

**TERTIARY EDUCATION TRUST FUND (TETFund)
TETFund NATIONAL RESEARCH FUND (NRF) GRANT
NRF RESEARCH BRIEF**

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CHAPTER ONE: INTRODUCTION

In pursuance to the Act establishing the Education Trust Fund (ETF) and now Tertiary Education Trust Fund (TETFund), the Board of Trustees of the Fund established a National Research Fund aimed at resuscitating research activities in the nation's tertiary institutions.

The TETFUND National Research Fund (NRF) Programme was introduced in 2009 as a special intervention approved by the President of the Federal Republic of Nigeria. The programme is aimed at promoting the conduct of applied research and innovation by academics in public tertiary educational institutions. The main objective is to drive the socio-economic development of Nigeria in an increasingly globalized and highly competitive knowledge-driven world economy.

To actualize the objectives of the National Research Fund, the Board of Trustees set up a committee tagged the NRF Screening and Monitoring Committee and charged it with the responsibility for implementing the intervention. After extensive consultations with experts and various stakeholders, the blueprint for roll-out of the National Research Fund was produced. The blueprint mirrors Nigeria's National Research Agenda, depicting the prioritised areas of research in academia which captured three main categories, namely: Humanities and Social Sciences (HSS); Science, Technology and Innovation (STI); and Cross-Cutting (CC).

In its current efforts at repositioning the Fund for more effective service delivery, the membership of the National Research Fund Screening and Monitoring Committee (NRFS&MC) was reconstituted in July 2019. The Committee immediately carried out a review of the three thematic areas of the NRF research spectrum and incorporated emerging issues of national developmental challenges requiring innovative solutions. This culminated in the development of 25 thematic areas, which formed the basis of the processing of proposals for grants awards in 2019.

In 2000, world leaders agreed on a vision for the future – a world with less poverty, hunger and disease, greater survival prospects for mothers and their infants, better educated children, equal opportunities for women, and a healthier environment; a world in which developed and developing countries were to work in partnership for the betterment of all. It was an ambitious vision of development; a vision that had human development at its core to sustain social and economic progress. Eight goals, eighteen targets, and forty-eight indicators were accepted as a framework for measuring development progress. They aimed to cut extreme poverty by half, ensure every child had the chance to go to school and live a long and healthy life,

and bring discrimination against women to an end. The risks of dying as a result of childbirth were to be dramatically reduced, deadly diseases brought under control, the environment better managed, and the benefits of progress more equally shared by all the nations of the world. Together, the aspirations of the Millennium Development Goals (MDGs) and their associated targets and indicators represented a powerful framework for action. The goals were then to be achieved not later than 2015.

The reality in a number of countries, including Nigeria, was the very poor performance in almost all the performance indicators of the MDGs. Most devastating for Nigeria was the lack of credible data of performance against which achievements could be measured and future plans be realistically contemplated. But the clock of development did not stop in 2015 as the world proceeded to craft the way forward in another measured step from 2015 to 2030; a process that led to the development of sustainable development goals (SDGs). The SDGs represent another set of global initiatives that have been designed to engage the various nation states from 2015 to 2030.

In order to put sustainable development at the core, various reports have identified the following transformative shifts, among others:

- Developed countries have a special role to play, fostering new technologies and making the fastest progress in reducing unsustainable consumption.
- A rapid shift to sustainable patterns of consumption and production - harnessing innovation, technology, and the potential of private business to create more value and drive sustainable and inclusive growth.
- Diversified economies, with equal opportunities for all, can unleash the dynamism that creates jobs and livelihoods, especially for young people and women. This is a challenge for every country on earth: to ensure good job possibilities while moving to the sustainable patterns of work and life that will be necessary in a world of limited natural resources.
- Ensuring that people have what they need to grow and prosper, including access to quality education and skills, healthcare, clean water, electricity, telecommunications and transport. ...We should make it easier for people to invest, start-up a business and to trade.
- Forge a new global partnership as we fight climate change, champion free and fair trade, technology innovation, transfer and diffusion, and promote financial stability.
- Need for a data revolution for sustainable development to improve the quality of statistics and information available to citizens. This should actively take advantage of new technology, crowd sourcing, and improved connectivity to empower people with information on the progress towards the targets.

The underline in the above is a pointer to the areas of possible intervention by the national research system. The strategic objective is to map out research and development activities that will address the SDGs and the identified targets.

2.1 Main Categories and Thematic Areas for the NRF

The NRF has hitherto been operating three main research categories namely, Science, Technology and Innovation (STI), Humanities and Social Sciences (HSS), and Cross-cutting (CC). Bearing in mind the critical role of engineering in delivering science and technology in the process of innovation, NRFS&MC took the decision to add engineering to STI leading to the new research category – Science, Engineering Technology and Innovation (SETI). At the end of the critical review of the thematic areas in each research category, the number of thematic areas increased from the 25 in 2019 to 28 for the present 2020 grant cycle. The thematic areas are distributed as illustrated in Fig 2; SETI (11), HSS(11) and CC(6).

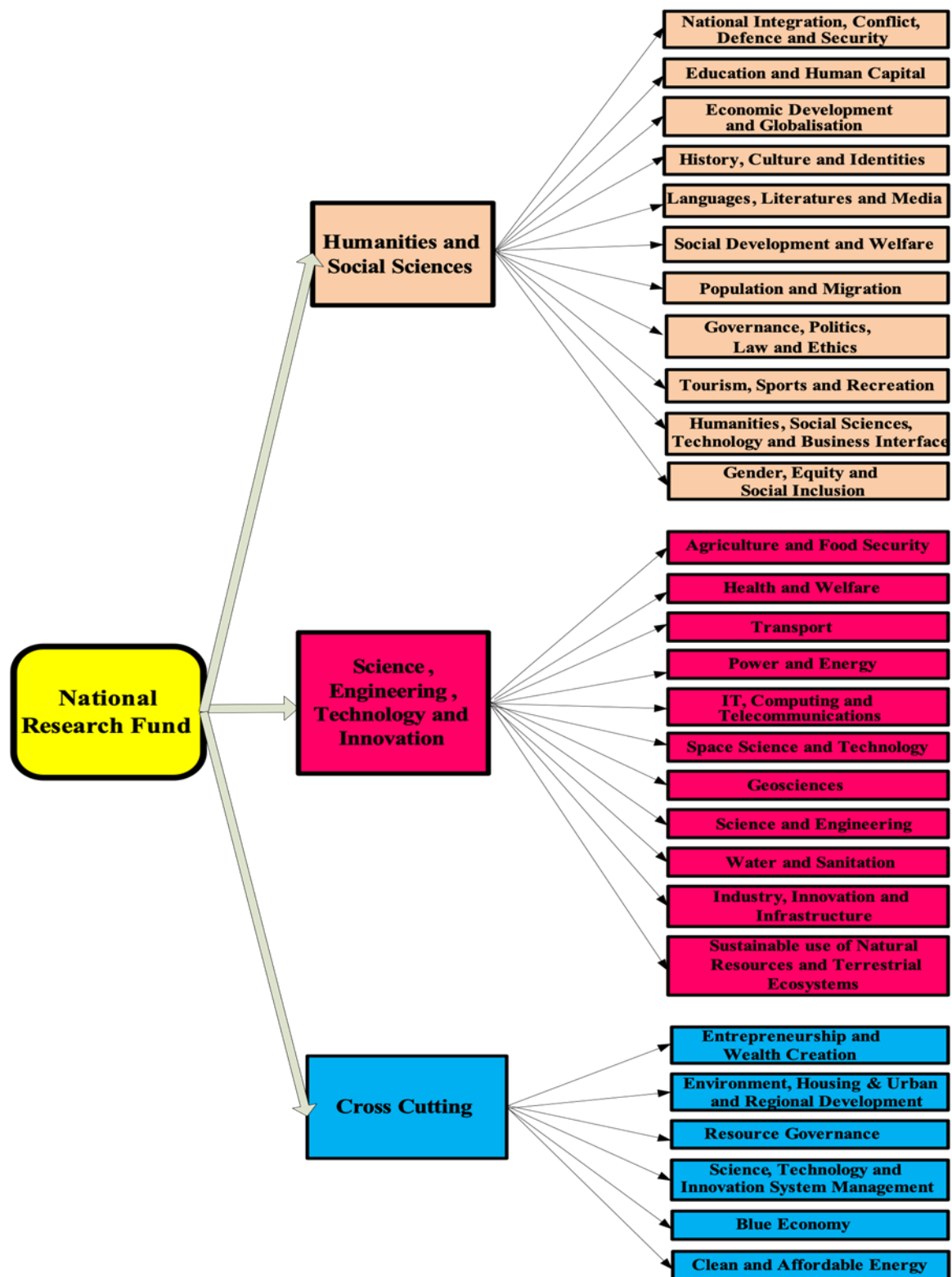


Figure 1: Main Categories and Thematic Areas for the National Research Fund

CATEGORY 1: HUMANITIES AND SOCIAL SCIENCES (HSS)

INTRODUCTION

The thematic areas for the Humanities and Social Sciences are carefully selected with the SDGs, national needs and emerging local and contemporary issues in mind. SDG 1, 2, 3, 4, 8, 9, 10, 11, 13 and 16 interface with the Humanities and Social Sciences directly. Human beings live in a socio-political, economic, and technological milieu and are therefore subject to the influence of these factors. Disciplines in the humanities and Social Sciences deal with what it means to be human, human systems, society, cultural productions and development. 'Any meaningful development must aim for the realization of the human potential and a maximum utilization of national and global resources for the benefit of all' (Bamgbose 2014). To realize the human potential, development must be grounded on the culture of a people. Non-culturally driven development models lead to 'disenfranchising retardation, such 'retardative distortions' institutionalize dependency (Mazrui cf. Khalil Timamy 2007:316). Development is driven by culture and it is itself a cultural process. Access to and utilization of information is right at the heart of development.

Thematic Area 1: National Integration, Conflict, Defence and Security

Nigeria has since independence gone through a 30-month civil war, periods of political instability, civil unrest, long periods of unconstitutional military rule, ethno-religious and communal conflicts, and bouts of socio-economic uncertainty, among others. The survival of the Fourth Republic, inaugurated in 1999, signalling the longest period yet of uninterrupted civilian governance in the country's history, has not fully addressed some of the instability and uncertainties of the past even as it has put a stop to others such as unconstitutional change of government. Rather, the Republic has witnessed heightened conflict and uncertainties relating to conflicts, calls for secession and restructuring of the Federation, acts of terrorism and insurgency, cross-border crimes, ethnic, regional and religious tension, among others.

It is generally acknowledged that a peaceful and more or less secure, predictable and stable socio-economic and political order is a sine qua non for national development in all its ramifications. It is therefore imperative that the country's research agenda focuses on how to address, contain, and find sustainable and innovative solutions to these intractable challenges to the nation's continued existence and capacity to meet the basic needs of the citizenry.

