. Akinbami *et al.* (2023) argued that while these outcomes strained firms, they also incentivized innovation in alternative energy, local fabrication of clean technologies, more fuel-efficient system, logistics efficiency, and digital operations to cut costs. According to Akinbami *et al.* (2023), Nigeria's solar and mini-grid sector has seen increased interests, particularly in underserved rural areas, as entrepreneurs respond to unprecedented high prices of diesel and petrol. Other studies also noted a positive long-term potential for innovation, especially in renewable energy and fuel-efficient technologies (World Bank, 2023; Bello & Sanusi, 2023, IRENA, 2023). However, the innovation benefits were not automatic. According to Yusuf and Akanbi (2022), structural constraints such as weak infrastructure, corruption, and policy uncertainty often prevent subsidy reforms from translating into sustained development of innovations.

Inflation and Innovation Capacity

Nigeria's inflation rate reached over 28% in early 2024, driven by food price shocks, currency depreciation, and energy costs (CBN, 2024; NBS, 2024). High inflation directly increases the cost of capital and production inputs, negatively affecting firms' capacity to invest in research and development (AfDB, 2023). High inflation rates raise the cost of inputs for innovators, particularly in sectors such as manufacturing and tech. According to AfDB (2023), the increases in the cost of capital, makes it more difficult for startups to secure funding. High inflation rates also erode purchasing power, discourages long-term

investment, and increases the cost of inputs required for innovation, such as imported high tech machinery, software, and technical labor (Ezeala-Harrison, 2023). Adelekan and Ogunbiyi (2022) noted that many Nigerian small and medium enterprises (SMEs) reduced their innovation budgets during inflationary periods due to shrinking profit margins and increasing uncertainty. Financial institutions wary of unstable macroeconomic conditions, often reduce lending, particularly for high-risk innovation activities (Nwosu & Uche, 2021). Additionally, inflation-related uncertainty makes it difficult for innovators to predict future market demand or input costs, further dampening the craving for risk-taking (UNCTAD, 2022). All of which undermine both the supply and demand for new products and technologies.

Nonetheless, some scholars highlight **"**necessity-driven innovation**"** as a counter-effect. High rising prices as seen in inflation encourages cost-saving process innovations, local substitution of imports with locally produced goods, spurring innovation in agro-processing, local manufacturing, retail logistics, fintech and digital services (Eze and Eyo, 2021; UNCTAD, 2022). These innovations often take the form of frugal innovations, using local materials and lean technologies to produce affordable products (Radjou *et al.*, 2012). The fintech industry has particularly benefited, as inflationary pressures push consumers toward mobile money, decentralized finance, and digital savings solutions to hedge against currency depreciation (CBN, 2023). The fintech companies developed creative ways to hedge inflation by provide value-stable financial products, such as dollar-pegged savings and crypto-based payment solutions (GSMA, 2023).

Sectoral and Regional Dynamics

Innovation responses vary significantly across sectors and industries. Fintech, agritech, and renewable energy have shown resilience and growth, partly due to digital scalability and external investments (GSMA, 2023).

- Fintech: The search for inflation-resistant savings and payment systems is spurring growth in blockchain technologies, mobile banking, and microcredit innovations (McKinsey, 2023).
- Renewable Energy: The rise in fuel costs is pushing demand for solar solutions in off-grid and peri-urban areas. Companies such as Lumos and Arnergy are expanding pay-as-you-go solar models, a form of social and technological innovation (Energy Commission of Nigeria, 2023).
- Agriculture: Inflation has made food prices volatile, increasing interest in agri-tech solutions that enhance productivity and reduce post-harvest losses, such as precision farming, solar drying technologies, cold storage innovation, and blockchain for supply chain traceability (IFPRI, 2023).

In contrast, manufacturing and traditional service sectors struggle due to their high dependence on energy and imported inputs (UNIDO, 2023). Regionally, innovation remains concentrated in urban innovation clusters, especially in Lagos, Abuja, and Port Harcourt (Nesta, 2021). Whereas the South East seem not to be visible with known innovation hubs, the Northern Nigeria lags due to lower access to education, digital infrastructure, and ongoing insecurity (OECD, 2022).

