Innovations

Evaluating the Impact of Government Budgetary Allocations on Science, Technology and Innovation (STI) Outcomes in Nigeria: A Decadal Analysis

Emeka Joseph; Ademola-Ajibade A.M;
Thompson-Adewole,V. U; Oluwadamilola Ajuwon; Abubakar Kazeem;
R.C Wakawa
National Centre for Technology Management (NACETEM)

Corresponding Author: **Ademola-Ajibade A.M**

Abstract: *This study evaluates the impact of government budgetary allocations on Science, Technology, and Innovation (STI) outcomes in Nigeria over the past decade. It examines the trends in government funding for STI, assesses measurable outcomes of these investments, and explores the correlation between budget allocations and STI performance. The study employs a trend/diagnostic approach, utilizing data from the National Centre for Technology Management (NACETEM) dashboard, World Bank, OECD, and UNIDO. The analysis reveals significant fluctuations in budget allocations across various sectors, indicating changing priorities and external influences. Key findings suggest that while certain sectors like telecommunications and fintech have seen advancements, overall STI performance remains modest. The study highlights the need for more consistent and strategic investment in STI to enhance Nigeria's global innovation ranking and economic growth. Recommendations include increased and sustained funding for critical sectors, improved monitoring and evaluation frameworks, and fostering private sector participation and international collaborations.*

Keywords: Science, Technology, Innovation (STI), Budgetary Allocation.

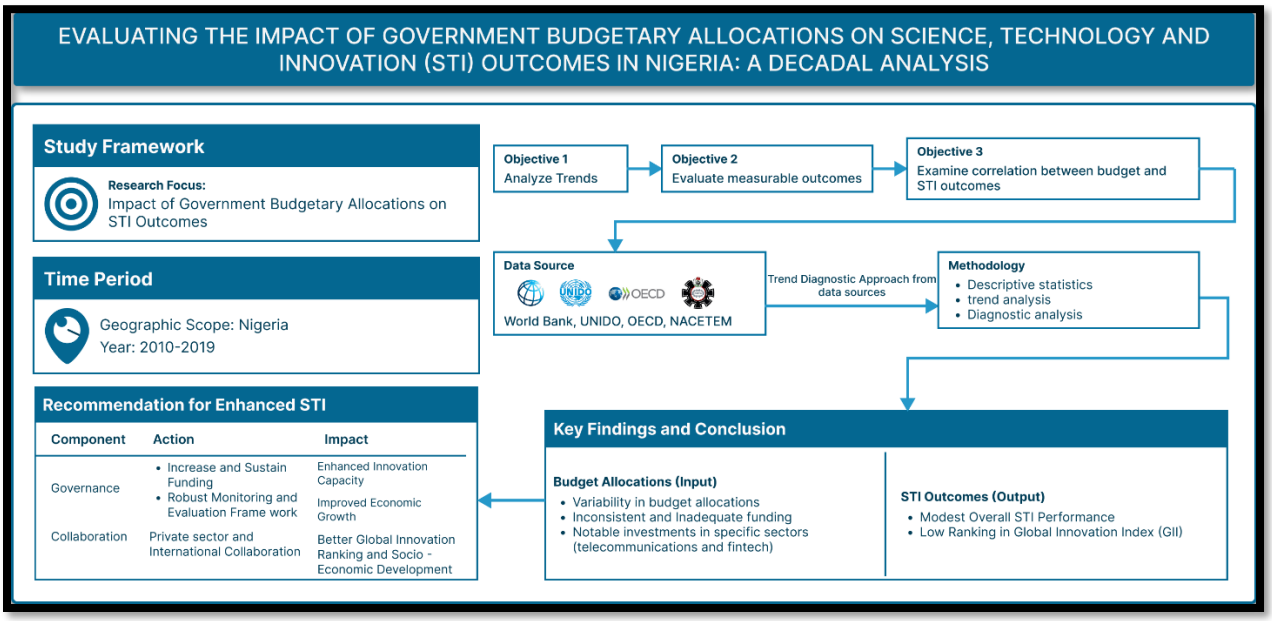

Figure 1: Graphical Abstract

1.0. Introduction

1.1. Background Information

Science, Technology, and Innovation (STI) are the pillars of economic growth and development in the modern world. The unique relationship among these three elements increase advancements in productivity, quality of life and can also address societal challenges. In Nigeria, the impact of STI in shaping the nation's socio-economic landscape is increasing lybeing recognised, and the government's budgetary allocations towards STI iscritical toward the scope and value of innovative activities within the country.