Strategic Objectives

The objectives for this research segment are to initiate studies and generate data to:

- I. Develop, on the basis of reliable data, effective policies and mechanisms for enhancing national integration, security, peace, defence and security and for quick and effective resolution of conflicts.
- II. Evolve mechanisms and models for the conduct and deliverance of free, fair and violence-free elections on a sustainable basis.
- III. Evolve mechanisms for engendering and guaranteeing national integration, security and continuous improvement in the socio-cultural, economic and political/policy contexts for, and quality and effectiveness of the institutions for, the maintenance of law and order and for the protection of lives and properties and the territorial integrity of the nation.
- IV. Improve and enhance the capabilities of national defence and security agencies as well as the institutions for conflict resolution, including those for alternative dispute resolution (ADR), mediation, peace enforcement, peacemaking and peace building.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Peace and Conflict Resolution	<p>Resource mobilisation and resource distribution conflicts, communal conflicts, ethno-religious and regional conflicts, election and governance-related conflicts, cross-border crimes and conflicts</p> <p>Peace education, ADR, conflict resolution, mediation, peace enforcement, peacemaking and peace building</p>
National Integration	<p>Successful integration models; challenges to, and opportunities for national integration in Nigeria</p> <p>Economic integration models and their application</p> <p>Policy and practice of national integration in historical and comparative perspective (NYSC, Unity Schools, Federal Character, etc); their uses, limitations and emerging/new perspectives and policies.</p>
Leadership and Values	<p>Role of values in leadership and governance</p> <p>Cultural/religious values and national development</p> <p>Values and institutional performance in the public and private sectors, and in community/town/village unions, religious, ethnic, educational, civil society institutions and in organized labour and informal sector networks/associations</p>
Electoral and Governance Reform	<p>Electoral reforms and electoral management</p> <p>Electoral violence and its implications to Nigeria's democracy</p> <p>Governance reform – demands, vested interests, strategies, activities, patterns, and consequences</p>

<p>Defence and Security: local, national and international dimensions</p>	<p>Evolution of Defence and security structures, strategies, tactics, and policies in Nigeria; studies of key defence and security institutions</p> <p>National Defence and Security Sector Reform: Scope, significance, and constraints</p> <p>Local security infrastructure: community policing traditional authorities and trans-border security</p> <p>International contexts/dimensions of defence and security issues: international peacekeeping, trans-border crimes, insurgency and terrorism</p> <p>Defence and security sector reforms/transformation (the military, police, paramilitary, including Customs, Immigration, EFCC, NDLEA, NSCDC, and the Correctional Service - former Prisons Service);</p> <p>Issues of technology application for defence and security.</p> <p>Nigerian foreign policy</p>
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Thematic Area 2: Education and Human Capital

The importance of education and human capital for national development cannot be overemphasized. Human capital means education, training, and skills that give people greater command over knowledge so that they are more productive. How well individuals and economies succeed will be determined mainly by how successful they are in investing and commanding the growing stock of knowledge. The wealth of a nation will depend on the quality of human capital available to it (Andy Rosenfield 2002). Indeed, all other aspects of development depend on educational development. This central importance of education has been underscored by SDG 4 which is to ensure inclusive and equitable quality education and promote lifelong learning. The emergence of knowledge-based economy facilitated by information and communications technology (ICT) has raised opportunities and barriers that require informed policies, skilled planning and sustainable interventions.

Globally, higher education is believed to be the core of human resource development with responsibility for getting graduates ready for employment not only for today but also preparing them for a future. In Nigeria today, the critical technical skills needed for the development of the country are grossly lacking despite the huge population that constitutes the workforce, as well as numerous higher education institutions (HEIs) and technical and vocational education training (TVET) system. Large numbers of graduates have continuously been found incapable of meeting up with the employment requirements of the workforce and have thus been unsuccessful in either securing or keeping a job. This is not far removed from the fact that our higher educational institutions have been largely disconnected from industrial and

socio-economic needs through consistent neglect of competence and undue emphasis on paper qualification.

There is therefore the need for research in education that would prepare current and future citizens for the new global, competitive and knowledge-driven world. In addition to addressing these global roles, research in education should also address the contemporary issues and problems facing the system such as:

- Education for relevance to the society and for national development objectives
- Funding and budgeting
- Graduate employability and skills development
- Curriculum in relation to outputs of the system
- Adequacy or otherwise of teaching and learning materials and resources
- Enrolment and classes sizes
- Planning, management, supervision and inspections for monitoring, implementation of blueprints and policies.

Strategic Objectives

The strategic objectives are to execute studies and provide data and information that will assist in:

1. Reviewing the current educational system at all levels for optimal performance and relevance
2. Policies, reforms, funding and cultural issues
3. Raising the standards and quality of education at all levels to produce graduate with relevant skills to thrive in the local and global economy
4. Appropriate and sustainable teaching and learning technologies (including, but not limited to ICT) for successful learning outcomes in the system.
5. freedom of learning, access and equity, lifelong and continuous education, eLearning, Open Distance Education, etc.
6. Higher education, technological, vocational and technical education.
7. Ensuring and assuring the relevance of the educational system to the socio-economic development of our nation state.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Sustainable and Appropriate Technology	Use of ICT and other technologies
	Mobile, virtual and e learning
	Technology dissemination, adoption and modelling

	<p>Cultural and demographic issues in ICT</p> <p>Gender Issues</p> <p>Large class management</p>
Quality Assurance	<p>Teaching and teaching qualities</p> <p>Teacher training issues including continuous training</p> <p>Program quality</p> <p>Ensuring the continuous maintenance of high qualities</p> <p>Learning and learner qualities</p> <p>Ethics in teaching and learning (examination malpractices, sexual and other harassments, etc.)</p> <p>Challenges brought about by technology</p> <p>Content mobility and functional education</p>
Access to Higher Education	<p>Private, public institutions at all levels</p> <p>Performance and other gaps</p> <p>Open and distance education</p> <p>Cross-border education</p>
Funding of Education	<p>Funding models</p> <p>Public/Private partnership issues</p> <p>Role of stakeholders at all levels of education</p>
Indigenous Education	<p>Integration of religious/traditional education with western education and vice-versa</p>

	Integration of home (social) education and experience into the system
Human Resource Development and Management	Needs assessment for national manpower development
	Education for manpower development
	Education for skill acquisition
	Management of educational institutions
Equity	Gender Equity, Affordability
	Education for the challenged (physically, mentally, etc.)
	Rights education

Thematic Area 3: Economic Development and Globalisation

Background

Nigeria's potentials and opportunities for economic development are as widely acknowledged as the challenges, pitfalls and contradictions that have negatively impacted on the full attainment of that goal. Thus, there is an urgent need for more sustained research and evidence-based policy attention to the key imperatives of policy, practice, structure, infrastructure and outcomes to enable the country optimise its local, regional and global advantages.

The current national policy framework sees poverty reduction as an important goal to pursue in a number of ways: removal of barriers in agriculture, industry and other real sectors of the economy; deregulation leading to a new wave of privatization; promotion of the private sector, access to international markets through export free zones; and the promulgation of code of corporate governance aimed at improving the flow of FDIs to diverse sectors of the economy

Key areas of focus in this regard would revolve around a sustained examination of the political economy of development challenges in Nigeria, addressing sustainability and robustness of the kind of economic growth that does not deepen poverty and unemployment but addresses competitiveness challenges in terms of legal, infrastructural and policy weaknesses, skills deficit and productivity inadequacies, among others. Other major areas of focus includes the position of the Nigerian economy within the international division of labour, the implications of Nigeria's membership of global and regional economic groupings and multinational corporations.

Strategic objectives

The strategic objectives of the research themes are to:

- i. Create a nexus between economic development research and economic development policy formulation and implementation.
- ii. Develop a broad-based analytical framework to enhance data-driven policy recommendations on development issues.
- iii. Build capacity for global competitiveness and promote the diversification of the Nigerian economy.

Elements of this thematic focus in specific terms include the following:

Sub-Themes and Research Focus

Sub-Themes	Research Focus
Economic Policy	Economic policy, price stability and growth fiscal and monetary policies Micro and Macroeconomic policies Economic strategy and policy for agricultural transformation
Economics of Globalisation	North-South and South-South Cooperation and Nigeria's economic development Globalisation – risks, opportunities and challenges The Economics of Free trade, exchange rates systems Multinational Corporations and Nigeria's development
Employment Creation	Agricultural productivity and job creation SMEs and employment creation Youth and public sector employment strategies and intensive schemes Privatization and employment in communication, power and related sectors
International Finance, Trade and Investments	Foreign Direct Investments, aids, grants, debts Nigeria and the Bretton Wood Institutions Non-oil exports promotion strategies Improving the gains for Nigeria from the ECOWAS, WTO and other frameworks of international trade such as the new African Continental Free Trade Area (AFCFTA) Agreement. Export free zones and Nigeria's international trade performance
Economic and Corporate Governance	Corporate governance in quoted companies Commercial banks and corporate governance

Income security	Salaries, Pension systems and old age welfare, Income security in the informal sector
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Thematic Area 4: History, Culture and Identities

It is acknowledged that no nation can achieve sustainable socio-political, economic and technological development without an in-depth understanding of the histories, cultures and belief systems of its component groups. Historical consciousness is a sine qua non for the achievement of enduring peace, unity, and progress at all levels because it has the tendency to foster a spirit of patriotism, national identity, sense of belonging and national integration. Emerging issues in religious relations not only in Nigeria but also across the world have had quite ambivalent perceptions among both adherents and non-adherents. Thus, it is important to relate Nigeria's past economic, social, political and religious conditions to its past experiences. The bottom-line is that sustainable development is better guaranteed within the framework of the nation's historical and cultural peculiarities.

Strategic Objectives

The objectives for this research segment are to:

- i. Gather data from reliable sources and employ appropriate methodologies for the reconstruction of various aspects of Nigeria's history and culture.
- ii. Utilize the results from historical and cultural research to properly understand Nigeria's deep rooted developmental challenges and the problems of nation building.
- iii. Utilize historical knowledge to appreciate the challenges of colonialism, neo-colonialism and globalization to Nigeria's quest for development.
- iv. Engender better understanding of the trends and prospects for the future of Nigeria.
- v. Documentation, archival work and comparative studies
- vi. Ethnic identities, migration, the diaspora and ethno-religious issues

Sub-Themes and Research Focus

Sub-Themes	Research Focus
Documentation, histories, archiving and retrieval systems	Histories, oral repositories, Indigenous knowledge systems and wisdoms; information and knowledge generation, coding and transfer; ideology, philosophies and ethics; comparative and areal studies, Hagiography / biographical studies.
Cultures and civilizations	Culture, traditions, Geo-Cultural values and the dynamic World, epochs and milieus. transitions and stabilities.

Religion, ideology and polity	Intra-religious challenges: Issues in internal conflict i.e. textual interpretations, sectarianism, religion and polity, religious movements, terrorism, global issues, religion, economy, tourism, education, politics and security.
History, culture and innovation	Technologies, inventions, indigenous knowledge systems and practices, culture and innovation and innovating cultures, legacies, modernity and modernization, entrepreneurship, labour practices and productivity.
Global and local identities, and the diaspora	Transformations and changes, the diaspora in time, space and context; citizenship and foreign policy dimensions.

Thematic Area 5: Languages, Literatures and Media

Language is at the heart of development. Ethnologue, an online catalogue of the world's languages, lists 529 languages for Nigeria, making Nigeria the second most linguistically diverse country in the world. Seven of the listed languages are extinct, twenty are claimed to be "in trouble" and 42 to be dying. The great majority of the other Nigerian languages remain very poorly studied and many are not studied at all. In fact, according to a bibliometric study by Harald Hammarström, Nigeria is also the world's second least documented country in the world. Each of the language groups has associated oral literatures and traditions which together with the languages constitute huge archives of folk wisdom, defining the respective worldviews and retaining critical indigenous knowledge systems and resources. The documentation, preservation, interpretations and utilization of these knowledge systems is critical to our identities, education, national integration and harmonious co-existence. In addition, it is critical to interface these resources with ICTs, media and education in order to enhance Nigeria's competitive advantage. The challenges of media and communication in a multicultural and multilingual nation cannot be overemphasized. It is therefore pertinent to encourage diverse studies in the areas of language Arts, Mass and intercultural communication as well as the new media, among many other areas.

