FUNDING RESEARCH IN A DEVELOPING ECONOMY

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PROTOCOL

1. INTRODUCTION

Research is generally understood as creative work undertaken on a systematic basis to increase the body of knowledge. The knowledge in turn is used to devise new applications and improve the standard of living (Currie-Alder, 2015). Funding research can be described as the provision of financial support to conduct investigations, studies, experiments, or projects to advance knowledge, discover new insights, solve problems, or develop innovative solutions (Currie-Alder, 2015). Research funding can come from various sources, including government agencies, private foundations, corporations, non-profit organizations, and individual donors. Research funding plays a crucial role in the advancement of science, technology, medicine, social sciences, and other fields. Funding enables researchers to carry out their work, which often involves field work, costs such as equipment, materials, personnel salaries, and facility usage. Without adequate funding, many valuable and potentially groundbreaking studies and projects might not be possible.

Economic development, which is the primary objective of developing economies, is intricately intertwined, with research. In essence, research plays a pivotal role as a transformation agent for sustainable progress in every society. In the modern global landscape, economies are driven by knowledge, innovation, and technological advancements, all of

which are deeply rooted in research endeavours. The progress of the developed as well as emerging economies of the South such as the BRICS -Brazil, Russia, India, China and South Africa have been linked to huge investments in research and development (R&D) (Fan, 2018). The process of economic development centres on the ability to understand, adapt, and harness the forces that shape industries, markets, and societies. Research, as the systematic exploration of these forces, equips developing economies with the necessary insights and tools needed to navigate developmental challenges, seize opportunities, Aand foster growth and development.

The developed countries of the world such as the United States, Germany, Japan, South Korea, and many countries within the European Union allocate significant funding to research institutions, universities, and private sector R&D initiatives to foster innovation and stay at the cutting edge of scientific and technological progress. For example, in the United States, federal funding for R&D grew from US$3.5 billion in 1955 to US$137.8 billion in 2020, a compound annual growth rate (CAGR) of 5.3%. In constant dollars, federal R&D grew by a 2.1% CAGR during this period (CRS Report, 2022, p.2). In emerging economies of the Global South, such as Brazil, India, China, and several countries in Southeast Asia and Africa, research is increasingly being accorded priority as well. These countries recognize the importance of R&D in driving economic growth, improving living standards, and addressing local and global challenges. China is a case in point. According to Bai, Wu and Yang (2021, p.1) citing data from OECD,

China's investment in R&D has witnessed a growth from 15.95 billion (Chinese yuan) in 1991 to 2.214 trillion (Chinese yuan) in 2019; the number of researchers increased from 3.18 million (1991) to 7.12 million (2019); and according to the statistics from the US National Science Foundation (NSF), China reached No. 1 in the world by 528,263 publications in the Science and Engineering field in 2018.

There is no doubt that funding research has produced positive outcomes for these developed and developing economies in the forms of technological advancements, job creation, economic growth and competitiveness, health and wellbeing of citizens, modernization of agriculture, education and skills development, global competitiveness, security, defence and sustainable development. Research not only empowers economies to adapt to changing circumstances but also empowers them to actively shape their developmental trajectories. By delving into the depths of scientific discovery, technological innovation, and social understanding, research unveils new avenues for improvement, uncovers potential market niches, and uncorks the potential for breakthroughs.

Compared to the developed economies, funding research is quite challenging in most developing economies. Factors that account for the disparity include but are not limited to, limited financial resources and competing government priorities, the nature of infrastructure and institutions, small and less diversified industrial bases, and less private sector engagement. Funding research in a developing economy holds

the key to fostering innovation and achieving socio-economic development. As developing economies struggle to bridge the gap between developmental aspiration and achievement, the effective allocation of funding resources emerges as a critical determinant in shaping their trajectory towards sustainable progress.

In this context, an examination of the strategies, mechanisms, and considerations involved in funding research is of great significance. By examining the benefits, opportunities and challenges associated with funding research in developing economies, this lecture aims to shed light on how developing economies can overcome the challenges therein and harness the potential of research to drive societal transformation and achieve economic development. In this lecture, we will attempt to answer the following questions: What are the benefits of funding research in a developing economy? Which are the funding sources for research in developing economies? What are the challenges faced by developing economies in funding research? What strategies should the developing economies adopt to ensure effective research funding? The lecture will attempt to provide answers to these critical questions.

2 THE BENEFITS OF FUNDING RESEARCH IN A DEVELOPING ECONOMY

In today's world that is interconnected and technologically driven, research and innovation play a pivotal role in shaping the trajectory of economic development. Developing economies, often characterized by their evolving infrastructures and emerging industries, stand to gain substantial advantages by prioritizing and investing in research initiatives.

In this section, the lecture examines the broad benefits that funding research brings to developing economies.

***Knowledge Generation and Innovation*:** In a developing economy, securing adequate funding for research initiatives is crucial for fostering economic growth, technological advancement, and social progress (Smith, 2018). Limited financial resources and competing priorities often challenge the allocation of funds toward research projects (Jones et al., 2020). However, strategic partnerships between governmental bodies, international organizations, and private sector companies have been identified as effective mechanisms for enhancing research funding in developing economies (Chen & Huang, 2016). In a globalized knowledge-driven economy, knowledge generation and innovation play a fundamental role in the sustainable development of economies, particularly in developing nations (Dutz, et al., 2018). By investing in education, fostering collaboration between academia and industry, and promoting research-driven policies, developing economies can create an ecosystem conducive to knowledge generation and innovation (Chen & Gupta, 2021). This, in turn, leads to the creation of new technologies, products, and services that drive economic growth and social progress (Dutz, et al., 2018).

Enhancement of Global Competitiveness: R&D plays a pivotal role in enhancing a country's global competitiveness. R&D encompasses the systematic investigation of new ideas, technologies, and processes to advance knowledge and drive innovation (Smith et al., 2018). Through

sustained investment in R&D, countries can foster the development of cutting-edge industries, bolster technological capabilities, and position themselves at the forefront of global markets (Johnson, 2020). In today's rapidly evolving economic landscape, innovation-driven competitiveness has become a key driver of sustainable growth (Jones, 2019). As firms engage in R&D activities to create and refine products, services, and solutions, they gain a competitive edge by offering novel and high-value offerings to the global market (Garcia et al., 2021). Governments around the world are increasingly recognizing the importance of R&D investment as a means to stimulate economic growth and job creation (Smith & Brown, 2022). Moreover, collaboration between academia, industry, and government is essential for effective R&D outcomes (Adams, 2017). This cooperation facilitates the transfer of knowledge from research institutions to practical applications in the market, thereby accelerating innovation and boosting global competitiveness (Chen et al., 2016).