Also, no nation has attained incessant economic growth without significant budgetary investments in key sectors that are identified for their high multiplier effects (Nurudeen & Usman, 2010). Cooray (2009) further reiterated that budget allocations to core sectors like education, technology and innovation, health, agriculture, and industry can enhance equity and noticeably reduce poverty. For this reason, the Nigerian government has since been allocating varying levels of funding to STI sectors. During the early post-independence years, there was focus on developing educational institutions and research centres to build a foundation for scientific and technological growth. Also, in recent decades, various policies and funding programs and models were brought up by the government with the intention of boosting research and innovation. This resulted in the establishment of bodies such as the National Office for Technology Acquisition and Promotion (NOTAP) and the National Agency for Science and Engineering Infrastructure (NASENI) there by institutionalizing support for STI. However, despite these efforts,

the allocation and utilisation of funds have frequently been criticised for being inadequate and inefficient (Uwubanmwen & Osagie, 2016).

In 2021, Nigeria committed to allocate 0.5% of its GDP, to research and development (R&D). This was for the purpose of increasing productivity in industries such as technology, healthcare, and agriculture (Onyedinefu, 2022; Science Nigeria, 2022). This was in response to the 2006 directive from the African Union that calls on its member states to set aside 1% of their GDP for STI initiatives (UN-OHRLLS, 2018). Although this was a step in the right direction, Nigeria still faces significant challenges in transforming these allocations into measurable STI outcomes.

Increased STI allocations hasfavourable effect on national innovation systems, as demonstrated by other African countries. South Africa, for instance, has continuously made investments in STI and has a strong system of science and technology indicators that track results and direct policy. The R&D surveys conducted in South Africa, which tracks gross expenditure on R&D (GERD), help the government make informed decisions that leads to greatereconomic development. (NACI, 2021). Similarly, Kenya is effectively institutionalising R&D practices, through its participation in the African Science, Technology, and Innovation Indicators (ASTII) initiative, and is able to effectively utilize STI data to spur innovation and inform policy (African Portal, 2021). These countries' strategic use of STI indicators and consistent investment in R&D offer valuable lessons for Nigeria, especially where gaps in data collection and the inconsistent use of STI indicators inhibit effective budget allocations (ACTS, 2022).

Also, the World Bank has created a methodological framework known as the Public Expenditure Review in Science, Technology, and Innovation (PER STI) for the purpose of conducting a thorough analysis of country research and innovation systems (World Bank, 2014). The PER STI examines aspects such as the policy mix's coherence and quality, governance, functional analysis, and program monitoring, providing an excellent framework for Nigeria to implement.

1.2. Problem Statement

Nigeria's Economic and STI context is characterised by a mix of promising advances and continued challenges. On the one hand, Nigeria has a good record of advancements in telecommunications, fintech, and innovations in agriculture driven by local startup businesses and education/research institutions. On the other hand, Nigeria has received only modest scores in additional measures of innovation on global indices. For example, in the Global Innovation Index (GII) 2022, Nigeria ranked 118th out of 132 economies, which speaks to the fact that additional investment and better implementation are necessary (WIPO, 2022).

For these reasons, understanding the relationship between government budgetary allocations and STI outcomes is important for discerning how public funding

eventually translates into scientific, technological, and ultimately economic outcomes. Adequate funding translates into the infrastructure needed to carry out appropriate research, high-quality research, and commercialisation of research. In Nigeria, the federal budget typically indicates substantial amounts earmarked for educational institutions, research institutions, and technology development initiatives. However, the true disbursement rate of the funding and its efficacy should be evaluated more closely.

Consequently, the study is important for various reasons, including providing a comprehensive assessment of government budgetary allocations and their impact on Science, Technology, and Innovation (STI) outcomes in Nigeria over the past decade.

1.3. Objectives

The main aim of the study is to evaluate trends of government budgetary allocations on STI outcomes in Nigeria from 2010 to 2019, while the specific objectives focus on:

- Analysing and quantifying the trends in government budgetary allocations earmarked explicitly for science, technology, and innovation (STI) in Nigeria over the past decade.
- Evaluating measurable outcomes and impact indicators of STI initiatives funded by the government.