Strategic Objectives

This research segment is to initiate research studies to:

- i. *Engage in the documentation*, creation of massive corpus, archives, documentaries and consequently stem the loss of heritage
- ii. Facilitate the constitutional requirement for use of Nigerian Languages and realization of SDGs (*Materials Development for Language Learning, Acquisition and Language Policy Implementation*)
- iii. Promote national integration
- iv. Provide content for diversity management, peace, conflict and security management and development planning

- v. Improve Nigeria's competitive advantage in the global space for cultural goods and services through the *provision of local content for media, entertainment and ICT, robotics and artificial intelligence (AI)*.
- vi. *Improve access to information, opportunities and participation*
- vii. Engage in the development of tools and software.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Language, literatures, media and development	Sustainable development, policy and planning, inclusion and exclusion; communication and participation, healthcare, agriculture, environment, transportation, safety/security/peace building, development of scientific, politics and governance, development terminologies and metalanguages; identity and integration
Technology and Local content issues	Local cultural content utilization in trade policies, localization and adaptation of technology, ICT and AI interfaces, Computational linguistics, utilization of GIS, scientific and technology terminologies
Documentation, theoretical issues, description, archiving	Descriptions, documentation, oral repositories, typologies, comparative and areal studies
Information and the Media	Various aspects of communication, communication for development, indigenous communication, education, old and new media, and Language Arts, etc.

Thematic Area 6: Social Development and Welfare

Central to this thematic area are SDG 1, 2 and 3 which relate to poverty, hunger, good health and wellbeing. Social development and welfare issues are central in development discourses and policy formulation. Of particular concern are those related to socially marginalized groups and vulnerable populations such as the aged and ageing populations, infants, orphans and vulnerable children, people living with disabilities (PWDs) and internally displaced persons. There are huge policy and program gaps in addressing critical social development welfare issues affecting these sets of people in Nigeria. To date, there is no comprehensive social security system in the country. With the fast growing population and rapid social transformations there is the need to develop robust and comprehensive social development and welfare policies and programmes that will address the need of the population. There is the need for an all-inclusive national social welfare policy to respond to the developmental needs of Persons living with Disabilities (PWDs), infants, orphans and vulnerable children, as well as the elderly within the society. This will address the growing social problem of infant mortality, alms solicitation, street begging, child labour, street

hawking by children, social excesses of street urchins as well as taking into consideration the plight of the ageing population and other vulnerable groups including PWDs.

However, there is a dearth of nationally representative data and research on these population sub-groups in Nigeria. This has been one of the major challenges in developing a policy framework for social welfare in Nigeria. Besides, there is the need to underscore the socio-cultural diversities in Nigerian societies. There is therefore the need to support and strengthen multi-disciplinary cutting-edge researches that adequately provide a platform for culturally compelling policies and program directions in developing social welfare programs. This is expected to culminate in responsive holistic policy and programmatic interventions towards ensuring improved quality of life of the Nigeria citizens. More so, the training component of the research process is to boost the professional training for the workforce on policy compliance and implementation among others.

Strategic Objectives

The strategic objectives for this segment are to:

1. Provide baseline data and situation analyses of the challenges of vulnerable groups in Nigeria for appropriate legal, policy and program interventions;
2. Document adequacy, efficiency and effectiveness of formal and informal social protection measures for various vulnerable groups
3. Review and document impact of the existing policies and programs for social development and welfare in Nigeria
4. Assess available human capacities and infrastructures for social development and welfare
5. Review and document impact of poverty reduction policies and programs.

Sub-Themes and Research Focus:

Sub-Themes	Research Focus
Ageing and Aged Population	Socio-cultural changes, social support and well-being of the young-old, old and the old-old. Longevity studies, Older parents and Adult married children
	Elder abuse
	Living arrangement, family structure and the elderly
	Health care, health utilization and respite care for the aged
	Economic and demographic aspects of population ageing
	Policy framework for the aged and ageing population
	Economic activities of older adults
	Informal and formal/institutional care of frail elderly

Infants and children	Health and social intervention studies
	Child Rights and Child Abuse
	The Media/internet and the Children
	Child trafficking and baby factories
	Juvenile Offenders
	Children in IDP camps Impact of armed conflict on children
	Evaluation of Policy and program interventions for infants and children
Orphans and Vulnerable Children	Patterns, determinants and causes
	Health and psycho-social effects
	Informal and formal fostering and adoption of children
	Institutional and family care of OVC.
Populations Living with Disabilities, HIV&AIDS and terminal diseases (cancer)	Demographic and social patterns
	Health and social intervention studies
	Assessment of Policy and program interventions
	Capacity development Social protection for people with disabilities
Social Reconstruction	Identity reconstruction, re-orientation and National Image
	Culture, Identity and Conflicts
	Gender Identity, Gender Orientations, and Development

Population and migration has implications for SDGs 3, 6, 7, 8, 10 and 11. Population study is a major developmental issue in a country. It provides reliable estimates of the citizenry and the factors affecting its dynamics, structure and configuration. Demographic research is focused on three critical areas of fertility, mortality and migration. Other emerging areas include labor force and employment, reproductive health, population and environment, and population and development studies. In addition, the phenomena of massive economic migration, refugees and displaced persons have become of global concern. In Nigeria, efforts in demographic research have not yielded sufficient data needed for sectoral planning and have left unresolved questions and agitations on past census figures. More important, Nigeria is still very weak in innovative use of ‘big data’ resources to drive growth and development.

Strategic Objectives

The strategic objectives for the research theme are to:

1. Support under-researched areas of population studies
2. Provide opportunity for capacity development in cutting-edge research
3. Facilitate a synergy between population research and policy development
4. Evolve ‘big data’ driven innovation in population studies

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Migration	Forced migration
	Refugees and the host communities
	Internally displaced persons (IDPs)
	Violence against immigrants and minority communities
	Migration and remittances
	Humanitarian aid
	Urban governance of migration
Labour Force and Employment	Situation analysis
	Gender and Labour force
	Unemployment
Population and development	Monitoring of development indicators
	Sectorial analysis and research on development
	Patterns, levels and determinants

Fertility, Mortality, Reproductive health including HIV/AIDS	High risk behaviour
	Child and maternal health
	Youth
'Big Data' driven innovation in population studies	Big data, mobility and migration studies
	Data revolution through record linkage and data integration
	Social Media, Big Data and Digital Demography

Thematic Area 8: Governance, Politics, Law and Ethics

Governance, Politics, Law and Ethics are key to the search for political and economic development, socio-cultural coherence, justice, equity and peace in Nigeria (SDG 16). However, the country's trajectory since independence has underscored how difficult it is to attain and sustain this facilitative environment, and how urgent and important it is now to focus research attention on these areas of national life as detailed below

Strategic Objectives

These are to:

1. Develop a better understanding of facilitative and hindering factors and forces for effective governance, democracy, development, socio-cultural coherence, peace and a just society emanating from the historical evolution of the frameworks for contemporary politics, law, justice and governance in Nigeria.
2. Identify policies and practices required for enhancing the structural, institutional and procedural requirements for enhancing the quality of politics, governance and the legal/judicial and ethical frameworks.
3. Examine mechanisms for strengthening the institutions for participation, representation, legislation, regulation and enforcement.
4. Identify and address the sociocultural bases for more effective engagement of leadership and followership of civil and political society, community-based associations, labour and professional organizations in politics, governance and an ethical order and effective judiciary in the context of the triumph of the rule of law.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Governance	<p>The political economy of governance;</p> <p>Nigerian experience of federalism in comparative perspective;</p> <p>Intergovernmental and intra-governmental relations;</p> <p>Legislature-executive-judicial relations;</p> <p>Local governance;</p> <p>Economic governance;</p> <p>Resource governance;</p> <p>Governmentality, bureaucratic effectiveness and service delivery;</p> <p>Corruption; horizontal and vertical accountability and transparency;</p> <p>Civil society, religion, ethnicity and governance.</p> <p>The making of constitutions and their amendments.</p> <p>Military rule.</p> <p>Assessments of the Four Republics</p>

Politics	<p>Party and electoral systems; elections, electoral reform, and electoral administration;</p> <p>Quality and role of leadership at local, state and federal levels;</p> <p>Sub-national politics;</p> <p>Role of civic, religious and community associations;</p> <p>Causes, nature and remedies of electoral violence;</p> <p>Challenges and opportunities for substantive democracy at local, state and federal levels;</p> <p>Politics, religion, ethnicity and traditional institutions.</p>
Law	<p>The legal and constitutional bases for an autonomous judicial system, judicial oversight and review;</p> <p>The structure of the judiciary; the judiciary in historical and comparative perspective</p> <p>Citizenship and indigeneity in legal perspective;</p> <p>The law and fundamental rights, freedoms and duties; the law and inclusivity;</p> <p>Law reform;</p> <p>The legal bases of federalism</p>

Ethics	<p>Ethics in Government, including the military and security sectors;</p> <p>Ethics in Business and in organised labour;</p> <p>Ethics in civil society, including the media;</p> <p>Ethics in the educational and cultural sectors;</p> <p>Ethics in Religious organisations and local communities;</p> <p>Ethics in Private life and in the informal sector;</p> <p>Ethics in politics;</p> <p>Opportunities and challenges in evolving a strong ethical order in Nigeria.</p>
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Thematic Area 9: Tourism, Sports and Recreation

Nigeria is still to take advantage of the growing modern tourism industry which, in 2005 registered approximately 800 million international tourist arrivals worldwide. As a labour-intensive industry, tourism has the potential to create more jobs per unit of investment than any other industry as it brings many benefits to governments, local authorities as well as the private sector through the generation of foreign revenue, financial returns on investment, taxation on tourists and tourist products, and, linkages to other local industries such as agriculture and fisheries. As noted by the World Economic Forum (WEF):

... despite the current difficulties, the Travel and Tourism (T&T) sector remains a critical economic sector worldwide and one that provides significant potential for economic growth and development internationally. A growing national T&T sector contributes to employment, raises national income, and can improve a country's balance of payments. The sector is thus an important driver of growth and prosperity and, particularly within developing countries, it can play a leading role in poverty reduction ...

The potential market segments for immediate development in Nigeria are likely to be leisure (new experience seekers; Nigeria's Diaspora; special interest; expatriate community; family holidays), conference and meetings, visiting friends and relatives (VFR), religious events, the Slave Routes, and other possible products.

Closely related to, and, indeed, some major elements of tourism are sports and recreation. Sports are competitive activities, organized under a collection of rules and customs, requiring specific skills or athleticism. Sports may be mental, such as card games and chess, or physical, such as track and field, ball sports, etc. Recreation is an activity purely for leisure, differing from sports in that it is non-competitive. The study of sports and recreation seeks to understand physiological elements such as performance and health; social implications such as psychology, ethics and responsibility; and practical application such as management, business and law. The importance of recreation cannot, therefore, be over-emphasized.

Thus, recreation has become one of man's basic needs. As noted by Ladani¹ "It was always so, but rapid changes in modern society have caused dramatic realizations about the relationship of leisure to creative and adjusted living. The character of recreation is changing rapidly. Modern trends in education, science and technology have given recreation and leisure a new dimension. Gone are the days when people feel that recreation can be done in any form. The scope is increasing daily because of the type of advancement experienced in the field of science and technology."

Sporting activities in Nigeria include soccer, cricket, field hockey, table tennis, tennis, netball, athletics (track and field), boxing, etc. Recreational activities include wrestling, local boxing, swimming, hunting, ayo, water regatta, boat regatta, dancing, acrobatics, fishing etc. Wrestling in particular was used for multipurpose for settling boundary disputes, for selecting champions, for ladies to choose their suitors and for honouring fallen heroes (Ladani, 1999).

Sport development is defined as a process where a desire in a particular sport is created and nurtured. This may include activities like participating in sports and getting information on the same. Unfortunately, the collection and generation of data on recreational, cultural and sporting activities have not received any serious attention in Nigeria. This is partly because of a poorly developed culture of data gathering and production and partly because the sub-sector and accompanying activities have been supervised by different Government agencies and line ministries. Typical agencies involved with data collection and analysis to generate information towards evidence-based developmental policies in the sector include the Federal Ministry of Sports & Social Development, National Theatre, National Archives, Television and Radio Stations, National Commission for Museum and Monuments, National Broadcasting Commission, News Agency of Nigeria, among others. For example, in the "*Guidelines for Implementation of The Sports Development Policy For Nigeria (1989)*", the Ministry is expected to, among others: encourage the development and organisation of and participation in sports in Nigeria; Co-ordinate and integrate efforts to raise the standard of performance in sports in Nigeria; and conduct and encourage research into all matters relating to sports.