For example, despite Nigeria's improved ranking at 114th in the world and 14th among African countries in the Global Competitiveness Index Rankings update of 2022, as compared to 125th out of 137 countries of the world in the Global Competitiveness Index 2017-2018 edition published by the World Economic Forum, it still has a long way to go. Nigeria ranks lower in productivity compared to South Africa, Morocco, Seychelles, Tunisia, Algeria, Botswana, Namibia, Kenya, Rwanda, Ghana, Senegal, and Uganda, which top Nigeria in the 2022 Competitive Index. In comparison, India witnessed the sharpest rise

among the Asian economies, with a six-position jump from 43rd to 37th rank, largely due to gains in economic performance (Dristi, 2022; Harmon, 2023; Schwab & Zahidi, 2020; WEF, 2018). Research funding encourages the development of new technologies, processes, and products that can enhance Nigeria's economic competitiveness on both domestic and global scales. This is critical for industries such as manufacturing, agriculture, and information technology. Investment in research promotes education and skill development among researchers, students, and professionals. This not only increases the pool of qualified individuals in various sectors, but also improves the overall human capital of the nation, contributing to economic growth.

Economic Growth: As noted by the NESG (2023), economic growth in Nigeria has remained persistently weak due mainly to poor investment in research and slow growth in sectors with substantial contributions to the GDP and employment, such as Agriculture, Manufacturing and Trade. Research initiatives often involve collaboration between academia, government, and industry. This fosters knowledge transfer and the application of research findings in practical settings. Research-driven innovations can lead to the creation of new export-oriented industries, expansion of opportunities for jobs and wealth creation, activation of untapped resources, thus reducing Nigeria's dependence on a limited range of commodities and export portfolio. Accordingly, a vibrant research ecosystem signals a commitment to innovation and development. This can attract foreign investors who seek opportunities in countries with a strong research and development foundation.

Comparative Analysis of Research Funding in Emerging Economies

As of September 2021, both China and India were emerging economies with rapidly growing R&D sectors. Both countries have been actively investing in research funding to promote scientific and technological advancements. However, there are differences in their approaches and the scale of funding.

China: China has been making significant strides in research funding and has become a global R&D powerhouse. The Chinese government has been investing heavily in science and technology, with initiatives like the "Made in China 2025" plan and the "Double First-Class" initiative aimed at elevating top universities and research institutions to international prominence. According to the UNESCO Institute for Statistics, China's gross domestic expenditure on R&D (GERD) grew from around 0.8% of GDP in 2000 to around 2.4% in 2019. The country has also been promoting public-private partnerships and encouraging foreign researchers to collaborate with Chinese institutions.

India: India has also been increasing its research funding and focusing on building a strong R&D ecosystem. The government has launched programs like "Make in India" and "Start-up India" to promote innovation and entrepreneurship. However, India's GERD has historically remained lower than that of many developed countries and China. According to the UNESCO Institute for Statistics, India's GERD was around 0.7% of GDP in 2019. Despite this, India boasts a large pool of skilled researchers and

engineers and has made significant contributions to various scientific fields. India also continues to benefit tremendously from the exploits of its diaspora community in R&D across the Americas, Europe and Middle East.

Comparative Analysis of Research Funding in Selected African Countries

Research funding plays a crucial role in fostering scientific and technological advancements within countries. This comparison focuses on the research funding landscape in two African countries: South Africa and Rwanda, up until September 2021.

South Africa: South Africa has established itself as a research hub in Africa, with several institutions dedicated to R&D. One of the primary sources of research funding in South Africa is the National Research Foundation (NRF), a government agency that provides funding for various research disciplines. According to data from 2020, NRF's budget allocation for R&D was around 8 billion South African Rand (ZAR). In addition to NRF, universities and private corporations also contribute to research funding.

Rwanda: Rwanda, despite its relatively smaller economy, has shown a commitment to investing in R&D to drive economic growth and innovation. The Rwanda Research and Innovation Fund (RRIF) is a key player in research funding. According to available data up to 2020, the Rwandan government allocated approximately 25 billion Rwandan Francs (RWF) to RRIF. The Fund supports various research projects and

initiatives aimed at addressing societal challenges and driving economic development.

Comparison: When comparing research funding in South Africa and Rwanda, it's evident that South Africa has a larger budget for R&D. The NRF's budget allocation is significantly higher than Rwanda's RRIF budget. However, Rwanda's investment in research, given its economic context, showcases a commitment to building a knowledge-based economy. Both countries emphasize the importance of research in advancing innovation and societal progress.

3. FUNDING SOURCES FOR RESEARCH FOR DEVELOPING ECONOMIES, WITH SPECIFIC REFERENCE TO NIGERIA.

It is an established fact that innovative research is not only an important tool for economic growth and development, but also capital intensive. Funding therefore becomes germane and critical to attaining research objectives. Research funding is however not an exclusive preserve of the state or government alone. Government Funding, International Aid, Grants and Collaboration, Public-Private Partnerships (PPP) and Private Donations and Philanthropic Organisations constitute major sources of research funding**.** It was based on this that Zeleny (1992) in Bloch and Sorensen (2015) asserts that the world over, funds for research come primarily from governments and business firms. Others include foundations and professional societies. In some countries, funding of research is a collaboration effort with governments, bilateral and

multilateral agencies and public organizations working together on projects of interest (Okolie, 2023).

Research funding can also be sourced from external sources, most commonly in the form of research grants and contracts. This has proved essential to the health and vitality of all research organizations (Haley, 2017). Funding from both sources is required to expand the scope of research. According to the National Bureau of Economic Research (NBER, 2007), Government funding for scientific research influences the size of the research sector as well as the productivity of researchers in public establishments. Over the years, most developing economies of the world particularly in Africa have been grappling with the challenge of funding research as well as environments that are not conducive for the conduct of research. In Nigeria, several attempts, programmes and policies have been put in place by different administrations to fund not just research but the educational sector as a whole. Nigerian universities and research institutes are bedevilled with the challenge of funding. Many African governments have committed themselves to increasing their gross domestic expenditure on R&D (GERD). GERD is generally regarded as a measure of how dedicated a specific country is to supporting research. But the reality is that most sub-Saharan African countries spend less than 0.5% of their GDP on R&D. Nigeria, for example, lags far behind, in that only 0.2% of its GDP is assigned towards the development of R&D (AU–NEPAD 2010). The funding Sources for Research will be examined under two broad categories: National Government and Non-National Government Sources

National Government Sources of Research Funding in Nigeria

The Federal Government of Nigeria has established several research funding agencies and put in place funding mechanisms to address the issues of funding research and training researchers. Most research activities in Nigeria are publicly funded through agencies, such as the Tertiary Education Trust Fund (TETFund), National Science and Technology Fund (NSTF), and Petroleum Technology Development Fund (PTDF), as well as several international and philanthropic organizations by way of sponsoring research, endowment funds, foreign aids, fellowships, donations, etc. Unfortunately, there is virtually no industry involvement in funding academic research in Nigeria (Donwa, 2006).