In achieving these objectives, the study employs a diagnostic analysis approach byutilising budgetary data and outcome indicators from the National Centre for Technology Management (NACETEM) STI dashboard and data from other governmental and institutional sources. Trends in budget allocations earmarked for STI are quantified and analysed to understand investment patterns and shifts over time. Measurable outcomes and impact indicators of STI initiatives are evaluated to assess their contribution to national development and innovation capacity.

In summary, the study examines thecorrelation between STI budget allocations and outcomes, while also identifying the disparities between allocated funds and tangible achievements. This analysis will provide insights into the efficiency and effectiveness of government policy and programs in STI in Nigeria.

2.0. Literature Review

2.1. Overview of theories linking government spending to economic and technological development

Science, technology, and innovation (STI) are important factors in socio-economic development and competitiveness in the global economy. Government budget expenditures influence STI outcomes by impacting the quality and quantity of research conducted, the level of technology transfer, and innovation within a

country. According to public goods theory, government spending on public goods, like infrastructure, research, and education is critical because these resources are non-excludable or non-rivalrous, meaning everyone in the society can benefit from them without sacrificing benefits to others (Horlcombe, 2000). Similarly, the Innovation Systems Theory emphasizes the importance of government spending in creating and sustaining an ecosystem that fosters innovation, because of the interaction/interrelationship between organizations including government, business, universities, and research organizations. Therefore, it is critical to understand how choices in government spending influence economic growth and technological innovation (Dosi& Nelson, 2013). The theories mentioned above support the view that government budget expenditure allocation and overall spending affects economic and technological advancement in Nigeria. Operational sing these theories underlines the importance of planning and investing in STI to support inclusive growth and positioning businesses for competitive advantage in the global economy.

For instance, The Global Innovation Index 2022 highlights that many countries, including Germany and South Korea increasing their government expenditure on R&D during the pandemic, contributing to supporting innovation sectors in areas such as developing diagnostic tools, vaccines, and contact tracing technologies (WIPO, 2022). In addition, the German government also announced a €50 billion R&D package in newer sectors including green technology, digital infrastructure, and health innovation. These efforts contributed to Germany maintaining its global position in biotechnology and pharmaceuticals, with firms developing critical technologies like mRNA vaccines (Wieler et al., 2021; Strategy & Business, 2021). This suggests that investments made by governments can stimulate growth in Science, Technology, and Innovation (STI), even in times of economic crisis. This international experience is helpful as we provide comparisons to Nigeria, where government allocations have historically lagged and are inconsistent, contributing to sub-par outcomes within the global innovation rankings (WIPO, 2022). The complexities of linking government allocations in STI funding to changes in innovation outcomes (e.g., investment is expected to lead to new knowledge and ultimately innovation outcomes) is also demonstrated in studies on the effectiveness of STI funding in developing countries. An example of this is the literature on Science, Technology, and Innovation Official Development Assistance (STI ODA) in developing countries, suggesting that, while financial marginal support for STI has increased, the impact of support on innovation capacity is heavily dependent on complementary research and development investments in the recipient country, as well as absorptive capacity (Lee & Cho, 2023).

In astudy by the UK Science & Innovation Network (UK SIN, 2017), discussed Nigeria's National Research and Innovation Fund (NRIF), with the aim ofearmarking a

minimum of 1% for STI. It highlights the government's increased budgetary allocations to the education and S&T sectors, distinguishing their roles in sustainable development. However, it notes that actual funding for research remains unclear and is often underfunded compared to other sectors like defence and agriculture. Therefore, for Nigeria to enhance its innovation performance, enhanced investments into emerging technologies and infrastructure must be prioritised.

The Oslo Manual places a strong emphasis on the role that government action plays in promoting technical advancement and innovation. It emphasises how vital it is to spend money on R&D and human resources in order to build a strong innovation system that promotes long-term economic success (OECD/Eurostat, 2018).

2.2. Empirical Review of Budget Allocations for STI in Different Studies.

Numerous empirical studies have explored the link between government spending and economic development. For instance, Omojimite (2010) investigated how budgetary expenditure on education impacts economic growth in Nigeria. He utilised Granger causality analysis and cointegration methods. The findings indicated a cointegration relationship between public spending on education, primary school enrollment, and economic growth. Similarly, Olugbenga and Owoye (2007) analysed the connection between government spending in various sectors and economic growth in OECD countries. Using Granger causality tests and cointegration, their results demonstrated a long-term relationship between government expenditure and economic growth. HSU and Younis (2008) explored the causal link between GDP and government spending using U.S. data from 1947 to 2002. Their analysis showed that total government expenditure drives GDP growth, with no evidence of reverse causation (Uwubanmwen & Osagie, 2016).