The need to develop tourism has not been lost to Nigeria as she developed a National Tourism Master Plan in 2002 with the support of the United Nations World Tourism Organization (UNWTO) and the United Nations Development Program (UNDP). Recognized in the planning process was the need to promote the sustainable development of the tourism industry through capacity building of the Government (at the Federal level) in the areas of human resource development, research development, improved sectoral planning and governance.

Arising from the above, research efforts, under the Fund, are expected to enhance the developmental efforts of the above organisations through fundamental research in to key issues driving the diverse sporting and recreational activities and tourism in the country. These research focus have been identified in the table that follows:

¹B. A. Ladani in "Recreation and Leisure Studies in Nigeria: Curriculum, Professional Challenges and Opportunities", Paper presented at the 33rd National Conference Held at National Institute for Sports National Stadium Complex, August 31-4th September, 1999.

Strategic Objectives

The strategic objectives are:

1. To execute studies and provide reliable data and information that will assist in:
 - a. Tourism, sports and recreation policy formulation and implementation.
 - b. Raising the standards and quality of sports and recreational activities as well as increase the levels of participation in them.
2. To evolve the mechanism for an all-inclusive stakeholder's involvement in the funding and other forms of promotion of tourism, sports and recreation.
3. To develop effective schemes for sustainable funding of the subsector and other mechanisms for the support of SMEs operating in the sector.
4. To engender review of the current institutional framework towards strengthening it for the management and development of the industry for relevance and optimal performance.
5. To evaluate the available education and training, as well as health institutions, based on international standard, towards the organization and management of the subsector in line with international best practices.
6. To identify the diverse products and technology in use in tourism, sports and recreation towards the development of the subsector in Nigeria.
7. To improve and enhance the quality-of-service delivery of the local hospitality industry.

Sub-Themes and Research Focus

Sub-Theme	Research Focus
Tourism, Sports, and Recreation	Institutional framework for sports and recreation development.
	Issues in policy, governance & organization of tourism, sports, and recreation.
	Management information systems in tourism, sports and recreation.
	Technology trends in tourism, sports, and recreation.
	Resources and facilities development in sports and recreation.
	Issues in funding of sports and recreation.
	Impact of sports and recreation.
	Contemporary and traditional sports and recreation.
	Security and health issues in tourism, sports and recreation. Globalizing traditional sports

Thematic Area 10: Gender, Equity and Social Inclusion

SDG no 5 foregrounds Gender. Promoting gender equity continues to be globally accepted as a development strategy for reducing poverty levels among women and men, improving health and living standards and enhancing efficiency of public investments (SDG, 1, 2,3, 4, 8). Importantly, a socially

inclusive society is based on fundamental values of equity, equality, social justice, and human rights and freedoms, as well as on the principles of tolerance and embracing diversity. Nigeria is one of 189 countries that adopted the Beijing Declaration and Platform for Action (BDPfA) in 1995, which provided institutional legitimacy around the demand for accountability on women's human rights and gender equality across countries. Also, at the heart of the Sustainable Development Goals (Agenda 2030) is ensuring that women and girls, everywhere, have equal rights and opportunity, and are able to live free of violence and discrimination. Efforts made by the country in this direction remain largely undocumented, coupled with multifaceted challenges hindering policy response and action in this sector; all of which have significant impact on the livelihoods and wellbeing of women, girls, and families. Thus, there is a general policy demand in the country to mainstream gender, equity and social inclusion issues in development praxis, yet, without requisite baseline data and frameworks, thereby demanding urgent national research response. Evidence-based data are required across sectors to guide policy, planning, and action towards transformative change needed for sustainable growth and well-being.

Strategic Objectives

Strategic objectives of this research segment are to:

- i. Critically assess progress recorded in the country in the implementation of the 12 critical areas of concerns in the Beijing Declaration and Platform for Action
- ii. Provide sex-disaggregated data and gender statistics across sectors for gender responsive policy and planning;
- iii. Track impact of policy and project implementations on women, girls, and the other vulnerable groups (children, the elderly, the poor, and People with disabilities etc.) across sectors;
- iv. Document issues of gender-based violence and response in line with best practices
- v. Document critical resources available to women and other vulnerable categories across sectors
- vi. Investigate 'the male factor' in achieving gender equality and social inclusion practice in the country;
- vii. Provide gender frameworks for measuring the SDG goals and targets

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
The implementation of the 12 critical areas of concerns in the Beijing Declaration and Platform for Action	<ul style="list-style-type: none"> i. Women and poverty ii. Education and Training for Women iii. Women and health iv. Violence Against Women v. Women and Armed Conflict vi. Women and the Economy vii. Women, governance, power and decision making viii. Institutional mechanisms for Advancement of Women ix. Human Rights of Women x. Women and the Media xi. Women and the Economy xii. The Girl Child
Gender and Identities	Culture, Gender Identities, Gender Orientations, and development
Legal and Policy Environment for Gender Equality and Women Empowerment (GEWE)	Gender Discriminatory laws, policies and other legal instruments;
	Women/Vulnerable Groups: access to justice
	Domestication/Implementation of International laws, Declarations and Instruments among others
	Implementation of national laws and policies relating to Women, Children, and other Vulnerable groups
	Gender Responsive Budgeting (GRB) as a governance tool
Identification of gender and equity issues across sectors; and impacts on policy and quality of life	Agriculture; Health; Politics, Governance & Leadership; Education; Science & Technology; Information & Media; Water and Sanitation; Infrastructure; Environment and Climate Change etc.
Labour and Productivity Issues	Women and the vulnerable groups in the labour force
	The Unpaid Care Work
	Work-Family Balance
	Child labour & Human Trafficking

Gender, Conflict and Security	Impacts of conflict on women, children and the vulnerable groups
	Gender implications of humanitarian services and/or disaster management
	Women and peace building
	Sexual/Gender Based Violence
Gender Equality and Empowerment of Women and Girls	Equality in Human capabilities
	Women's Economic Empowerment
	Voice, participation and leadership
	Safety
Gender, Culture & Society	Culture, Gender Identities, Gender Orientations, and development
	Formal and informal institutions
	Women's legal rights
	Culture, social norms and traditional practices
Gender Dimension of Risks and Opportunities	Climate Change
	Education and training
	Disaster Risks
	Urbanisation
	Demographic changes
	Migration
Gender and the SDGs	Gender as a cross-cutting issue for achieving SDG goals and targets

Thematic Area 11: Humanities, The Social Sciences, Technology and Business Interfaces

Science and technology exist in the context of culture and they are themselves cultural processes. The SDGs, globalization and the realities of the new technology environment have imposed the need for the Humanities and social sciences to adapt. The issues of local cultural content in ICTs, trade policies; emerging ethical issues in biotechnology, as well as developments in AI, especially as it relates to computational linguistics, Big Data, machine-human language interface such as Robot Interaction Language (ROILA), have created new frontiers for the humanities and social sciences research. New business value chains are required that build on the unique advantages for creativity and innovation situated in humanistic and social sciences fields. Enhancing Nigeria's competitive advantage therefore needs the exploitation of diversity and associated cultural industry for the production of goods and services.

Strategic Objectives

This research segment is to initiate research studies to:

- i. *Developing local content for ICTs and AI*
- ii. Local content Policy issues in trade policies, technology and national assets
- iii. Developing humanistic entrepreneurship and business value chains
- iv. Improve Nigeria's competitive advantage in the global space for cultural goods and services through the *provision of local content for media, entertainment and ICT, robotics and artificial intelligence (AI)*.
- v. *Improve access to information, opportunities and participation*
- vi. Engage in the development of tools and software

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Local content in trade policies and infrastructure	Trade Policy issues, cultural opportunities in infrastructure and national assets for productivity and competitiveness
Culture, Science, Technology	Innovation, Local cultural content utilization, localization and adaptation of technology, ICT and AI interfaces, Computational linguistics, utilization of GIS, scientific and technology terminologies, tools, apps and software
Business value chains	Existing and prospective opportunities for entrepreneurship, development of products and services.
Culture, Entrepreneurship and Innovation	Culture and entrepreneurship, Innovating culture,

CATEGORY 2: SCIENCE, ENGINEERING, TECHNOLOGY AND INNOVATION (SETI)

Nigeria was ranked 114 out of 129 countries on the **2019 Global Innovation Index**, published by the World Economic Forum, which measured countries' innovation capabilities and how they drove economic growth and prosperity. Nigeria's scores in the research, and knowledge/ technology categories were rather discouraging. Nigeria was placed 119th in human capital and research; 122nd in infrastructure; 123rd in University/Industry Research Collaboration; 126th in creative goods export; 106th in knowledge and technology output; and 101st under creative output.

Nigerian tertiary education institutions have the potential to deploy their education, training, research and innovation to align with the **Sustainable Development Goals (SDGs) (2015 – 2030)** whose targets and indicators are a powerful framework for action to tackle a range of developmental challenges. The African Union agenda, 2063, is both a vision and a plan to build a more prosperous Africa in 50 years, Nigeria inclusive. Nigerian tertiary education institutions must domesticate and own the implementation process of these continental and global goals.

Modern economic growth and development efforts are interlocked with strategic human capacity building/utilization activities. Despite the abundance of natural resources, our national economy is dominated by labour intensive, low value-adding technologies in a mono-product fuelled economic setting.

The twenty first century world is anchored on a highly competitive globalised economy best described as information-rich; knowledge-based; science, engineering, technology, and innovation-driven; and predominantly private sector-led. This calls for integration of science, engineering, technology and innovation-driven, value-adding research and development activities into our nation's development efforts. In some cases, conducting fundamental research in areas of comparative national advantage would become necessary. The research themes align with the SDGs, and researchers are encouraged to follow same.

Thematic Area 12: Agriculture and Food Security

The world needs about 50% more food by 2030. Mechanisation and other investments in agriculture can help the smallholder farmers who are in the majority to earn a better living and provide enough nutritious food for our growing population and build pathways to sustain future growth. Nigeria's ecological conditions, climatic and cultural diversities put the country at an advantage for the production of a wide range of food products. The varying vegetation from the mangrove forest in the Niger Delta through the Guinea, Sudan Savannah to the Sahel Savannah has made it possible for the production of an aggregate of food commodities which are found in tropical climate, the highlands and the delta regions.

Furthermore, cultural practices of the various ethnic groups present alternatives for various uses of agricultural commodities, resulting in different products. Nigeria has a pool of knowledge in indigenous technologies which can be upgraded to produce and process agricultural raw materials and enhance food availability in the country. Besides, many crops which are known to thrive in other climatic regions can also be grown in some parts of the country - wheat for example. This area is thus a thriving ground for research that would provide data on improved technologies for sustained food production and food security.