Tertiary Education Trust Fund (TETFund): is one major key research funding agency of the Nigerian government. TETFund came into being at a time when the education sector had suffered many years of neglect by successive governments which resulted in large-scale decay of institutional facilities, physical structure, academic teaching and research equipment (Eze, 2014).).

The Education Trust Fund later re-named TETFund was set up under the Education Tax Act No. 7 of 1993 as amended by Act No. 40 of 1998. The law setting up the Fund stipulates that a 2 per cent (now 3 per cent) education tax be imposed on the profits of all registered companies in Nigeria. In the distribution of the funds, 50 per cent goes to the Universities, 25 per cent to the Polytechnics while 25 per cent goes to

Colleges of Education (TETFund Act 2011). The Table below indicates the total amount remitted to TETFund from 2011-2022.

2011 – 2022 (AS PER CBN TRANSFER)

YEAR	COLLECTION
2011	**₦128.52billion**
2012	**₦188.37billion**
2013	**₦279.17billion**
2014	**₦189.61billion**
2015	**₦207.43billion**
2016	**₦130.12billion**
2017	**₦154.96billion**
2018	**₦203.28billion**
2019	**₦221.30billion**
2020	**₦257.01billion**
2021	**₦189.54billion**
2022	**₦328.80billion**
TOTAL	**₦2.478 trillion**

The mission of TETFund is to provide focused and transformative intervention, in public Tertiary Institutions in Nigeria through funding and effective project management. While its vision is to be a world-class intervention agency in Nigeria's tertiary education. As part of the responsibilities of TETFund, it provides funding for academic staff to

embark on in-service training and development by sponsoring their further training in various academic fields, both local and international (Abdulaziz, Olokooba, & Iyekolo, 2020). Due to TETFund interventions, many lecturers have been sponsored to local and international seminars and conferences in addition to TETFund -sponsored overseas training and retraining of academic staff (Ofojebe, & Chukwuma, 2015).

To access the funds, institutions that had previously benefited from the Fund are required to render a satisfactory and credible account of previous funding as a yardstick to qualify for more funding. This is to ensure the development of the educational sector, with a specific focus on public tertiary institutions in Nigeria (TETFund, 2015, p.2). According to Wapmuk and Amini (2018) the funds disbursed to public tertiary institutions are to be used for the provision or maintenance of:

i. Essential physical infrastructure for teaching and learning;
ii. Instructional material and equipment;
iii. Research and publication;
iv. Academic staff training and development; and
v. Any other need which, in the opinion of the Board of Trustees, is critical and essential for the improvement of quality and maintenance of standards in the higher educational institutions.

Public research funding is a major component of R&D investment. It involves direct transfers from government (national/federal, regional/state, and local) in the form of contracts, grants or donations (excluding repayable loans to enterprises for conducting R&D) for the

coverage of current costs (mainly R&D personnel labour costs and non-capital expenditures on materials, supplies, etc.), and capital expenditures (investment in fixed assets) for performing R&D (OECD, 2002). As part of its contributions to R&D TETFund has sponsored several scholars for local and international conferences. The importance of conferences, trainings and workshops cannot be overemphasized.

The Table below shows the number of scholars from tertiary institutions that have been sponsored by TETFund for both local and international conferences (2011 – TILL DATE):

INSTITUTION TYPE	FOREIGN		LOCAL		TOTAL NO. OF CONFERENCE ATTENDEES	TOTAL AMOUNT DISBURSED (N)
	NO. OF CONFERENCE ATTENDEES	AMOUNT DISBURSED (N)	NO. OF CONFERENCE ATTENDEES	AMOUNT DISBURSED (N)		
UNIVERSITIES	11,353.00	12,419,154,763.06	16,553.00	3,505,053,797.35	27,906.00	15,924,208,560.00
POLYTECHNICS	5,247.00	5,977,111,219.63	13,190.00	2,765,597,099.44	18,437.00	8,742,708,319.03
COLLEGES OF EDUCATION	5,150.00	5,678,789,611.56	20,383.00	3,810,052,537.02	25,533.00	9,488,842,148.58
TOTAL	21,750.00	24,075,055,594.25	50,126.00	10,080,703,433.77	71,876.00	341,557,590,028.03

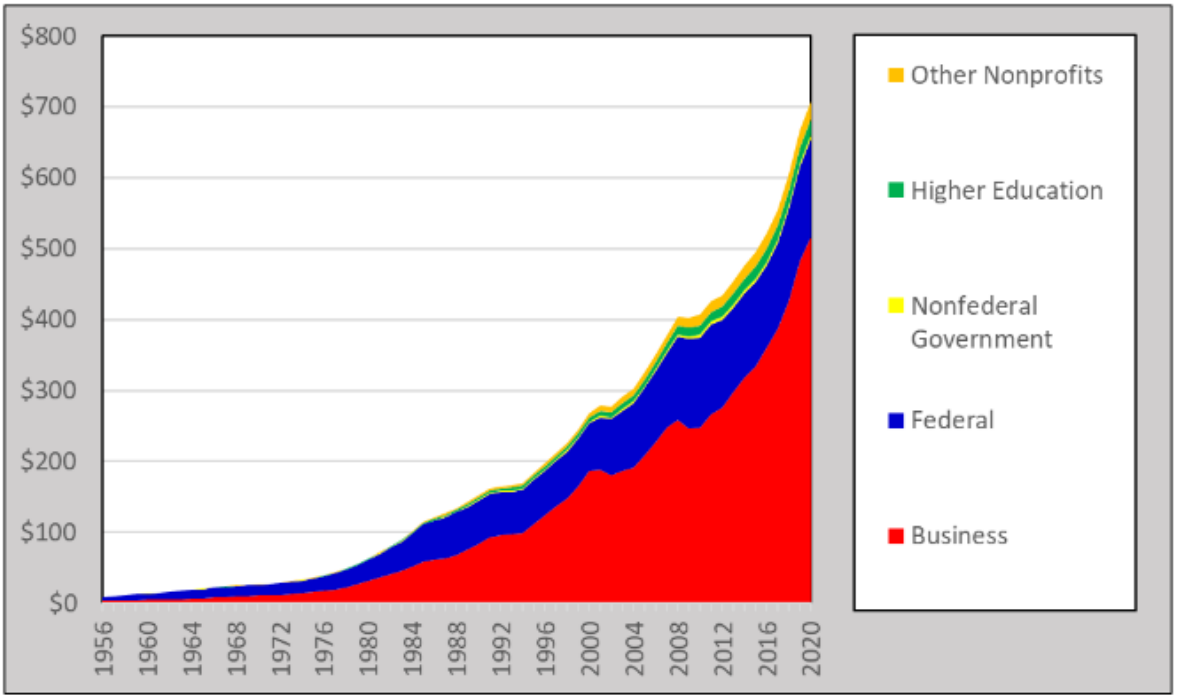
For instance, in the United States Public research funding represented on average 0.75% of the GDP of OECD economies in 2009, with the highest share of government-financed R&D funding in the GDP exhibited by the US, Finland, Iceland, Portugal, South Korea, Denmark and Sweden. The ratio of public research funding to total gross domestic expenditure on R&D (GERD), however, tends to be higher in less-industrialised economies, where private funding of R&D is in short supply. In advanced industrial economies with abundant provision of private funding to R&D,