Lorzides and Vainvoukas (2005) utilised the trivariate causality test to explore the connection between government spending and economic growth with data from Greece, the United Kingdom, and Ireland. Their findings revealed that government expenditure, as determined by the Granger causality test, causes economic growth in all the countries analysed. Coming to the Nigerian terrain, Nurudeen and Usman (2010) examined the effect of government spending on Nigeria's economic growth through a disaggregated sectoral analysis. Their findings indicated that total capital expenditure, total recurrent expenditure, and government spending on education negatively impact economic growth. Udegbunam and Oaikhenan (2003) employ a descriptive approach to suggest that government spending on infrastructures in sectors as health, transport, education, and communication, fosters national development in Nigeria. Alutu and Izilein (2012) use trend analysis to evaluate the impact of budgetary allocations to the education and health sectors on human capital development in Nigeria. Their findings indicate that the funding for these sectors is inadequate to significantly boost human capital development and, consequently,

economic growth. The authors recommend increasing budgetary allocations to these critical sectors to enhance overall growth (Uwubanmwen & Osagie, 2016).

In their 2013 study, Oyakhilomen, Abdulsalam, and Grace analysed the impact of agricultural budgetary allocations on economic growth in Nigeria. They discovered that while there is a positive relationship between agricultural budget allocations and economic growth, this significance is only evident for the two-year lagged values. Meanwhile, Ejiogu, Okezie, and Chinedu (2013) investigated the causal relationship between government spending on education and economic growth in Nigeria, finding that expenditures on education are positively correlated with GDP.

All the above analysis frameworks highlight the need to evaluate the impact of STI expenditures on innovation and technology. As seen above, numerous efforts have been made in the Nigerian Scenario to promote sectoral innovations. However, the analyses seem to have produced a mixed bag of results with successes in certain areas, such as agriculture and telecommunications, while in the broader technology sectors they encountered challenges regarding aspects like infrastructure and financing. For that reason Monitoring and Evaluation (M&E) is an important part of ascribing the impact of STI investment and adjusting policy. A strong M&E framework supports the efficient use of public funding and accurately assesses the impact of that funding on STI outcomes, as evidenced by the South African STI Scorecard, which provides a very tangible measure of the status of STI progress over time, as well as a great deal of detail about funding allocation, effectiveness and areas for improvement.

2.3. Gaps in the Existing Literature

i. Identification of Areas Where Research is Lacking

Current literature lacks comprehensive studies on the long-term impact of STI investments in Nigeria, particularly in emerging Technologies. Additionally, there is limited research on the effectiveness of policy frameworks governing STI funding and implementation. Addressing these gaps can provide a more complete understanding of the impact of STI investments in Nigeria.

ii. Potential for Future Research

Future research should focus on longitudinal studies to assess the sustained impact of STI investmentsand comparative studies with better STI case studies from other developing countries. Investigating the roles of private sector involvement, and potential international partnerships to exacerbate STI investment outputs in Nigeria can also be insightful.

3.0. Methodology

3.1. Research Design

The trend/diagnostic approach was adopted to evaluate the impact of government budgetary allocations on Science, Technology (inputs) and Innovation (STI) outcomes (outputs) in Nigeria over a decade (2010-2020). This approach involved the following steps:

3.2. Data Sources

Data for the study were retrieved from the National Centre for Technology Management (NACETEM) Dashboard. The Dashboard culled/sourced data from innovation surveys conducted every three (3) years on various STI indicators in Nigeria, World Bank data on government expenditure, economic indicators, and STI-related metrics, OECD, UNIDO, etc.

3.3. Data Collection Method

Government Budgetary Allocations: Data on government budgetary allocations on Research and Development (GBARD) (inputs) and key STI Outcomes indicators from the NACETEM dashboard, such as the number of patents filed, research, R&D expenditures, publication counts, technological advancements, and innovation indices.