Strategic Objectives

The strategic objectives are to:

1. sustain research efforts for the enhancement of agricultural development for improved food security, zero hunger, and zero poverty in line with the **Sustainable Development Goals nos. 1 and 2**;
2. identify and provide evidence-based data on food commodities for which the country has comparative advantage;
3. conduct studies into the use of contemporary technologies for the improvement of agricultural output to meet local demand and significant entry into global market; and

4. encourage multidisciplinary research in livestock production, aquaculture fish and shellfish production, crop production, agricultural mechanization, food processing and storage, and agricultural management and policy evaluation.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Production	Development of improved planting materials (seeds, stems, etc) and varieties, Crop Management and Protection
	Development of fertilizers and integrated soil health management suitable for the ecology of Nigeria
	Design and development of machinery for agricultural production
	Development of environmentally-friendly agrochemicals
	Converting waste to wealth; developing products from agricultural waste
	Aquaculture and Fisheries
	Livestock: Breeding, Feeding/Management, Animal Health
	Micro livestock: Breeding, Feeding/Management, Animal Health
	Development of Biotechnology tools for crop and livestock improvement
Processing	Value addition to indigenous food products
	Development of new products from local commodities, as alternatives to imported food products
	Food quality and Food safety
	Design and development of machineries and equipment for processing agricultural commodities
	value chain analysis and improvement of neglected crops
Preservation and storage	Development of storage systems for agricultural commodities
	Upgrading indigenous technologies for food storage
	Building capacity for design/fabrication and management of silos
	Development of commercial refrigeration systems for fruits, vegetables, fresh foods and other food items
Distribution	Developing packaging materials for food distribution
	Improving transportation systems for food distribution

Thematic Area 13: Health and Welfare

Nigeria's general health system performance was ranked 187 among 190 member nations of the World Health Organisation (WHO) in the year 2017. Preventable disease burden and poverty have been identified as major causes of the problem. Maternal mortality ratio in Nigeria is one of the highest in the world. Other health status indicators, such as infant mortality, under-five mortality and adult mortality rates, are higher than average for sub-Saharan Africa.

The **Sustainable Development Goal no. 3** is towards ensuring healthy lives and promoting well-being for all at all ages. Similarly the 2018 - 2022 National Strategic Health Development Plan (NSHDP) was developed to implement appropriate policies and programmes as well as undertake necessary actions that will strengthen the National Health System in order to be able to deliver effective, quality and affordable health. The 2018 NSHDP has as its target:

- Reducing morbidity and mortality rates due to communicable diseases to the barest minimum;
- Reversing the increasing prevalence of non-communicable diseases;
- Meet global targets on the elimination and eradication of diseases; and
- Significantly increasing the life expectancy and quality of life of Nigerians.

The overarching goal of the NSHDP is to significantly improve the health status of Nigerians through the development of a strengthened and sustainable health care delivery system.

Nigerian Universities have tremendous potentials to contribute to ensuring healthy lives and promoting wellbeing for all ages. The commendable achievements of the Africa Centre of Excellence for Genomics of Infectious Diseases (ACEGID) at Redeemers University, sponsored by the World Bank, in identifying useful epitopes for Ebola and diagnostics for Lassa fever within a short time is a compelling example.

Strategic Objectives

The strategic objectives are to:

1. strengthen the national health system such that it would be able to provide accessible, affordable, effective, efficient and high quality health services that will improve healthcare delivery system;
2. utilize research to inform policy, programming, improve health, achieve national and international development goals as they relate to health and contribute to the global knowledge platform;
3. provide a sustainable implementable national health investment plan;
4. develop equity-oriented strategies for health delivery in the country;
5. develop lifestyle - related policies: alcohol misuse, tobacco control and nutrition, physical activities, prevention of road traffic crashes and behavioral change communication with regards to sexual activity especially among the vulnerable groups of the AIDS epidemic in the country;
6. establish a sustainable mechanism for capacity development and enhancement;
7. Develop capacity for comprehensive response to emerging and reemerging diseases including zoonotic diseases

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
National Health Systems Management	Health research policy and mechanism for evidence-based policy making in health
	Human resource development and management to address the dearth and poor capacity of health care workers and identify inefficiencies, wastage and fraud
	Improving the managerial capacity and motivation of health care workers
	Setting health research agenda and priorities
	Ethical standards and practice codes for health research
	National Health Information Management System and Impact of ICT on Health Services
	Evaluation of National health interventions for relevance, efficiencies, effectiveness, adequacy and impact of national health interventions such as NHIS, NACA, NPI and NTBLIC programmes
	Inter-sectoral collaboration
Health Systems and operations	Bio-informatics: develop a comprehensive repository for health research at all levels (including both public and non-public sectors)
	Health research communication strategies – creating a framework for sharing research knowledge and its application
	Quality Assurance, Rational drug use, monitoring and Evaluation in Healthcare For Health Products
	Efficacy of locally available and affordable health technologies that may save lives.
Priority Diseases and Health Problems	Infectious diseases; Neglected tropical diseases (NTD); Non-communicable diseases (Stroke, heart failure, myocardial infarction, cancers, lung diseases, diabetes mellitus); acute rheumatic fever and rheumatic heart disease; sickle cell diseases; chronic kidney disease and other epidemiological/transitional diseases
	Epidemiological research to identify the major health problems, their pattern of distribution and determinants in different parts of the country and in different segments: orphan diseases, orthopaedics, geriatrics, dental health, prosthetics etc.
	Maternal and child health care
	Mental Health, substance abuse and suicide

Product Development Research (Pharmaceutical, biological and diagnostics, therapeutics and educational products)	Developing new and improved tools for the prevention, treatment and control of diseases of local importance
	Drug discovery, development and delivery, value addition to herbal medicinal resources and traditional knowledge
	Research into traditional medicinal practices and products
	Application of biotechnologies in development of molecular diagnostics, recombinant vaccines, vaccine and drug delivery, bio-remediation, sequencing pathogen, genomes, female-controlled led protection against sexually transmitted infections, bio-informatics, nutritionally enriched genetically modified crops, recombinant, therapeutic proteins and combinatorial chemistry
	Application of nanotechnology in health – diagnostic tools, drug and vaccine delivery, surgical devices, prosthetics, methods of diagnosis and prevention; more effective treatment with existing drugs, detection of pathogens such as mycobacterium and HIV
Social and Behavioural Research	Research on socio-cultural and environmental factors affecting health: to identify determinants of gender issues, domestic violence, conflict, migration/displaced people, poverty alleviation, social security system for the under-privileged and people living with disabilities
	Research on mental health
	Monitoring and evaluation of the impact and efficacy of information, education and communication (IEC) materials

Thematic Area 14: Transport

The interrelatedness of transportation development and economic growth has been a constant theme of geographic inquiries, particularly in economic and transportation geography. With increasing urbanization, transportation of goods and people has become so complex that it cannot be left to the whims and caprices of the diverse public and private transport operators in the sector. More so, the fact that several countries have established national research and training institutes for the study of socio-economic and technical issues of transportation further accentuates this point.

The varying problems of transportation across cities and villages in Nigeria call for fundamental research towards providing evidence-based and practical solutions that will lead to the realisation of the **Sustainable Development Goal no. 11**. The country at present is characterized by:

- Intra- and inter-city road networks in varying motorable conditions;
- Air transport system for in-country and out-country travels by millions of Nigerians with local and foreign service participation;

- Rail system that has been largely neglected thereby denying the country the unique opportunity of mass transportation of people and goods currently being handled by road-damaging haulage trucks and trailers; and
- Inland waterways transport that has not been developed to take advantage of its great potential in some areas of the country.

Strategic Objectives

Research on transportation is geared towards:

1. Establishing the operational characteristics of the following modes of transportation in the country: road transportation (cars, trucks, trailers, motor cycles, bicycles, etc.), Rail transportation; air transportation, and inland waterways; and
2. Acquiring scientific understanding of the various transportation systems towards providing support to the established units or ministries of government with responsibility for the development of transportation policies as well as planning and operations for regions, cities and towns.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Transportation Systems	For each of the different modes of transportation (road, rail, air, waterways):
	Basic features, operational characteristics and level of deployment in the country
	Spatial characteristics using GIS
	Economic impact
	System of maintenance
Transportation Safety and Security	Generation of accident database
	Policies and programmes to promote safety and security
Road Transportation Facilities and Plans for Cities and Regions	City traffic flow simulation
	Traffic operations
	Road construction profile across the country
	Cost trends for highway projects in the country
	Materials for road construction
Railway System	<u>Railway Systems National Network Planning and Design, Intra-City Light Rail Design, Component Materials and Design</u>

Transportation Formulation	Policy	Policy issues for the different modes of transportation
		Institutional framework for policy formulation and implementation,

Thematic Area 15: Power and Energy

The scarcity of energy supply is of great concern in Nigeria despite considerable available energy resources both renewable and non-renewable. The role of energy and power in achieving economic growth needs no emphasis as the state at which it is used has become a veritable indicator of the level of development of a nation. Electricity is one of the major constraints to national growth with the Power and energy sector supplying only 20% to about six million customers; consequently, businesses and individuals run generators several hours per day at operating costs which vary from four to six times the tariff per kilowatt-hour on the public grid. The energy and power supply problems impact on urban and rural populations despite the abundance of basic energy resources - renewable and non-renewable. Thus, electricity supply occupies a central position in the nation's quest for national development. The main challenge is the conversion of available energy sources into thermal energy to meet our domestic and industrial requirements for direct heat, mechanical energy for direct use to drive machines, and into electricity, which is the most versatile form of energy. Also crucial is the institutional framework for the management of the energy and power supply chain.

The following applied research related activities towards the development of the power and energy sector are still to be largely addressed:

1. Lack of research in innovative approaches on energy transformation (e.g. Variable Renewable Energy development and integration);
2. Lack of research in smart grids and distributed power generation technology and modeling;
3. Planning and design of interfaces between large (backbone) grids, mini and nanogrids, with a focus on enhancing reliability and resilience of power systems; and
4. Low cost technologies for rural electrification.

Nigerian tertiary education institutions have a great role to play through education, training, research and innovation towards providing stable energy supply to meet growing national demands.

Strategic Objectives

In consequence of the above, the strategic objectives of research on energy and power are to:

1. Determine the national energy demand and supply patterns;
2. Generate data and information on the quality and quantity of the available energy resources;
3. Develop and deploy appropriate technologies for energy conversion to meet the thermal and electric power needs of the nation;
4. Establish the characteristics of the national system for the generation, transmission and distribution of electrical power;
5. Evolve appropriate institutional framework for the management of the energy supply value chain;
6. Develop alternative sources of energy;

7. Develop energy storage systems; and
8. Develop technologies towards achieving the **Sustainable Development Goal no. 7** of affordable and clean energy.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Energy Resources Audit	Evaluation of the available non-renewable energy sources (crude oil, natural gas, tar sand and coal)
	Renewable energy resource potential (Hydropower, solar, biomass, wind)
Energy and Power Generation (Non-renewable Sources)	Establishment of the existing power generation capacity of the various power plants operating in the country including the identification of their operational problems (material, human and organizational)
	Environmental impact assessment of power generation systems
	Development of technologies for efficient conversion into electricity
	Design and production of various energy converters
	Energy mix to meet demand
	Economics of power generation
Energy and Power Generation (Renewable Sources)	1. Hydro:
	Development of mini- and micro-hydropower schemes
	Environmental impact of dam construction
	Design and construction of hydropower stations
	Engineering design and production of hydropower plants, equipment and accessories
	2. Solar Energy:
	Development of solar energy conversion technologies for the production of heat and electricity
	Manufacturing of solar energy production systems
	Market studies of solar energy systems
	Solar data acquisition across the country and development of solar maps
	3. Biomass:

	Development of efficient and less hazardous biomass conversion devices and systems to utilize materials such as agricultural residues, and animal and human wastes as energy sources for use particularly in the rural areas
	4. Wind Energy:
	Wind data acquisition across the country and development of wind maps
	Development of wind energy conversion technologies
	Local production of components and spare parts of wind power systems
	5. Hydrogen:
	Keeping abreast of international trends in hydrogen production and application
	Developing a database on the potential of this emerging energy resource
	Developing local capacity for hydrogen to ensure hydrogen utilization as a preferred energy source
Electricity Transmission	Evaluation of the existing transmission systems in the country, identifying operational problems
	Transmission systems to minimize losses and damages to the environment
	Materials of electricity transmission
Electricity Distribution	Identification of the existing distribution systems in the country
	Spatial distribution of electricity demand and supply
	The economics of power distribution
Management Structure	Organizational structure for the optimal management of the national energy generation, transmission and distribution systems
	Protection and control mechanisms in power generation, transmission and distribution
	Reliability analysis of power generation, transmission and distribution systems

Thematic Area 16: IT, Computing and Telecommunications

The greatest contemporary boost to world economic development is the Information and communications technology (ICT) revolution. ICT is an increasingly evolving and expanding industry that has markedly revolutionized the way we do virtually everything including e-government, e-learning, e-health, e-commerce, e-banking and e-agriculture.