public funding is commonly used as an instrument for supporting the provision of certain types of technological knowledge, which are deemed to be 'socially' beneficial but would otherwise not be provided by competitive markets due to their particular characteristics (Chorafakis, n.d).

According to the Office of Technology Policy, U.S. Department of Commerce (1997) the United States became a global leader in R&D in the 20th century, funding as much as 69% of annual global R&D in the period following World War II. R&D in 2020 was 83 times higher than it was in 1956 in current dollars, and more than 11 times higher in constant dollars(CRS,2020).

Figure 1. U.S. R&D Expenditures by Source of Funding, 1956-2020

Current dollars, in billions



Source: CRS analysis of National Science Foundation, *National Patterns of R&D Resources: 2019–20 Data Update*, NSF 22-320, Table 6, February 22, 2022, https://ncses.nsf.gov/pubs/nsf22320.

While interrogating research funding in the US particularly about R&D the CRS (2022) analysis of National Science Foundation, National Patterns of R&D Resources: 2019–20 claims that:

> Two sectors—business and the federal government—have together accounted for more than 90% of U.S. R&D funding since 1955, though their combined share has fallen from a high of 98% in 1956 to 93% in 2016. Federal R&D expenditures as a share of total U.S. R&D expenditures peaked in 1964 at 66.8%, the same year that business R&D expenditures reached a nadir of 30.8%. Between 1964 and 2000, the federal government's share fell and business's share rose. In 2000, business accounted for 69.4% of U.S. R&D expenditures and the federal government 25.1%. This shift in the composition of R&D funding resulted not from a reduction in federal government R&D expenditures, but rather from faster growth in business R&D expenditures. From 2000 to 2010, business R&D's share declined from 69.4% to 61.0%, and has risen each year since, reaching an all-time high of 73.1% in 2020; from 2010 to 2020, the federal share declined from 31.1% to 19.5%.5

The Table below further gives a detailed analysis of research funding in the US.

Table 1. U.S. R&D Funding by Sector and Character, 2020

Current dollars, in billions

Sector	Basic Research		Applied Research		Development		Total	
	Dollars	Percent	Dollars	Percent	Dollars	Percent	Dollars	Percent
Federal Government	43.8	40.6%	43.7	31.3%	50.3	10.9%	137.8	19.5%
Nonfederal Government	2.7	2.5%	1.7	1.2%	0.6	0.1%	5.0	0.7%
Business	36.2	33.5%	78.6	56.3%	402.7	87.4%		73.1%
Higher Education	14.3	13.3%	6.0	4.3%	2.2	0.5%		3.2%
Other Nonprofit Organizations	10.9	10.1%	9.5	6.8%	4.7	1.0%	25.1	3.5%
Total	**107.9**	**100.0%**	**139.5**	**100.0%**	**460.5**	**100.0%**	**708.0**	**100.0%**

Source: CRS analysis of National Science Foundation, *National Patterns of R&D Resources: 2019–20 Data Update*, NSF 22-320, Tables 7-9, February 22, 2022. Elements may not add to totals due to rounding.

Note: Rows and columns may not add to totals due to rounding. 2020 data are preliminary and may be revised.

The Petroleum Technology Development Fund (PTDF): is another institutional framework designed to promote research and development in Nigeria, especially in the areas of science and technology innovation. The Petroleum Technology Development Fund (PTDF) is a parastatal of the Ministry of Petroleum Resources established by Decree 25 of 1973 for the development, promotion and implementation of petroleum technology and manpower needs through research and training of Nigerians. According to its enabling Act, the Fund is set up to train Nigerians to qualify as graduates, professionals, technicians and craftsmen, in the fields of engineering, geology, science and management in the petroleum industry in Nigeria or abroad (Okebukola, 2015). The mandates of the Fund include:

i. To provide scholarships and bursaries wholly or partially in Universities, Colleges, and Institutions in petroleum undertakings in Nigeria or abroad;

ii. To maintain, supplement or subsidize such training or education as mentioned above;

iii. To make suitable endowments to faculties in Nigeria universities as approved by the minister;

iv. To make available suitable books and training equipment in institutions in Nigeria;

v. To sponsors regular visits to oilfields, refineries, and petrochemical plants and arrange necessary attachments of personnel to establishments connected with the development of the petroleum industry;

vi. To finance participation in seminars, conferences and workshops which are connected with Petroleum Industry Bill in Nigeria and abroad.

However, following the enactment of the Petroleum Industry Act (PIA), the PTDF mandate is further expanded to cover areas of strategic relevance in the Oil and Gas industry for sustainable development.

These new mandates are;

a. To enhance and develop world-class infrastructure and facilities in tertiary institutions that provide courses of studies relevant to the oil and gas industry.

b. To initiate, design and implement effective indigenous research and capacity development for Nigeria's petroleum industry, coordinate with research centres in Nigeria and abroad on the adaptation of technology and innovations appropriate for the need of the Nigeria Petroleum Industry.

c. To use existing human resource development facilities in Nigeria and expanded manpower development programmes in the petroleum, where applicable, support skills acquisition programmes aimed at enhancing employment, in the petroleum industry in Nigeria.
d. To periodically compute, evaluate and update the basic needs of the Nigeria's Petroleum industry in terms of skills, expertise and know-how, promote in-country fabrication and manufacturing of equipment used in the Nigerian petroleum industry. xi. Finally, to facilitate the attainment of 100% Nigeria content in the petroleum industry (Adekalu, et al, 2014).