3.4. Data Analysis Methods

The data analysis involved different steps to ensure a comprehensive understanding of the impact of budgetary allocations on STI outcomes: Three methods of analysis were deployed for the study;

3.4.1. ***Descriptive Statistics:*** The data were summarised using mean and standard deviation

3.4.2. Trend Analysis: Trend analysis using regression was conducted to identify patterns and changes in budgetary allocations (inputs and STI outcomes). Regression analysis was used to depict trends in budgetary allocations and STI outcomes from 2010 to 2019 in Nigeria. The relationship between the independent variables (GBARD allocations and STI outcomes) and the dependent variables (Industrial Design Applications non-residents)

$IDA_n = \beta_0 + \beta_1 GBARD.R\&D_t + \beta_2 GBARD\%R\&D_t + \beta_3 GBARD\%EDU_t + \beta_4 GBARD.T\&I_t + \beta_5 GBARD.H_t + \beta_6 GBARD.STI.E_t + \beta_7 GBARD.STII.Ex_t + \beta_8 STI.IPT_t + e_t$

Where;

IDA_n = Industrial Design Application (Non-resident)

β_0 = Constant

e = error term

t = time series variable from 1…15

GBARD = Government Budgetary Allocation to Research and Development

R&D = Research and Development

EDU = Education

T&I = Trade and Investment

H = Health

STI.E = Science, Technology and Innovation Energy

STI.Ex = Science, Technology and Innovation Exploration

STI.IPT = Science, Technology and Innovation Industrial Production Technology

3.4.3. ***Diagnostic Analysis:***

To assess the impact of these budgetary allocations on specific STI outcomes by analysing key indicators and metrics. To achieve this, correlation analysis was used to determine the strength and direction of the relationship between government budgetary allocations and STI outcomes.

4.0. Results

4.1. Analysis and Discussion

The indicators considered were grouped into the following focus areas:

Table 1: Descriptive statistics of the Study variables GBARD on R&D and STI

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
GBARD TO R&D	10	46.65	197.42	92.1760	46.04521	1.486	0.687
GBARD as percent of R&D	10	0.00	0.03	0.0140	0.00966	0.813	0.687
GBARD Com &Tech	10	0.00	0.96	0.6230	0.34364	-1.402	0.687
GBARD Percent Edu.	10	2.28	7.79	3.4700	1.62375	2.466	0.687
GBARD as percent STI	10	6.80	25.85	14.4670	5.74244	0.685	0.687
GBARD Trade &Invest	10	0.00	2.93	1.8080	1.03129	-1.182	0.687

GBARD on Agric	10	12.87	48.70	24.0710	14.20231	1.102	0.687
GBARD on Health	10	3.21	7.07	4.6540	1.24937	0.630	0.687
STI Energy	10	1.87	4.78	2.8960	1.02695	1.049	0.687
STI Space	10	0.00	9.21	4.0890	3.10589	0.558	0.687
STI Earth Exploration	10	0.00	2.74	1.3720	0.86036	0.151	0.687
STI Industrial Prod Tech.	10	6.81	19.15	12.2480	4.17942	0.463	0.687
Ind. Design App non-resident	10	0.00	326.00	1.1060E2	118.70430	1.058	0.687
Patent App Non-resident	10	0.00	869.00	3.8140E2	348.95979	0.107	0.687
Patent App Resident	10	0.00	439.00	1.1620E2	159.58474	1.600	0.687
Valid	10						

1. **GBARD percentage on Education**

GBARD Percentage to Education

Similar to the analysis made by Alutu and Izilein (2012), Table 1 showed that on average, 3.47% of the budget was allocated to education. The high positive skewness indicates that most values were low, with a few very high values which indicates that there were some years with much higher allocations compared to the average, which could be due to specific policy decisions or economic conditions during those years.

The moderate standard deviation further suggests that while the budgetary allocations were not consistent year over year, the variations were not overly significant. However, the resultant effect from the variations has some effect on the output.

From the analysis, policymakers can examine the years with higher allocations to understand the circumstances that led to increased investment in education, which could inform future budgetary decisions to achieve more consistent and potentially higher allocations to education since education has a crucial role to play when discussing science, technology and innovation.

2. **GBARD on R & D Allocation (**Total GBARD to R & D and Total GBARD to R & D as percentage of Total Annual Budget)

On average, the government allocated 92.176 million Naira to R&D over the 10 years. The high standard deviation suggests significant variability in the annual allocation, suggesting significant fluctuations in funding levels over the years. The positive skewness indicates that there were some years with exceptionally high

allocations while on average, the budget allocated to R&D as percentage was 1.4% of the total budget. The positive skewness indicates that the percentage was generally low but with occasional higher values.
R&D plays a crucial role in the development of the economy, and its success necessitates adequate allocation. The variability and skewness suggest that while R&D funding was generally low, specific years saw higher investments. There is a need to understand the reasons behind these higher allocations in order to be able to plan for future R&D budgets.