World economic development and international economic competitiveness are becoming increasingly knowledge driven. ICT is unarguably the most contemporary intellectual infrastructure. Software development and its huge out-sourcing industry know no boundaries and this is one area the country can make easy entry. Therefore, national investment in ICT development would readily enhance our national development initiatives and contribute significantly towards achieving the **Sustainable Development Goals nos. 11, 12 and 15**. Nigeria is reputed to be amongst the world's fastest growing ICT, especially GSM, markets. Unfortunately, this ever-expanding local market is currently being serviced only by imports.

Strategic Objectives

The major strategic objectives in investing in ICT research and development are to:

1. develop a critical mass of experts and other skills in the industry to enable the country to key into this ever expanding international market;
2. to contribute to the rapidly evolving and expanding knowledge of ICTs;
3. to promote the development of ICT applications in critical sectors of the economy; and
4. to promote ICT as a principal driver of the Digital Economy and enable the country to key into the ever expanding international market.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Telecommunications	Wireless communications
	Data/ LTE networks
	Fibre optics application
	GSM handset development and production, including medical issues (radiation emissions) and social issues
	Intelligent agents for monitoring telecommunication networks
	Network/Information/Computer Security, Rural/Universal Telecommunication Access (RTA/UTA), EM Waves and Antenna Technology
	Physical transmission media Development, Frequency Spectrum Management techniques, EMC/EMI (Equipment), Power Line Broadband Communications

Computing	Artificial intelligence, Neural Networks, Robotics, Cloud computing in the Nigerian environment, Quantum Computing
Data Sciences	Data warehousing, data mining, big data analytics
Information Technology and Information Systems	Computer networking, new web technologies, Internet of Things (IoT), Cyber and internet crimes including internet security and e-banking fraud prevention, Bio-informatics, Biometric security, social influence of the web
Software Engineering	Model Driven Engineering, Green Software Development, Automated Software Testing, Software as a Service, Service Oriented Architectures, Development of Mobile Systems
Software Applications	Health sector, agricultural sector, education, business, environment, military, other critical areas
	Local Content Development
Computer Hardware and Associated Peripherals	Computer architecture
	Micro-processor design, development and production
	High performance/speed computing
Multimedia and Animation	Multimedia computing (particularly for education and public enlightenment)
	Animation and its applications
	Simulation and its applications
Data Banks	Development of web based national data bank in critical sectors such as security, health, education, agriculture and infrastructure
Disruptive technologies	Block chain technologies, digital and cryptocurrencies, collaborative commerce

Thematic Area 17: Space Science and Technology

Areas of interest in space science are astronomy, astrobiology, astrophysics, solar and space plasma physics, space weather and planetary and lunar science. Research areas include seismic hazard assessment for siting of critical facilities for national planning and development, integrated geohazard monitoring using geodetic and geophysical techniques, delineation of fault lines for geohazard prediction and mitigation, micro zonation for seismic hazard characterization and the immediate neighbourhood, and geoid determination to enhance surveying and planning.

Needs assessment carried out by the National Space Research and Development Agency (NASRDA) of Nigeria confirmed that satellite data utilization is needed for development in many sectors of our national

economy, especially as a way to achieving the **Sustainable Development Goals nos. 11 and 15**. These include:

Space weather, atmospheric research and modelling, air quality, microgravity in biological systems and drugs, Instrumentation development in atmospheric and space research, ionospheric research/modelling and instrumentation, oceanography and space geodesy, development of liquid propulsion system, rocket system guidance navigation and control, propellant mixture and Burner, single and multi stage, cluster hybrid rockets, space balloon development, geospatial technologies for urban security and expert systems, rocket design, assembly, integration and test research, rocket propellant toolkits, and smart agriculture. Others are space application automation, nano satellites, space artificial Intelligence and robotics, astronomy and astrophysics, space plasma, satellite altitude and determination and control, satellite radio frequency design, propulsion, rocketry and interplanetary systems and perturbations, radiation and effects on satellites, space robotics and image processing and dissemination, cluster systems and cloud administrations, space biology and medicine, space meteorology, geodynamics and crustal deformation and subsidence global sea level dynamics.

Effective development and deployment of space science and technology tools in our nation's development efforts would, in turn, promote the economic viability of the space programme through effective patronage both domestically and internationally.

Strategic Objectives

In view of the above, the strategic objectives of research on space science and technology are to:

1. promote the development of critical manpower with requisite knowledge, skills and tools of space science and technology for Nigeria's inclusion as an effective participant in the globalized economy;
2. intensify research activities to ensure the active development of Nigeria's available critical space infrastructure (remote sensing and communication satellites) to promote sustainable socio-economic development at reduced costs;
3. use the available space infrastructure to promote mutually beneficial win-win research partnerships to solve critical national developmental problems at an accelerated rate;
4. develop independent, accessible, relatively inexpensive, flexible and dynamic remote sensing and communication capabilities that would stimulate a broad spectrum of applications in the above-indicated national needs;
5. conduct demand-driven research on space applications to meet the needs of stakeholders in an internationally competitive and sustainable manner; and
6. ensure the systematic popularization of space science and technology applications through government – academia – private sector partnership in problem-solving.

Sub-Themes and Research Focus

Sub-Theme	Research Focus
Space Science	Satellite Earth station Development (LNA, HPA, VSAT), Renewable Energy Technology for space segment, Satellite launch pad design, Satellite Propulsion system, Rocket design, Ground segment development, Space segment development, Satellite capacity increase, Spacecraft Design, Rain and cloud attenuation
Agriculture	Mapping land use planning and management e.g. flood plains suitable for rice cultivation
	Crop inventory and yield forecasting, vegetation inventory/revision, planning and management including sustainable forest logging and grazing and afforestation planning
	Mapping, investigating and monitoring pest infestation including desert locust and Quelea birds risks
	Crop performance monitoring
	Mapping, investigation monitoring of distressed crops areas
Water Resources Development and Management	Surface hydrology and watershed management including analysis of major drainage basins
	Location of dams or planning water impoundment for various uses, including irrigation, domestic, industrial, navigation, fisheries, recreation, hydroelectric power, etc.
	Structural analysis for aquifers, springs and borehole locations
	The preparation of water resources master plans
Solid Mineral Exploration and Exploitation	General geology mapping and map update/revision
	Planning solid mineral exploitation including mine reclamation
	Structural (including linear) analysis and regional geological reconstruction and mineral exploration
	The preparation of geomorphologic maps
Ecosystems Management with	Mapping/differentiation of endemic/economic flora and fauna and wild life habits and ecosystems (e.g. dry forests and wetlands)
	Forest and rangeland monitoring

Associated Goods and Services	Pollution of marine ecosystems due to effluents from domestic and industrial wastes
	Planning, protection and management of lakes, reefs and mangrove ecosystems
	Mapping and monitoring of wild aquatic plants, e.g. water hyacinth
	Local and regional planning for tourism and tourism potentials, as well as investigation of historical/archaeological sites
Demographic and Cadastral Analysis	Mapping/planning population survey and census enumeration and human settlement areas
	Rural and urban growth mapping and monitoring
	Monitoring land use/cover dynamics
Transportation and Utilities	Terrain evaluation for various uses of regional planning.
	Route location and road allocation planning with road maintenance strategies.
	Planning and economic railway network development
	Mapping and planning utilities location; oil pipelines. power transmission lines, cables and telecommunication networks
	Planning waterways and general land and water transportation networks
Environmental Management	Mapping/planning sewage location and domestic and industrial waste disposal sites
	Mapping/monitoring soil and land degradation
	Determination of environmental impact assessment
	Risk zone mapping and environmental inventory and monitoring
Defense and Security	Mapping of state and international boundaries
	Mapping/planning terrain trafficable for movement of ground troops and military wares.
	Provision of maps/geo-information for vehicle tracking
	Mapping/determination of camouflages
	Bathymetric mapping of the coastal areas for surveillance purposes

Health and Public Health Delivery	Epidemiology studies of the relationship between disease vectors and environmental variables (larvae habitats) e.g. flooded pastures and transitional swamps and other breeding sites and plants
	Weather data for delineating harmattan dust areas with associated diseases
	Remote sensing for meningitis early warning, and in prevention and isolation of river blindness environment
Skills and Capacity Building	Facilitate/enhance remote sensing education or capacity building for the use of earth observation data
Disaster Management	Development of measures for Prevention and mitigation

Thematic Area 18: Geosciences

Geoscience, also known as earth science, comprises any of the sciences that deals with the earth and its natural systems. This includes Geology, Geophysics, Geochemistry, Geotechnics, Remote Sensing etc. Nigeria is blessed with abundant solid mineral resources, and generally all branches of geosciences are required for maximum resource utilisation. Outside of oil and gas industry, the sustainable development of the solid minerals sector would also help diversify the national economy and provide alternative sources of revenue. Most of the minerals are currently mined and exported in their raw form, which is rather unfortunate. The association of impurities with many of the mineral deposits calls for beneficiation to ensure removal of impurities. Mineral processing deficit is a common national problem that needs urgent attention. The dearth of modern mineral mining and processing activities calls for active research and development to develop value-adding technologies. The current trends of buildings collapse and road failures calls for research in Geotechnical assessment for sustainable infrastructural development. It is also important to begin to assess the geothermal energy resource potentials using improved technologies given the urgent need for the country to substantially improve its drive towards harnessing other renewable energy sources. Hence, the above thematic area is expected to support Nigeria's quest in addressing the **Sustainable Development Goals nos. 6, 7, 9 and 11.**

Strategic Objectives:

The objectives are to:

1. Seek better understanding of physical processes within the earth as they relate to and influence human activities, including possible hazards;
2. Enhance solid minerals prospecting, mining and processing technologies;
3. Develop methodologies/technologies that would enhance oil recovery from old oil fields/marginal fields;
4. Develop improved technologies to harness geothermal energy resource potentials;

5. Enhance sustainable infrastructural development using appropriate geotechnical solutions; and
6. Establish geospatial characterization protocols for underground resources.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Prospecting, Exploration and Processing	Improving exploration and mining activities through technological inputs, especially for artisanal operators
	Tackling the mineral processing deficit challenge through mineral beneficiation and processing activities
	Addressing environmental challenges in mineral beneficiation and processing, Including health risks
	Producing modern design, and fabrication of mining equipment and processing machinery for small-scale operators
	Improving groundwater prospecting techniques to ensure water security
	Enhancing oil recovery techniques for marginal field operators
	Designing and fabrication of spare parts to enhance effectiveness of the Nigeria content policy
	Designing and manufacturing of modular refineries for use in teaching and research in our higher education institutions
	Development of oil pollution remediation technologies
Geothermal Energy Resources	Developing appropriate technologies to identify geothermal energy resources potential
	Developing appropriate technologies to harness the geothermal energy resources
Hazards	Achieving Sustainable Seismic hazard monitoring in Nigeria
	Developing early warning systems against possible natural hazards
Geotechnics	Developing Geotechnical assessment for safe and sustainable infrastructural development activities

Thematic Area 19: Science, Engineering and Technology

Science, Engineering and Technology form the pillars and fulcrum of development of modern knowledge based societies. It was therefore, hardly surprising that in June 2014, the 23rd Ordinary Session of African Union Heads of State and Government Summit adopted a 10-year Science, Technology and Innovation Strategy for Africa (STISA-2024). The strategy is part of the long-term people centered AU Agenda 2063 which is underpinned by science, technology and innovation as multi-function tools and enablers for achieving continental development goals.