The Raw Material Research and Development Council: is another agency that contributes to research and development in Nigeria. The establishment of the Raw Materials Research and Development Council (RMRDC) was in response to the clarion call by the private sector for government intervention on the over-reliance on imports by Nigeria's Manufacturing industry for the supply of its raw materials, processing equipment and spare parts. RMRDC was established by the RMRDC Act, originally promulgated into law by Decree 39 of 1987 and presently cited as RMRDC Act, CAP R.3 Laws of the Federation of Nigeria, 2004. RMRDC was established at a time when dwindling foreign exchange earnings from petroleum were expended to import raw materials and products that were available or could be competitively produced in Nigeria (Ehimiaghe & Adejoh, 2022). The RMRDC as an institution performs several functions and services in relation to its mandate. Policy

advisory role, raw material local content development, research and development, entrepreneurship cluster development initiatives, technology development and upgrade, workshops, conferences and seminars, Consultancy and Business Investment Services, Capacity Building and Skills Acquisition Training (RMRDC, 2022).

Non-National Government Sources of Research Funding in Nigeria

In addition to the public/government sources of research funding in Nigeria, several other sources including international organizations, foreign governments, and multinational institutions also provide funding for research projects in Nigeria. These funds are typically allocated to address specific development goals, promote scientific advancement, and address societal challenges. Examples of such organizations include: the United Nations and its agencies like the United Nations Children's Fund (UNICEF), World Health Organization (WHO), United Nations Development Programme (UNDP), and the International Organization for Migration (IOM). They often provide grants for research in areas such as public health, education, and sustainable development. The World Bank supports various research initiatives related to economic development, infrastructure, and poverty reduction. The African Development Bank (AfDB) funds projects in Nigeria that contribute to the continent's economic and social development. The European Union (EU) is another funding source for research in areas that are of interest to the Union. It often collaborates with Nigerian institutions on research projects through its various funding

programs. Many countries provide bilateral aid to Nigeria, which can include funding for research in areas of mutual interest.

Furthermore, private individuals, corporations, and philanthropic foundations play a crucial role in funding research initiatives in Nigeria. These donations can be directed towards a wide range of fields, including healthcare, education, agriculture, and technology. Examples of philanthropic organizations include the Dangote Foundation, which was founded by Nigerian businessman Aliko Dangote. This Foundation supports initiatives in health, education, and economic empowerment, and the Elumelu Foundation which focuses on entrepreneurship, leadership development, and empowering African entrepreneurs. Some major international Foundations that support research in Nigeria include, but are not limited to Ford Foundation, Fredrich Ebert Stiftung (FES), Bill and Melinda Gates, Open Society Foundations, MacArthur Foundation, and Carnegie. These international Foundations support projects in line with their visions, missions and goals in promoting and advancing a better world. Each Foundation has specific criteria and focus areas for funding. When seeking funding from these Foundations, it's important to thoroughly review their guidelines, funding priorities, and application procedures. In addition, these Foundations periodically update their funding priorities, hence, researchers seeking funding are advised to visit their official websites or contact them directly for the most current information on funding opportunities.

4. CHALLENGES OF FUNDING RESEARCH IN DEVELOPING ECONOMIES

Despite the importance of research in driving innovation, economic growth and development, several obstacles hinder the adequate allocation of resources and support to research initiatives. These challenges contribute to a stagnation of scientific progress and limit Nigeria's potential to address critical issues and compete on the global stage.

Resource Constraints and Competing Priorities

Resource constraints and competing priorities are major challenges when it comes to funding research endeavours in developing economies like Nigeria. Resource constraints refer to the limitations imposed by the availability of financial, human, and infrastructural resources. Research, particularly in fields like science, technology, and medicine, requires substantial financial investment to cover expenses such as equipment, materials, personnel salaries, and administrative costs. When funding is limited, researchers often face difficult decisions about which projects to pursue and how to allocate available resources effectively. This can result in potentially groundbreaking research projects being shelved or scaled down due to lack of funding, inhibiting progress and stifling innovation.

Competing priorities compound the challenge of funding research. In a world with a myriad of pressing issues, policymakers and funding bodies must make difficult decisions about where to allocate resources. In such scenarios, research projects might struggle to secure funding,

particularly if their immediate societal impact is not clear and convincing, or do not align with the priorities of the time.

Moreover, the competition for research funding can intensify when several researchers or institutions pursue similar goals. In such cases, limited resources may be spread thin across various projects, hindering the depth and impact of individual endeavours. Researchers tend to find themselves caught up in the race to secure limited funding available for the research/project rather than focusing on the project itself.

This scarcity of funds affects not only the quality and quantity of research conducted, but also the ability to attract and retain talented researchers. It can impede the growth of the research culture and hinder the country's progress in various fields.

Nigeria faces a multitude of pressing issues, including healthcare, education, infrastructure development, poverty alleviation, and security. As a result, research often takes a backseat to these more immediate and visible concerns. Allocating funds to research can be perceived as a luxury when compared to urgent demands in areas like public health or basic infrastructure.

Institutional Barriers

In Nigeria, like many other developing countries, the journey towards achieving substantial research funding faces several hurdles, with

institutional barriers being one of the foremost challenges. These institutional barriers encompass a range of structural, organizational, and procedural obstacles that impede the effective allocation, disbursement and utilization of funds for research purposes.

Nigeria's bureaucratic processes often hinder the efficient flow of funds for research projects. Cumbersome administrative procedures, excessive paperwork, and slow decision-making can lead to significant delays in the disbursement of funds. Researchers are required to go through cumbersome processes, from proposal submission to grant allocation, which can dampen their enthusiasm and hinder timely project execution. Effective research often requires collaboration and interdisciplinary interaction. Inadequate platforms for researchers to network, share ideas, and form partnerships across institutions hinder the development of comprehensive and impactful research projects. Limited collaboration also restricts the potential for leveraging external funding sources. In many cases, the gap between academia and industry in Nigeria hampers research funding. Industry-sponsored research can provide practical solutions to real-world problems and create pathways for innovations to reach the market. However, the lack of effective communication and collaboration between academic researchers and industries can result in missed opportunities for funding synergies.