3. R&D Focus Areas

GBARD Communication Technology, GBARD Science, Technology and Innovation, GBARD Trade and Investment, GBARD Health and GBARD Agriculture and Rural Development

- **Communication Technology** and **Trade and Investment**: On average, 0.623 million were allocated to communication technology, and 1.808 million was allocated to trade and investment, respectively. The negative skewness suggests that the majority of allocations were relatively high, with fewer low values for both.The allocations to communication technology and trade and investment are generally high, reflecting a governmental priority. In contrast, agriculture and rural development showed substantial variability, indicating fluctuating priorities or external factors influencing budget decisions. In as much as communication technology and trade and investment enjoyed generally high allocations in the past decade, agriculture and rural development that showed fluctuating priorities will need to be given urgent consideration going by the current situation in this sector which is key to the economy.
- **GBARD Science, Technology and Innovation (STI** and **Health)**
  The result shows that the average allocation is 14.4670 million Naira and 4.6540 million Naira,, respectively. These moderately high allocations indicate the two sectors received a substantial amount of the budget, with allocations being relatively high most of the time and only occasionally much higher than the average.
- **GBARD Agriculture and Rural Development**
  On average, 24.071 million Naira were allocated to agriculture and rural development, as shown in Table 1. The positive skewness suggests that there were some years with particularly high allocations.

4. Science, Technology and Innovation (GBARD STI Energy, GBARD STI Earth Exploration, GBARD STI Space Exploration and GBARD STI Industrial Production and Technology)

STI Energy had an average allocation of 2.896 million Naira. The positive skewness suggests that while most annual allocations were around the average, there were a few years with significantly higher allocations.**STI Earth Exploration** received an average annual allocation of 1.372 million Naira, indicating a lower level of investment compared to other areas. The skewness being close to zero indicates that the distribution of annual allocations is relatively symmetric with consistent year-to-year investments. **STI Space Exploration** had an average allocation of 4.089 million Naira, with moderately high and somewhat varied investments. **STI Industrial Production Technology** had the highest average allocation at 12.248 Million Naira, with generally high and consistent investments, and some years showing slightly higher values.

Science, Technology and Innovation is a very key area of development in any economy, which cuts across different sectors, and should not be deprived of adequate allocation. The analysis suggests occasional peaks in funding in STI Energy and Space Exploration. The symmetric distribution in Earth Exploration indicates steady investment, while the higher and consistent investments in Industrial Production Technology reflect its priority status. Energy is a crucial aspect of STI that should be accorded priority because this drives almost every sector of the economy. Paucity of allocation is a major challenge which has shut many businesses, and the ones still existing struggle with the high cost of production, which results in high prices of the final commodity.

5. **Industrial design, patent applications resident and patent application non-resident)**

Patent applications from non-residents on average, were 381.4 per million. The skewness close to zero suggests a relatively symmetric distribution. This suggests that the distribution of non-resident patent applications is fairly balanced. **Patent applications filed by residents** each year showed the mean value of 116.2 per million. This average suggests a moderate level of patent application activity from residents annually. The high variability and positive skewness indicate that most years had moderate application numbers, but a few years had significantly higher numbers. **Industrial Design Applications Non-Resident**on average shows there were 110.6 per million non-resident industrial design applications annually. The high standard deviation of 118.70430 per million indicates that the number of applications fluctuated significantly from year to year. However, the positive skewness of 1.058 suggests that while most years had application numbers close to the mean, a few years had much higher numbers, creating a right-skewed distribution.

Industrial design and patent applications are dependent on allocations across various STI indicators. The results showed that Non-resident patent applications enjoyed balanced interest, whereas resident patent applications indicated occasional peaks. The significant fluctuations in non-resident industrial design applications suggest varying external interest. There is a great need to encourage resident patent applications through generous allocation in order to encourage more innovations.

Regression Analysis

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000[a]	1.000	0.000.	0.000.

a. Predictors: (Constant), STI Industrial Production Tech., GBARD Trade and Invest, STI Energy, GBARD to R&D, GBARD Percent Edu., STI Earth Exploration, GBARD on Health, GBARD as percent of R&D

b. Dependent Variable: Industrial Design Application non resident

The model summary reveals **R = 1.000** and **R Square = 1.000**: These values indicate that the model explains 100% of the variance in the dependent variable (industrial design applications by non-residents). This perfect fit is highly unusual and suggests overfitting, where the model is too tailored to the specific data, potentially due to multicollinearity or other issues.