A recourse to Nigeria's profile in the Global Innovation Index 2018 reveals some strengths and weaknesses when benchmarked against 126 other lower/middle-income countries and the Sub-Saharan Africa region in the following areas:

(a) Human Capital and Research	Score	12.9%	Rank	116
(i) Education	Score	29.5%	Rank	109
(ii) Tertiary Education	Score	7.8%	Rank	110
(iii) Research and Development	Score	1.3	Rank	103
(b) Business Sophistication	Score	23.5%	Rank	104
(i) Knowledge Workers	Score	33.1	Rank	72
(ii) Innovation Linkages	Score	16.6%	Rank	118
(iii) Knowledge Absorption	Score	20.9%	Rank	102
(c) Knowledge and Technology	Score	10.3%	Rank	119
(i) Knowledge Creation	Score	3.6%	Rank	111
(ii) Knowledge Impact	Score	13.8%	Rank	113
(iii) Knowledge Diffusion	Score	13.4	Rank	104

The above discouraging statistics amongst Middle-income and Sub-Saharan countries, not to talk of developed countries, make compelling case for a refocusing of teaching and research paradigms in Nigerian Tertiary Education Sector, if the country is to key into and emerge amongst the frontline achievers in STISA-2024. It is particularly imperative that Nigeria must pursue vigorously the **Sustainable Development Goals (SDG) 12 and 17**: Goal 12 demands that we “ensure sustainable consumption and production patterns” while Goal 17 requires that we “strengthen the means of implementation and revitalize the global partnership for sustainable development”. This of course, necessitates a robust and seamless institutional framework for the regulation of educational delivery, professional practice and skills development in the country. This will bring into play stakeholders such as: the Council for the Regulation of Engineering (COREN), Pharmacy Council of Nigeria (PHCN), Institute of Chartered Chemists of Nigeria (ICCON), Computer Professional Registration Council of Nigeria(CPRCN), Teachers Registration Council of Nigeria (TRCN), the National Board for Technical Education (NBTE), The National Commission for Colleges of Education (NCCE) and the National Universities Commission (NUC)) which regulate the education and professional training of the different cadres of manpower; two, the agencies which control the major building and construction projects in the sector through technical evaluation of

designs and granting of approval; and three, other key stakeholders such as the Manufacturers Association of Nigeria (MAN).

In view of the above, the implementation plans previously adopted by the World Summit on Sustainable Development (WSSD) become instructive as strategic Objectives.

Strategic Objectives

In consequence of the above, the strategic objectives are to:

1. Encourage integration of scientists' and engineer' advice into decision-making bodies at all levels;
2. Promote partnerships between scientific, public and private institutions;
3. Engender collaboration between natural and social scientists in project conception, design and execution;
4. Promote upgrading and beneficial use of local and indigenous knowledge and skills for scientific and engineering applications;
5. Strengthen the scientific and engineering bases for sustainable project management;
6. Improve long-term scientific and engineering planning and assessment; and
7. Build up a critical mass of Nigerians with scientific and engineering capacity and capability for sustainable development.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Human Capital Resources and Resourcefulness in Science, Engineering and Technology (SET)	Networking of local and international personnel and institutions
	Gender and Physically Challenged in Science, Technology and Engineering.
	Employment generation, Capacity building in Manufacturing, construction and building, Oil and gas, Information and Communication Technology, Engineering Design and Processes
	Integrated capacity building (human capital, infrastructural and institutional) for industrial management, processes and practices.
	Middle and High Level Manpower
Knowledge Creation and Utilization in STI	Foundries, Machine Tools and parts, 3D Printing, CAD/CAM systems, Drones and UAVs, Robotics Engineering, Mechatronics,
	Advanced manufacturing Systems and Processes, Assessment Models, ground-based observations.
	Basic and industrial chemicals, chemical processes engineering, petrochemicals, Nanotechnology, Electrical and Electronics engineering and processes.

Knowledge Impact and Diffusion	Vehicle design and development, Auto parts development, Autonomous vehicles, Electric vehicles development, Electrical Machineries and tools,
	Integration of Indigenous Science and Engineering Knowledge
	Entrepreneurship and Small and Medium Enterprises
	Teaching, Research and Community Service
	High Tech manufacturing and services

Thematic Area 20: Water and Sanitation

Poor access to improved water and sanitation in Nigeria remains a major contributing factor to high morbidity and mortality rates especially among children according to UNICEF, 2018. The use of contaminated drinking water and poor sanitary conditions results in increased vulnerability to water-borne diseases. Hence, access to adequate water, sanitation and hygiene (WASH) has become increasingly important in Nigeria. In addition, Nigeria is among the countries that still practise open defecation, which ranks very high among the factors that lead to underground water contamination. The situation becomes compounded by the near-absence of pipe borne water, leading to indiscriminate sinking of surface wells and boreholes which become frequently contaminated by industrial effluents. This thematic area addresses **goals no. 3, 6 and 12 of the Sustainable Development Goals (SDGs)** namely Health, Clean Water and Responsible Consumption.

Strategic Objectives

The strategies are to:

- enhance equitable access to water, sanitation and hygiene services.
- develop effective efforts to eradicate the practice of open defecation.
- strengthen tailored community approaches to total sanitation including Community-Led Total Sanitation (CLTS) in rural, peri-urban and riverine settings.
- strengthen national and subnational bodies' capacity to develop and implement equitable and gender-sensitive WASH policies, strategies and guidelines.
- ensure sustainability of water services.
- develop effective and affordable means of achieving clean water
- develop affordable technologies for purifying water including desalination.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Water security	Water Policy and regulation Sustainability of water supply systems Water quality and safety monitoring Surface water management systems Ground water management systems
Water supply	Water harvesting Water storage Water purification, treatment and filtration Water conveyance and distribution systems Water packaging
Waste Water Reuse	Water pollution and remediation Waste water treatment and re-use
Sanitation	Collection, treatment and disposal of solid and liquid waste Recycling of municipal solid and liquid waste Addressing open defecation Community led total sanitation systems
Water Sanitation and Hygiene (WASH)	Water, sanitation and health WASH policies and implementation

Thematic Area 21: Industry, Innovation and Infrastructure

In 2018, Nigeria occupied the 116th position out of 140 countries, according to the Global Competitiveness Report published by the World Economic Forum. The country's total exports and imports amounted to 20.7 percent of its GDP, which is too low in view of the nation's enormous potential. As a result of very high lending interest rates, nonperforming loans remain a problem in the industrial sector, with adverse effect on rapid industrialization, competitiveness, wealth creation and industry-university-government collaboration in research and development. The challenge is therefore to bridge the digital divide, promote sustainable and competitive industries, and invest in scientific research and innovation in order to facilitate sustainable development in line with the **Sustainable Development Goal no. 9 which aims at building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation.**

Unfortunately, the Global Innovation Index 2018 ranking of Nigeria out of 126 countries in some key pillars of the **SDG Goal No. 9**, namely, infrastructure (26.5%, 114), Human Capital and Research (12.9%, 116), Knowledge Output (10.3%, 119) and Innovation (16.6%, 118) suggests that Nigeria and indeed its Tertiary Education Sector have challenging tasks in catching up with other developing countries. Moreover, the International Centre for Investigative Reporting (ICIR), in a piece titled "ANALYSIS: Nigeria's manufacturing output is the same today as it was in 1982" argued that "while it is true Nigeria has the third

highest Manufacturing Value-Added (MVA) in Africa owing to her huge economic size, the trend from 1981 till date shows that very little success has been recorded over the years. This, therefore, casts doubt on the country's ability to achieve Sustainable Development Goal 8 - involving "higher levels of productivity of economies through diversification, technological upgrading and innovation, including through a focus on high value-added and labour-intensive sectors".

Also of crucial importance is the institutional framework for the regulation of professional practice and skills development in the sector. This comprises: one, the agencies (e.g. the Council for the Regulation of Engineering (COREN), the National Board for Technical Education (NBTE), The National Commission for Colleges of Education (NCCE) and the National Universities Commission (NUC)) which regulate the education and professional training of the different cadres of manpower; two, the agencies which control the major building and construction projects in the sector through technical evaluation of designs and granting of approval; and three, other key stakeholders such as the Manufacturers Association of Nigeria (MAN).

Strategic Objectives

The strategic objectives are to:

1. strengthen and enhance the position of Nigerian industry in Africa and globally,
2. entrench best practices in the Nigerian Industrial Sector;
3. entrench regular evaluation of the institutional, legal and policy frameworks for industrial growth and competitiveness;
4. ensure continuous human and institutional capacity development and enhancement;
5. promote gender and people with disability equity in Nigerian industries,
6. foster industry-university-government collaboration for rapid industrialization and wealth creation,
7. promote endogenous technical and managerial capacities for industrial development
8. improve the capacity of the Nigerian industries to contribute towards the realization of national and global development goals,
9. develop a coherent national industrial renewal plan.

Sub-Themes and Research Focus:

Sub-Themes	Research Focus
Processes and practices	Developing metrics, benchmarks and performance indicators to continuously measure an industries competitiveness and service delivery.
	Developing best practices for productivity improvement and continuous innovation.
	Applications of emerging technologies in industry.
	Developing processes, strategies and templates for sustainable industrial development and continuous innovation.

	Methodologies for collaborating with Nigerian tertiary education institutions to utilize research outcomes for development and innovation.
	Industrial supply chain issues.
	Impact of government regulations and taxes on industrial development and competitiveness.
People issues	Integrated capacity building (human capital, infrastructural and institutional) for industry processes and practices.
	Safety, health and insurance issues in the industry.
	Gender issues in the industry.
	Labour relations in the industry.
	Aligning corporate social responsibility goals and initiatives with community needs and national development goals.
Quality issues	Standardization and quality assurance of processes and products.
	Methodologies for continuous engagement with stakeholders for continuous quality enhancement.
Market research methodologies	Mobile and real-time data collection.
	Analysis and management of big data.
	Achieving continuous differentiation (asserting and demonstrating uniqueness, ensuring continuous relevance in changing times).
Industries' Governance and Management Profile	Institutional, Regulatory and Legal frameworks, Policy formulation, conflict and dispute resolution mechanisms
	Interface of Local and International legal frameworks and financial regulations;
	Operational Challenges (investment climate, material inputs, human and organisational)
	National and International Networking of Nigerian Tertiary Education Institutions and Experts,

Integrated Industrial Infrastructure for Manufacturing, Construction and Communication	Foundries, Machine Tools and parts, Artificial Intelligence Science Technologies, Drones and UAVs Science and Technology, Robotics Science and Engineering, Mechatronics Science and Engineering,
	Impact of infrastructure deficit and high capital cost on industrial growth and value chain.
	Advanced manufacturing Systems, Basic and industrial chemicals, chemical processes engineering, petrochemicals.
Automotive Products Development	Vehicle design and development, Auto parts development, Autonomous vehicles, Electric vehicles development

Thematic Area 22: Sustainable Use of Natural Resources and Terrestrial Ecosystems

Nigeria is one of the largest repositories of natural resources in the world. These resources are exploited to support livelihood of Nigerians. However, the way and manner in which these resources are exploited, even though more for good cause, will lead to total depletion if not effectively managed. Similarly, for the present generation to bequeath the future generations this wealth of Natural Resources, we must not only discipline ourselves against the extravagant and ignorant ways of squandering our land, water, plants, soils and animal resources. Therefore, we must devise better ways of exploiting these resources as well as optimizing the management of our terrestrial ecosystem for sustainable livelihood in response to the **Sustainable Development Goals nos. 13 and 15**. The effect of past reckless activities must be reversed to establish a lasting equilibrium for sustainable development.