Insufficient Private Sector Engagement

Insufficient private sector engagement stands as a significant challenge in the realm of funding research, hampering the advancement of scientific discovery, technological innovation, and societal progress. This challenge arises from a variety of factors, each contributing to a complex landscape that limits the potential benefits that could otherwise be realized through increased collaboration between the private sector and research initiatives. Private sector entities often prioritize short-term returns on investment due to their fiduciary responsibilities to shareholders. Research and innovation, on the other hand, entail uncertain outcomes and longer timeframes. The inherent risk associated with cutting-edge research can deter private sector engagement, as failures could lead to financial losses and negative impacts on reputation. In research, intellectual property (IP) is a valuable asset. Private companies may hesitate to engage with research initiatives if they fear that their proprietary knowledge could be exposed or that the results of collaborative efforts might become freely accessible to competitors. This challenge becomes more pronounced in cases where the research outcome has the potential for commercialization. The goals of private sector entities and research institutions can differ. While academia often prioritizes the advancement of knowledge for the greater good, private companies are focused on generating profit. This misalignment can hinder meaningful collaboration, as the pursuit of profit may lead to restricted access to research findings or biased manipulation of results. Many private sector actors, particularly those operating in highly competitive industries, prioritize immediate financial

gains over long-term investments. This short-term orientation may lead them to overlook the potential benefits of funding research, which often requires a longer-term commitment to yield significant outcomes. Measuring the return on investment (ROI) for research funding can be challenging, particularly when considering the indirect and long-term impacts on innovation and societal progress. Private sector entities might hesitate to invest when the potential ROI is difficult to quantify. Collaboration between the private sector and research institutions can be hindered by a lack of effective platforms and intermediaries that facilitate partnerships. Establishing these connections and fostering ongoing collaboration requires dedicated effort, resources and incentives such as tax breaks.

Inadequate Infrastructure

Inadequate infrastructure presents a significant challenge to funding research in Nigeria. According to the Nigerian Economic Summit Group (2023) of 140 countries ranked on the Global Competitiveness Index in 2019, in terms of infrastructure, Nigeria ranked 133rd, and Nigeria is one of the countries with the worst infrastructure in the world. For research to thrive, a solid infrastructure is essential. In Nigeria, a country with vast potential and a growing research community, the lack of infrastructure poses a significant challenge to funding research initiatives. Inadequate infrastructure hampers research progress in Nigeria and it is imperative to discuss potential solutions to address this challenge.

Infrastructure encompasses a wide range of facilities, equipment, and services necessary for researchers to carry out their work effectively. This includes laboratories, libraries, high-speed internet, reliable electricity, and transportation systems. Without adequate infrastructure, researchers face numerous obstacles that impede their ability to conduct meaningful research, collaborate with peers, and share their findings with the global scientific community.

There are several challenges arising from Lack of Infrastructure. These includes:

i. **Inadequate laboratory facilities**. Research, especially in fields such as science, engineering, and medicine, heavily relies on well-equipped laboratories. The absence of state-of-the-art laboratory facilities limits researchers' ability to conduct experiments, analyze data, and make breakthroughs. Second,

ii. **limited access to information**. Lack of modern libraries and online resources limits researchers' access to up-to-date information, hindering their ability to review existing literature, build upon previous studies, and remain at the forefront of their fields.

iii. **Unreliable electricity supply**. Frequent power outages disrupt research activities and pose challenges for running experiments, storing sensitive samples, and maintaining essential equipment.

iv. **Inadequate internet connectivity**. Access to high-speed internet is crucial for collaboration, data sharing, and communication with the global scientific community. Slow or unreliable internet

connections hinder researchers' ability to engage in international research networks.

v. **Poor transportation systems**. Poor transportation systems make it difficult for researchers to travel to conferences, workshops, and collaborative meetings. This isolation limits exposure to new ideas and impedes knowledge exchange.

Lack of Research Culture

While financial constraints undoubtedly play a significant role in this issue, the lack of a robust research culture further exacerbates the challenges faced by researchers and institutions seeking funding for their projects. Several factors contribute to the lack of research culture as a challenge in securing research funding in Nigeria. Perhaps beyond academia, there is still inadequate public awareness and recognition of the value of research as a driver of societal progress and economic growth. The lack of a research culture can make it difficult to advocate for the importance of allocating funds for projects that might not yield immediate results. Universities and research institutions often lack the necessary infrastructure, resources, and support systems to foster a thriving research environment. This not only affects the quality of research but also undermines the ability to attract external funding.

A robust research culture requires adherence to ethical standards and research integrity. Instances of research misconduct or fraudulent practices erode trust and discourage potential funders from investing in research initiatives. Research is often most effective when conducted

collaboratively across disciplines and institutions. A lack of a research culture can impede the development of collaborative networks and partnerships that are attractive to funding agencies. A strong research culture involves not just conducting research but effectively communicating findings to peers, policymakers, and the general public. Without effective communication, the impact of research remains limited, and its value to society is not fully realized

Brain Drain

Brain drain, the emigration of highly skilled and educated individuals from one country to another, has emerged as a significant challenge affecting the funding and progress of research in Nigeria. This phenomenon has been particularly detrimental to the country's ability to develop and sustain a vibrant research ecosystem. As noted by Okunade and Awosusi (2023) migration of skilled researchers and academics seeking better opportunities abroad or what has become popularly known as the Japa syndrome has become a new normal. The current net migration rate for Nigeria in 2023 is -0.273 per 1000 population (Macrotrends, 2023). This syndrome has diverse impacts including on the local research community which faces a shortage of expertise, reduced innovation, and a lack of continuity in critical areas of study.

Nigeria has a history of producing talented researchers and scientists, but the attraction of better facilities, higher salaries, and more conducive research environments in developed countries often leads these individuals to leave. This results in a loss of intellectual capital that

is critical for advancing research and innovation within the country. The migration of skilled professionals often creates a vicious cycle. The lack of investment in local institutions due to brain drain diminishes their ability to compete globally and attract funding. This in turn forces more researchers to seek opportunities abroad, exacerbating the problem as Nigeria continues to lose its next generation of scientists to developed countries (Beaudry, Mouton & Prozesky, 2018). Brain drain has a direct impact on research funding in Nigeria. With fewer researchers available locally, there is a decreased capacity to carry out high-quality research projects. This makes it challenging to secure funding from international organizations and collaborators, as the country's research output and capabilities are diminished. Researchers who leave may focus on topics that are more relevant to their host countries, neglecting critical issues specific to Nigeria's development. While Nigeria suffers from brain drain, developed countries benefit from the influx of skilled professionals. These countries capitalize on the knowledge and skills of these individuals, further widening the gap in expertise between Nigeria and these nations

5 STRATEGIES FOR EFFECTIVE RESEARCH FUNDING

Bearing in mind the challenges associated with funding research in Nigeria, there is a need for an effective and efficient strategy that will further promote research funding in Nigeria. Government commitment towards funding is unquestionably the most critical factor in university research. In Nigeria, the National Policy on Science and Technology recommended that 5 per cent of GNP be set aside for research, but Nigeria's federal university system is said to spend less than 1.3 per cent

of its budget on research (Oyewole, 2009). There have been complaints of university authorities withholding and subsequently diverting research grants for other purposes. Bako (2005) reported that out of the total accrued revenues in universities, the universities use up to 98 per cent of recurrent expenditure on paying salaries and allowances, 12 per cent on maintaining services and zero allocation for research. Education Stakeholders have recommended that Government at the federal and state levels should provide and release a minimum of 25 per cent of the national/state budget for education with a minimum of 40 per cent of the education budget for universities. This is in alignment with the provisions of the operational plans of the country's Vision 20:2020 (Okebukola, 2015).