Institutional and Policy Responses

To support innovation in this economic climate, Nigeria must pursue deliberate policy interventions. These include improving the ease of doing business, improving access to affordable energy for innovators, strengthening intellectual property protection, offering tax incentives for R&D, and investing in technical education (FMST, 2022). Human capital innovation is constrained not just by capital but by skills. In an inflationary environment, emigration of skilled professionals, often called "brain drain", undermines innovation capacity in Nigeria. Efforts to retain and reskill talent, especially in science and technology fields, are essential to navigating this economic transition (World Economic Forum, 2022).

Government policy plays a crucial role in shaping innovation outcomes amid economic shocks. The Nigerian government introduced several initiatives such as the National Digital Economy Policy (NDEPS) (2020–2030) and the Technology and Innovation Fund. NDEPS outlines a vision for innovation-driven growth, but its implementation must be scaled up in response to current economic realities (NITDA, 2021). Public-private partnerships can also help de-risk early-stage

innovation, especially in sectors critical for economic transformation.

A recurring critique is that many innovation policies are poorly aligned with macroeconomic realities. For example, while the removal of subsidies was a fiscal reform, it was not matched by commensurate investments in energy alternatives or innovation infrastructure (World Bank, 2023; FMST, 2022). Furthermore, macroeconomic instability has reduced foreign direct investment (FDI) in innovation-intensive sectors, with investors seeking more stable environments (UNCTAD, 2022). Without predictable policies and innovation incentives, Nigeria risks missing the opportunity to leverage current economic pressures into long-term innovation gains.

Synthesis

The literature on the economics of innovation in Nigeria reveals a complex and evolving relationship between macroeconomic shocks, specifically the removal of fuel subsidies and sustained high inflation and the country's innovation performance. The evidence presents a nuanced picture, with both constraining and enabling forces influencing innovation across sectors and regions.

Fuel subsidy removal has emerged as a double-edged reform. On one hand, the immediate aftermath marked by rising fuel and transportation costs has strained firms' operational capacity and increased production costs (Akinbami *et al.*, 2023; IMF, 2023). This shock has particularly affected manufacturing and logistics-heavy sectors. However, several scholars highlight that this economic pressure has catalyzed innovation out of necessity, especially in renewable energy and cost-saving technologies. For instance, businesses have begun adopting solar mini-grids and fuel-efficient production processes as alternatives to expensive fossil fuels (IRENA, 2023; Bello & Sanusi, 2023). Thus, while the subsidy removal initially constrained innovation through higher costs, it also created incentives for long-term adaptation and resilience through technological upgrading.

In parallel, high inflation has exacerbated the challenges faced by innovators. Persistent inflation reaching over 28% in early 2024 (CBN, 2024) eroding firms' purchasing power, increased borrowing costs, and deterred risk-taking in R&D investments. SMEs, which constitute the bulk of Nigeria's innovation base, have been particularly vulnerable. Many have cut innovation expenditures to stay afloat (Adelekan & Ogunbiyi, 2022). Nonetheless, inflation has also triggered frugal and incremental innovations, particularly in industries such as agri-tech and retail; where entrepreneurs have adopted lean business models and low-cost technologies to serve price-sensitive consumers (Eze & Eyo, 2021; Radjou *et al.*, 2012).

A critical insight from the literature is the sectoral divergence in innovation resilience. Digital-driven industries such as fintech, e-commerce, and telehealth have shown stronger adaptive capacity, leveraging their scalability and limited dependence on physical infrastructure (GSMA, 2023; Nesta, 2021). In contrast, traditional sectors such as manufacturing and transportation, which are more exposed to energy price volatility and import dependence, have struggled to innovate under economic pressures (UNIDO, 2023).

Policy responses have shown some promise but lack coherence. While programs like the NDEPS and government-backed innovation funds exist, they often operate in silos and fail to address the systemic constraints facing innovators, such as access to finance, regulatory bottlenecks, and infrastructural deficits (FMST, 2022; NITDA, 2021). Moreover, the mismatch between fiscal reforms (like subsidy removal) and compensatory innovation investments reflects a broader challenge of policy misalignment (World Bank, 2023; Yusuf & Akanbi, 2022).

Geographic disparities further compound the innovation challenge. Urban centers such as Lagos and Abuja are innovation hotspots, benefiting from better infrastructure, connectivity, and institutional support (Nesta, 2021). However, other regions and the rural areas lag behind due to insecurity, weak education systems, and poor infrastructure, resulting in a highly uneven innovation landscape (OECD, 2022).