Table 3: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	75264.000	8	9408.000	0.0	.a
	Residual	0.000	0	.		
	Total	75264.000	8			

a. Predictors: (Constant), STI Industrial Production Tech., GBARD Trade and Invest, STI Energy, GBARD to R&D, GBARD Percent Edu., STI Earth Exploration, GBARD on Health, GBARD as percent of R&D

Table 3: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	75264.000	8	9408.000	0.0	.a
	Residual	0.000	0	.		
	Total	75264.000	8			

a. Predictors: (Constant), STI Industrial Production Tech., GBARD Trade and Invest, STI Energy, GBARD to R&D, GBARD Percent Edu., STI Earth Exploration, GBARD on Health, GBARD as percent of R&D

b. Dependent Variable: Industrial Design Application non resident

The ANOVA table shows Sum of Squares for Regression = 75,264.000 and Residual = 0.000: This indicates that all the variance in the dependent variable is explained by the model, leaving no unexplained variance. This further supports the concern of overfitting.

Table 4: Coefficients indicating change in the dependent variable for a one-unit change in the respective independent variable, holding all other variables constant.

Model		Unstandardised Coefficients		Standardised Coefficients
		B	Std. Error	Beta
1	(Constant)	-449.239	0.000	
	GBARD to R&D	-2.035	0.000	-1.024
	GBARD as percent of R&D	11981.651	0.000	1.252
	GBARD Percent Education	10.841	0.000	0.192
	GBARD Trade and Investment	-33.447	0.000	-0.366
	GBARD on Health	55.835	0.000	0.560
	STI Energy	74.345	0.000	0.835
	STI Earth Exploration	18.772	0.000	0.159

STI Industrial Production Tech.	7.399	0.000	0.304

a. **Dependent Variable: Industrial Design Application non resident**

Positive coefficients (GBARD as Percent of R&D, GBARD on Health, STI Energy) indicate a positive relationship with the number of industrial design applications by non-residents. This means that increases in these allocations are associated with an increase in industrial design applications.

Negative coefficients (GBARD to R&D, GBARD Trade and Investment) suggest an inverse relationship, where higher allocations are associated with fewer industrial design applications. The zero standard errors and infinite t-values are unrealistic and indicate issues such as multicollinearity, where the predictors are highly correlated with each other, leading to instability in the coefficient estimates

Table 5: Excluded Variables

Model	Beta In	T	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
GBARD Communication Tech.	.a	.	.	.	0.000
GBARD as percent STI	.a	.	.	.	0.000
GBARD on Agric.	.a	.	.	.	0.000
STI Space	.a	.	.	.	0.000

a. Predictors in the Model: (Constant), STI Industrial Prod Tech., GBARD Trade and Invest., STI Energy, GBARD R&D, GBARD Percent Edu., STI Earth Exploration, GBARD on Health, GBARD as percent of R&D

b. Dependent Variable: Industrial Design Application non-resident

Variables such as **GBARD Communication Technology**, **GBARD as Percent of STI**, **GBARD on Agriculture**, and **STI Space** were excluded due to multicollinearity, indicated by a tolerance of zero.

Table 6: Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	0.0000	302.0000	86.6667	96.99485	9
Residual	0.00000	0.00000	0.00000	0.00000	9
Std. Predicted Value	-0.894	2.220	0.000	1.000	9
Std. Residual	.	.	.	.	0

a. Dependent Variable: Industrial Design App nonresident

The residuals are all zero, confirming the perfect fit indicated by the R-squared value. The standard deviation of predicted values (96.99485) shows variability in the predicted number of industrial design applications, but the perfect fit of residuals further suggests overfitting.

5.0. Summary and Conclusion

The research focuses on analysing the impact of government budgetary allocations on STI outcomes in Nigeria from 2010 to 2019. The aim is to analyse trends in government funding for STI, evaluate the outcomes of government-funded STI initiatives, and examine the correlation between budget allocations and STI outcomes. The methodology involves a trend/diagnostic approach using data from NACETEM, World Bank, OECD, and UNIDO. The data analysis includes descriptive statistics, trend analysis, and diagnostic analysis to assess the impact of budgetary allocations on STI outcomes. Key findings indicate variability in budget allocations, with notable investments in telecommunications and fintech. However, overall STI performance is modest, as reflected in Nigeria's low ranking in the Global Innovation Index. The study identifies gaps in the existing literature, particularly regarding the long-term impact of STI investments and the effectiveness of policy frameworks. The study concludes that government budgetary allocations significantly influence STI outcomes in Nigeria. While there have been advancements in specific sectors, overall STI performance remains limited due to inconsistent and inadequate funding. To enhance Nigeria's innovation capacity and economic growth, the study recommends:

- Increasing and sustaining budget allocations for critical STI sectors.
- Implementing robust monitoring and evaluation frameworks to assess the impact of STI investments.
- Encouraging private sector participation and international collaborations to boost innovation outcomes.