Echono (2022) advocates accelerating the triple Helix by forging linkages between the universities and the productive sector to fast-track Nigeria's technological advancement and economic development. This would also translate to increased research funding from the private/ industrial sector.

Solving Local Challenges: In Nigeria, addressing local challenges requires a concerted effort to fund research initiatives that can contribute to sustainable solutions (Smith, 2019). By providing financial support for research projects, stakeholders can facilitate the exploration of innovative approaches to challenges such as healthcare disparities (Johnson et al., 2020), agricultural productivity (Okeke & Adeleke, 2018), and renewable energy adoption (Okonkwo, 2021). Efforts to fund

research in Nigeria have gained traction through collaborations between governmental bodies, non-governmental organizations, and academic institutions. These partnerships have led to increased research investment and the development of strategies to channel resources effectively (Brown et al., 2022).

To maximize the impact of research funding, it is essential to ensure that the research projects align with local needs and priorities. Engaging local communities in the research process fosters a sense of ownership and enhances the relevance of the findings (Adewale & Mohammed, 2017). Additionally, fostering interdisciplinary collaboration among researchers from diverse fields enables comprehensive problem-solving approaches (Chukwuma et al., 2019). In a nutshell, funding research to address local challenges in Nigeria holds the potential to drive positive change across various sectors. By promoting collaboration, stakeholder engagement, and strategic resource allocation, Nigeria can make significant strides toward sustainable development and improved quality of life for its citizens.

Human Capital Development and Capacity Building: Funding R&D for human capital development and capacity building is essential for promoting sustainable economic growth, social progress, and innovation. Human capital refers to the knowledge, skills, abilities, and health of individuals, which collectively contribute to their productive capacity and potential. Here's how you can approach funding R&D for human capital development and capacity building:

a. ***Identify Priority Areas:*** Determine which sectors or fields need the most attention in terms of human capital development and capacity building. These could include education, healthcare, workforce training, skill development, entrepreneurship, and more.
b. ***Collaborate with Experts:*** Partner with academic institutions, research organizations, non-profits, and industry experts who specialize in human capital development. Collaborative efforts can help ensure that the funding is directed towards impactful projects.
c. ***Create Grant Programs:*** Establish grant programs that provide funding for research initiatives, projects, and initiatives that focus on improving human capital. These could be open to researchers, educators, organizations, and individuals working on innovative solutions.
d. ***Competitive Proposals:*** Require applicants to submit detailed proposals outlining the goals, methodologies, expected outcomes, and budget of their projects. A competitive selection process ensures that the best and most promising projects receive funding.

6. TETFUND INITIATIVES ON RESEARCH FUNDING IN NIGERIA

TETFund being an Intervention Agency set up to provide supplementary support to all level of public tertiary institutions in Nigeria has renewed its commitment for transformative intervention activities. That is why the Fund has been strengthening its Content-Based Interventions to promote impactful and innovative research for national development as panacea to societal problems.

Distinguished Ladies and Gentlemen, I am pleased to report that we at TETFund resolutely believe that apart from the provision of physical infrastructure to change the face of our tertiary institutions, no effort should be spared in the pursuit of conscious investment drive in R&D, as it remains the most compelling strategy for addressing national challenges and accelerating sustainable growth and facilitating national development.

Accordingly, and in line with its commitment to ensuring our education system particularly at the tertiary level is geared towards addressing societal problems, TETFund established the Department of Research and Development/Centres of Excellence in 2014 to promote the institutionalization of R&D through effective support for impactful research and innovative partnership between tertiary institutions, industry and government as a national response towards technological revolution, human capital development and sustainable economic competitiveness.

To address the paucity of funds necessary to facilitate cutting-edge research in the areas of national priorities, TETFund introduced the National Research Fund (NRF) intervention intended to fund impactful research which will contribute to national developmental efforts as well as tackle global challenges. The Fund has been focusing the intervention towards strengthening scientific research. For instance, out of 128 NRF Batch Six grants awarded in 2019, 78 grants which translates to 60.9%

were awarded for Science, Engineering, Technology and Innovation (SETI) category, while 39.1% of the awards were for Humanities and Social Sciences, and Cross Cutting categories. Similarly, 118 of the 217 NRF Batch Seven grants awarded in 2020 were for SETI, while 182 of the 270 NRF Batch Eight grants which translates to 67.4% were awarded to SETI category for 2021. Between December 2022 and January 2023, the Fund released a total of **₦5,736,026,102(Five Billion Seven Thirty Six Million Twenty Six Thousand One Hundred Two Naira)** as research grants to 289 research teams under the National Research Fund (NRF).

Furthermore, TETFund has in 2021 awarded Mega Research Grants to four Research Clusters. The Clusters are Vaccine Production – Veterinary and Covid 19 Vaccine Development & Production; Drug Development; Infectious Diseases; and Dairy R&D Support. The Covid-19 Vaccine being developed by one of the research clusters is currently undergoing clinical trial.

To enhance the capacity of our lecturers for innovative and impactful scientific research, the Fund has sponsored lecturers from beneficiary institutions in 2021, 2022 and 2023 for intensive capacity building programme on Research for Impact programme. The ultimate objective is to translate research from Nigerian tertiary institutions to innovations, inventions and solutions for practical application and commercialization.

In addition, TETFund has funded other innovative initiatives targeted at deepening impactful research and uptake of research outcomes with potentials for commercialization. In this regard, the Fund in 2022 sponsored the TETFund Alliance for Innovative Research (TETFAIR) programme, an initiative designed to pull scientific researchers, innovators and inventors from beneficiary universities through a competitive selection process to accelerate their researches, innovations and inventions with the aid of state-of-the-art innovation hub, experts and mentors to enable them transform their ideas into innovative solutions up to Proof of Concept and Prototypes that can be pitched to investors for commercialization. The successes recorded from the initial TETFAIR programme conducted for participants from universities motivated the Fund to approve the second phase in 2023 to accommodate participants from Universities, Polytechnics and Colleges of Education (Technical).