In sum, the literature underscores a paradox: while Nigeria's macroeconomic environment is currently hostile to traditional innovation investments, it is simultaneously creating opportunities for adaptive, frugal, and digital innovations. Unlocking the transformative potential of these trends will require coordinated policy support, targeted investments in innovation ecosystems, and a stabilizing macroeconomic framework.

DISCUSSION

Macroeconomic shocks could equally constrain and stimulate innovation, depending on the institutional and sectoral context. While some firms respond with adaptive strategies and new technologies, others reduce innovation activities due to uncertainty and cost pressures. The findings of this systematic review provide critical insights into how Nigeria's innovation landscape is being reshaped by the dual pressures of fuel subsidy removal and high inflation. The evidence supports the proposition that macroeconomic instability, while typically a constraint, can also act as a catalyst for context specific and necessity driven innovations.

One of the most salient findings is that fuel subsidy removal, though economically painful in the short term, has created new incentives for innovation, particularly in sectors heavily reliant on energy. The increased cost of fossil fuels has led to greater interest in renewable energy technologies, such as solar mini-grids and energy-efficient production methods (IRENA, 2023; Bello & Sanusi, 2023). This aligns with economic theories suggesting that price shocks can accelerate the diffusion of alternative technologies when traditional systems become unsustainable (Porter & van der Linde, 1995). However, the extent to which this potential is realized depends significantly on the enabling environment, including policy coherence, infrastructure, and access to finance (Yusuf & Akanbi, 2022).

On the other hand, high inflation poses a more persistent and systemic challenge to innovation. Inflation increases the cost of borrowing, erodes disposable income, and reduces the capacity of firms, especially SMEs to engage in risk-taking activities such as R&D and product development (Adelekan & Ogunbiyi, 2022). Yet, in an interesting twist, inflation has also encouraged frugal innovation. Entrepreneurs in sectors such as agriculture and informal retail have responded to rising costs with creative, low-cost solutions tailored to the local market (Eze & Eyo, 2021; Radjou *et al.*, 2012). These grassroots innovations underscore the adaptability of Nigeria's entrepreneurial base, though they often operate in isolation due to weak institutional support.

A key issue that emerges from literature is sectoral asymmetry. Digital sectors such as fintech and e-commerce have thrived despite macroeconomic disruptions, largely due to their scalability and lower dependence on physical infrastructure (GSMA, 2023). In contrast, traditional sectors such as manufacturing, transportation, and heavy industry have struggled to maintain competitiveness and innovative capacity in the face of rising costs and uncertain demand (UNIDO, 2023). This divergence reflects broader global trends in which intangible, digital-based innovation outpaces physical innovation in times of crisis.

Policy and institutional dynamics play a decisive role in determining how innovation ecosystems respond to economic shocks. Although Nigeria has made strides with initiatives such as the NDEPS and various innovation funding schemes, implementation remains inconsistent and poorly aligned with macroeconomic reforms. For example, while fuel subsidy removal was a major economic reform, it was not matched by adequate investments in alternative energy infrastructure or support for affected industries. This lack of policy synergy limits the potential of economic shocks to generate positive innovation spillovers.

Ultimately, this review reinforces the notion that innovation under economic pressure is possible but not automatic. The direction and intensity of innovation responses depend on a confluence of factors, including firm characteristics, sectoral dynamics, institutional capacity, and government policy. If Nigeria is to transition from a reactive to a proactive innovation economy, it must adopt a more integrated approach that simultaneously addresses macroeconomic stability, infrastructure development, and ecosystem-level innovation support.

CONCLUSION

In conclusion, while the removal of fuel subsidies and rising inflation pose substantial macroeconomic challenges—bringing operational risks and increased costs for firms—they also open a unique window of opportunity for innovation and strategic adaptation in Nigeria. These pressures could accelerate a shift toward energy sustainability, financial inclusion, and import substitution. However, the realization of these benefits depends heavily on proactive policies, infrastructure investment, and institutional support for innovation ecosystems. The trajectory of

innovation in Nigeria will depend largely on how effectively policy, investment, and entrepreneurial responses aligned to convert short-term shocks into long-term gains. The recent developments also present opportunities for creative adaptation and localized innovation.

This study reasoned that policymakers must prioritize not only inflation control measures and subsidy reforms but also craft coherent innovation policies that facilitate resilience and inclusivity across sectors and regions. It is also recommended that the Science, Technology and Innovation policies of Nigeria is crafted to address challenges posed by macroeconomic instabilities as they affect innovation at the micro-levels.

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