These measures are essential for fostering a more innovative and competitive economy, addressing socio-economic challenges, and improving Nigeria's global innovation ranking.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of generative AI and AI-assisted technologies in the writing process.

During the preparation of this work the authors used Consensus AI tool in order to search for relevant literature for the paper. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the published article.

References:

1. *ACTS. (2022). Final synthesis report: Strengthening STI systems in Africa. African Centre for Technology Studies.*
2. *African Portal. (2021). Assessing science, technology, and innovation metrics in Africa.*
3. *Alutu, U. U., & Izilein, E. (2012). Juxtaposing the trends in Nigeria's capital and recurrent expenditures on human capital development. Finance and Banking Review, 1(2), 1981–2010.*
4. *Cooray, A. (2009). Government expenditure, governance and economic growth. Comparative Economic Studies, 51(3), 401–418.*
5. *Dosi, G., & Nelson, R. R. (2013). The evolution of technologies: An assessment of the state-of-the-art. Research Policy, 42(8), 1290–1312.*
6. *Holcombe, R. G. (2000). Public goods theory and public policy. In Public sector economics (pp. 155–175). Springer.*
7. *Lee, J., & Cho, K. (2023). Effects of science, technology, and innovation official development assistance on foreign direct investment in developing countries. Sustainability, 15(16), 12293.*
8. *Loizides, J., & Vamvoukas, G. (2005). Government expenditure and economic growth: Evidence from trivariate causality testing. Journal of Applied Economics, 8(1), 125–152.*
9. *National Advisory Council on Innovation. (2021). South African science and technology indicators report.*

10. *Nurudeen, A., & Usman, A. (2010). Government expenditure and economic growth in Nigeria: A disaggregated analysis. Business and Economic Journal, 2010(4), 1–11.*
11. *OECD/Eurostat. (2018). Oslo manual 2018: Guidelines for collecting, reporting and using data on innovation (4th ed.). OECD Publishing.*
12. *Olugbenga, A. O., & Owoye, O. (2007). Public expenditure and economic growth: New evidence from OECD countries. International Journal of Social Economics, 34(8), 438–446.*
13. *Omojimite, B. U. (2010). Education and economic growth in Nigeria: A Granger causality analysis. Africa Research Review, 4(3), 90–168.*
14. *Onyedinefu, G. (2022, January 19). FG implements 0.5% GDP allocation to promote tech, innovation. BusinessDay. businessday.ng*
15. *Oyakhilomen, O., Abdulsalami, Z., & Grace, Z. R. (2013). Agricultural budgetary allocation and economic growth in Nigeria: Implications for agricultural transformation in Nigeria. The Journal of Sustainable Development, 10(1), 16–27.*
16. *Science Nigeria. (2022, January 19). FG to commence 0.5% STI GDP allocation implementation. Science Nigeria. sciencenigeria.com*
17. *Strategy & Business. (2021). How COVID-19 will affect investment in global innovation. Strategy & Business. www.strategy-business.com*
18. *Udegbunam, R. I., & Oaikhenan, H. E. (2003). An examination of the role of public infrastructure in national development. The Nigerian Economic and Financial Review, 8(2), 35–36.*
19. *UK SIN. (2017). UK Science & Innovation Network country snapshot: Nigeria. UK Science & Innovation Network. assets.publishing.service.gov.uk*
20. *Uwubanmwen, A. E., & Osagie, O. (2016). Analysis of sectoral budgetary allocation and economic development in Nigeria. Sokoto Journal of the Social Sciences, 6(2), 280–297.*
21. *Wieler, L. H., Rexroth, U., & Gottschalk, R. (2021). Emerging COVID-19 success story: Germany's push to maintain progress. Our World in Data.*
22. *World Intellectual Property Organization. (2022). Global innovation index 2022: What is the future of innovation-driven growth? World Intellectual Property Organization. www.wipo.int*