In the same vein, the Fund has also supported the Innovation Fellowship for Aspiring Inventors and Researchers (i-FAIR) programmes, the i-FAIR 1 in 2020, i-FAIR 2 in 2021 and is supporting i-FAIR 3 in 2023 as one of the sponsoring partners. The i-FAIR programmes were organized by the Israeli Embassy to support scientific researchers, innovators and entrepreneurs who are passionate about using innovation to solve societal problems and transform Nigeria. I am pleased to report that some of the university academics nominated by the Fund to participate in i-FAIR 2 programme came out with innovations that are patented.

In line with its commitment to strengthen research capacities in the country, the Fund has sponsored over 20,240 academic staff of TEIs for PhDs, over 16,109 for masters degrees, 981 for benchwork in foreign institutions, and 92 for Post-Doctoral programmes specially targeted at strengthening scientific research capacity of the country.

In its effort to enhance the capacity of our scholars for ground-breaking research to attract international research grants and benefit from other funding windows for research across the globe, TETFund has sponsored 1,761 academic staff of beneficiary institutions from across the country for the train-the-trainer capacity building programme on Research Proposal Writing and Grant Management held in various countries between 2019 and 2022. This widely applauded programme was stepped down and held locally across the six-geopolitical zones between the first and second quarters of 2023 to ensure that more lecturers of beneficiary institutions benefit from it.

In addition, TETFund is facilitating Nigeria's participation in Horizon Europe through a program that is focusing on preparing Nigerian researchers to be able to compete effectively to access research grants under the EU Horizon. The Fund is also midwifing the establishment of a bilateral relationship with the EU on Research & Innovation. To facilitate the actualization of the AU-EU partnership on research and Innovation, the National Contact Points (NCP) has been constituted and is being supported to serve as channels for information dissemination on

opportunities and provide guidance to Nigerian researchers on various work programmes.

Distinguished Personalities, the recognition of the role of Centres of Excellence in Institutionalization of R&D has motivated the Fund to establish twenty-four Centres of Excellence in our beneficiary institutions with twelve in Universities, six in Polytechnics, and six in Colleges of Education, specializing in various aspect of national needs. The strategic aims for establishing the Centres are to support strategic and applications-oriented research and expertise with potential industrial applications; bring together the complementary resources needed for technical development and industrial application; and bridge the gap between researchers and users, thereby stimulating and strengthening triple-helix relationship.

Furthermore, in appreciating the role of critical research infrastructure in facilitating scientific and innovative research as well as product development, the Fund is concluding Plan to provide Innovation Hubs as well as Central Multipurpose Laboratories in our beneficiary institutions, as key scientific research facilities needed to promote enabling environment to enhance impactful and innovative research outputs, and accelerate competitiveness of the institutions for national development. The facilities would also reduce the need for our scientific researchers to visit oversea institutions for benchwork and other critical research activities.

In addition, the Fund has in 2023 established three (3) additional Centres of Excellence with an allocation of **₦1Billion(One Billion)** each. These are:

I. Centre of Excellence for Diaspora Research and Development at the University of Ibadan to provide the platform for engaging Nigerians living in diaspora to tap from their diverse expertise and enormous resources to solve societal challenges and support national aspiration;
II. Centre of Excellence on Pedagogy and Curriculum Development at Ahmadu Bello University, zaria; and
III. Centre of Excellence on Digital Literacy and Emerging Technology at Obafemi Awolowo University, Ile-Ife.

7. THE IMPERATIVE OF FUNDING MILITARY RESEARCH

Given the peculiarity of the Nigerian Defence Academy as a Military University, this lecture will not be complete without a word on the imperative of funding military research. One of the primary reasons for funding military research is to ensure national security. Developing advanced defence technologies, strategies, and capabilities can help a country deter potential threats, protect its citizens, and maintain its sovereignty. Military research often drives technological innovation. Many technologies that were initially developed for military purposes, such as the internet and GPS, have found civilian applications that have transformed various aspects of society and the economy. There is no doubt that a strong military can enhance a country's global influence and diplomatic power. Having cutting-edge military capabilities can

contribute to a nation's credibility on the international stage and enable it to participate in strategic alliances and negotiations. Furthermore, military research can stimulate economic growth by creating high-tech jobs, driving demand for R&D, and fostering a culture of innovation. This can have positive ripple effects throughout the economy. Historically, military research has played a role in pushing the boundaries of scientific knowledge. The pursuit of advanced defence technologies can lead to breakthroughs in fields such as materials science, aerospace engineering, and artificial intelligence, which can then be applied to various civilian sectors.

Against the backdrop of contemporary security challenges facing Nigeria, possessing a strong military can act as a deterrent against potential aggressors. The idea is that if a country has powerful defence capabilities, potential adversaries will think twice before considering hostile actions. Consequently, well-funded military research can equip a nation to respond effectively to crises, disasters, and emergencies, both domestically and internationally. Military assets can provide logistical support, medical aid, and disaster relief in times of need. On the whole, funding military research involves striking the right balance between traditional and non-traditional security priorities.

8. CONCLUSION

Funding research in a developing economy is an imperative that holds the potential to reshape the trajectory of progress and innovation within these nations. This paper has underscored the multifaceted significance of research funding, elucidating its role in fostering economic growth, driving technological advancement, and addressing pressing societal challenges. By investing in research, developing economies can lay the foundation for sustainable development, empowering local talent, and cultivating a culture of inquiry and discovery.

In conclusion, the vital role of funding in fostering research and innovation within developing economies like Nigeria cannot be overstated. This paper has also examined the nature of funding challenges, the underlying factors that contribute to these challenges, and potential strategies to overcome them. The journey toward building a knowledge-driven economy requires concerted efforts from various stakeholders, including government bodies, private enterprises, international organizations, and educational institutions.

Nigeria's unique blend of resources, talents, and cultural diversity positions it as a potential hub for groundbreaking research that addresses local challenges while contributing to global advancements. However, realizing this potential hinge on the establishment of sustainable funding mechanisms that prioritize research across diverse disciplines. Strategies such as public-private partnerships, innovation funds, tax incentives, and international collaborations hold the promise

of nurturing a thriving research environment. As demonstrated by numerous successful examples from around the world, investing in research yields substantial returns, not only in terms of technological breakthroughs but also in economic growth, job creation, and enhanced quality of life. By adopting a holistic approach to funding research, Nigeria can elevate its position on the global stage, drive innovation, and lay the foundation for a prosperous and sustainable future.

I thank you for your kind attention

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