Strategic Objectives

The strategic objectives are to:

1. generate evidence-based data on the existing pattern of natural resource exploitation
2. identify strategies for reduction of natural resource input utilization for sustainable livelihood;
3. evaluate extant policies on natural resource management for improved effectiveness; and
4. restore and conserve endangered, exhausted or degraded natural resources especially in fragile ecologies.

5. Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Development of Critical Data Base	Development of data base for water resources
	Biodiversity information system
	Development of data base on solid mineral reserves and exploitation patterns
	Database on forestry ecosystem depletion
	Data on soil fauna, land degradation and desertification

	Data base on mountains and mountainous ecologies
	Data base on biomass availability
Optimal utilisation of natural resource	Improving water use efficiency in agriculture, domestic and industrial applications
	Efficient use of biodiversity
	Efficient use of soil resources for improved livelihood
	Efficient and sustainable use of fuel wood and biomass for livelihood
Extant Policies for sustainable natural Resource Management	Evaluation of existing national policies on natural resource management
	Evaluation of existing regional/ international policies on natural resource management
Restoration and Conservation of Natural Resources	Identification and conservation of degraded land resources
	Conservation of endangered species
	Biodiversity conservation

CATEGORY 3: CROSS-CUTTING TOPICS

Thematic Area 23: Entrepreneurship and Wealth Creation

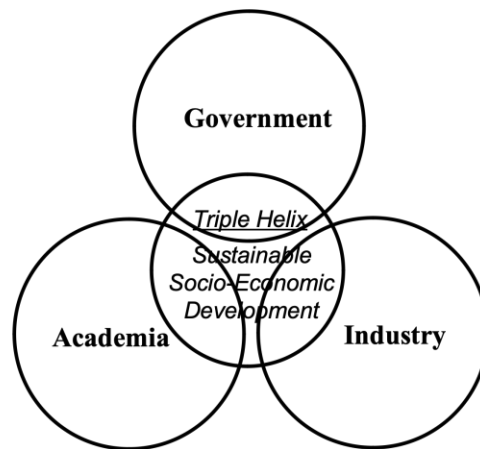
Goal No. 8 of the SDG titled Decent Work and Economic Growth, is aimed at promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. Today, job availability is not keeping pace with the growing labour force. To address the challenges posed by the present situation there is a need for the development and implementation of research-driven policies that encourage entrepreneurship and job creation.

In the 21 Century, the highly competitive global economy is best described as information rich; knowledge-based; science, technology and innovation (S,T&I) driven. Skills acquisition and value-adding research and development (R&D) are critical enablers of entrepreneurship and wealth generating enterprises. Also, the use of ICT tools helps accelerate and promote assimilation of global best practices. Manufacturing catalyses promotes growth of the private sector. Knowledge-driven SMEs generally form the bedrock of all viable, globally competitive modern national economies; hence their critical role in entrepreneurship and wealth creation programmes.

Research and tertiary education systems are primary drivers of such programmes, playing three key roles - they produce cutting edge knowledge; they transfer, exchange and apply that to drive innovation; and they educate and skill knowledge workers. This has been achieved in most rapidly developing economies

through the operation of the government-industry-academia partnership, usually referred to as the Triple Helix as depicted in Fig. 2. Under Triple helix, research institutions are challenged with industrial problems with research-driven solutions being deployed to relevant micro, small and medium enterprises (MSMEs) in a continual process of increasing the industrial competitiveness of these actors.

Figure 1: Triple Helix Partnership for Sustainable Socio-Economic Development



Strategic Objectives

The objectives are to:

1. promote value-adding, demand-driven research and development activities by deploying global best practices that will ensure accelerated growth and development of viable SMEs
2. develop vocational enterprises for the emergence of diverse and globally competitive products and services.

Sub-Themes and Research Focus:

Sub-Theme		Research Focus
Socio-cultural Imperative in Modernization	Change in Economic	Influence of culture and tradition on entrepreneurship and wealth creation
		Identifying knowledge and skills gap in developing a globally competitive economy
		Public policy framework for integrating sciences, technology and innovation into National Development Programme
		Strengthen government –academia-industry collaboration

Triple Helix (Government-Academia-Industry) Linkage	Models for strengthening Triple Helix partnerships for socio-economic development of Nigeria
Technology-Driven Diversification of National Economy	Upgrading/modernization of traditional process technologies (multi-sectoral) with great multiplier effect with emphasis on: “Low hanging fruits”, that is, near market or pilot plant stage’ High profile value-adding activities (process improvement, product development, quality improvement, cost reduction, productivity enhancement, packaging effectiveness, enhanced delivery system, etc.) to ensure the attainment of export grade goods and services by SMEs
	Technology adaptation for SMEs
Advantages of manufacturing Technology (Capital Goods Research, Production and Reverse Engineering)	Engineering design and fabrication of tools, equipment, and machinery for multi-sectoral applications, deploying virtual manufacturing tools
	Design, engineering simulation and computer modelling of engineering processes, plant, machinery and spare parts for rapid prototyping for use by SMEs
	Engineering materials research (iron, steel, non-ferrous metals and alloys, plastics, glass, ceramics, polymer electronics and nanotechnology)
	Mechanical engineering tools development (power tools, hand tools, cutting tools and machine tools)
Software Development	Local software development for use in all thematic areas capitalizing on locally and globally available opportunities
Biotechnology and Bio-resources Development	Bioreactor design and fabrication using virtual manufacturing tools
	Industrial enzymes production
	Bio-prospecting, molecular biology and pharmaceuticals
	Bioremediation
	Effective and safe herbal combinations therapy for malaria, hypertension, diabetes, etc
	National inventory of medicinal aromatic and pesticidal plants of Nigeria
	Development of intellectual property rights for traditional medicine
	Models of financing SMEs

Financing of Innovation and Nurturing Entrepreneurship	Venture capital development
	Technology incubation
	Models of technology/industrial parks
Job Creation Capacity of different Sectors of the economy	Studies on graduate employability
	Job creating capacity of different sectors, SME's
	Policy plan of Government on Job creations, (Macroeconomics, Environment etc.)
	Relationship between decent work environment and productivity
	Functional characterization of the economy by formal and informal sectors

Thematic Area 24: Environment, Housing and Urban and Regional Development

SDG11 and the New Urban Agenda (NUA) have assigned special role to cities being engines of economic growth and the platform for addressing poverty. It requires creating career and business opportunities, safe and affordable housing and building resilient societies. It includes also upgrading slum settlements, investing in public transport, creating green spaces, and getting a broader range of people involved in urban planning decisions.

Nigeria is faced with enormous environmental and urban developmental challenges posing threats to the livelihood of tens of millions of its teeming population. Among these challenges are:

- **Coastal erosion** which has been buffeting much of the country's 853km coastline and **sheet and gully** erosions which have done untold damage in the South-East, with severe threat to agriculture and dwellings.
- **Deforestation** - Nigeria is fast losing its forest cover at an annual national *deforestation* rate of 0.76%. As at 1985, deforestation had already claimed over 1,544 square miles of the nation's forests and the problem continues unabated.
- **Desertification** – This is posing a great threat to the frontline states of northern Nigeria. Over ten states and 34% of the nation's prime arable land are being affected by this encroachment.
- **Oil spillage and gas flaring** - This is one of the consequences of oil exploitation in the South-South zone of Nigeria resulting in reduction of farmlands and pollution of water resources.

As far as the urban environment is concerned, Nigeria has one of the fastest rates of urbanisation in the world. With an urbanisation rate of 5.3%, the growth of urban populations in Nigeria is twice the international average. It is estimated that before the year 2050, 60% of Nigerians will be living in urban centres. However, the urban environment in Nigeria is not without its problems. Some of these relate to:

- Transportation- A major challenge of cities, urban transportation and mobility takes away productive time and increases transaction costs for businesses and households.
- Water and sanitation- Solid and liquid waste management is inefficient and disorganized. Most households lack adequate access to clean and portable water, and when they do is often costly and unaffordable.
- Inadequate housing- Statistics on housing deficit does not exist in any organized form and this has affected policy formulation. Access to finance and ineffective mortgage system are additional problems affecting performance of the sector.
- Waste disposal- This relates to lack of capacity of municipal agencies to collect, process and dispose waste.
- Threat of environmental pollution- From automobile and industrial activities.
- Climate change with impacts on air quality, health of people, ecosystems, plants, animals and their habitats, etc.

Nigeria must begin to address these problems in a serious, concerted and strategic manner if it is to achieve its developmental goals and objectives. One of the ways to achieve this is through Research and development in the area of Smart Cities.

A smart city is a new platform that integrates information and communication technology in a secure way to manage urban development. Research is needed in the aforementioned areas to make city life more efficient, cleaner, safer, and less costly.

Strategic Objectives

The objectives are to conduct research on the physical and built environment that will:

1. Provide reliable data and generate information for effective planning and policy formulation at all levels of government
2. Provide information for effective and proactive management of the environment
3. Provide scientific understanding of Nigeria's ecology and Environment and develop appropriate environmental technologies which could tackle environmental problems and mitigate the effect of ecological disaster
4. Explore innovative strategies and mechanisms for managing the nation's urban growth & development.
5. Provide models, measurement methods and other scientific tools needed to develop effective mitigation and adaptation strategies against climate change.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Desertification, Coastal and Gully Erosion	Monitoring information systems for desertification, coastal and gully erosions
	Appropriate technologies for desertification and erosion mitigation and control
	Drought and environmental disaster early warning systems
	Sustainable development in ecologically distressed areas
Pollution, Environmental Health and Ecosystem Management	Air pollution and environmental health, especially in urban centres
	Oil pollution bioremediation and ecosystem restoration
	Clean hydrocarbon exploitation. Novel materials for carbon capture applications
	Sustainable biodiversity projects
	Reforestation/Innovative forest management practices
	Novel sensing and pollution detection technologies
Housing	Appropriate building systems and technologies
	Social housing: Housing economics and finance
	Sustainable Building/Construction materials
Urban Development	Environmental sanitation; waste recycling and waste disposal technologies
	Municipal services and sustainable urban development
	Participatory Planning,
	Inclusive Cities (Gender, Persons with Disability, Aged People)
	Urban Management and Governance
	Land Tenure and Land Title regularization
	Urban Population Growth
	Urban Planning Education and Training
	Urban Transportation

	Urban Land Use Change
	Urban Agriculture
	Industrial Cluster Mapping
	Urban Economic growth and Finance
	Rural Urban Linkages and Regional Development
	Urban Infrastructure (Roads, Water, Electricity)
	Urban Planning and Urban Design
	Urban Regeneration/Renewal
Smart Cities	A Cyber-Physical Infrastructure for Smart Cities
	Robust and Responsive Sensor Network
	Personalized Health Care
	Advanced sustainable buildings and the Smart Grid
	Preventing Cyber Attack
	Green Computing
	Lost and Unaccounted Natural Gas
Climate Change	Monitoring and mitigation of anthropogenic greenhouse gases (GHG); development of green remediation technologies using indigenous materials
	Impact, vulnerabilities and adaptation to climate change
	Climate modelling and scenarios
	Forest and land use monitoring systems and enhancement of forest carbon stock
	Impact of climate change on food security
	Analysis of adaptation and mitigation strategies to climate change
	Mitigating climate change
	Climate change and air quality
	Ecosystems and climate change
	Energy and climate change

Thematic Area 25: Resource Governance

The major resources of concern are oil, gas and mineral resources on the one hand and land on the other hand, as presented below.

Oil, Gas and Mineral Resources

Nigeria is well endowed with the existence of several natural resources in the forms of oil, gas, solid minerals and land. There is no gainsaying the fact that oil and gas account for more than 70 per cent of the national revenue. At an average of 2.2 million barrels of oil per day Nigeria has a reserve to production ratio of 42 years for oil and 155 years for gas. The long-term vulnerability of the country is underscored by the non-renewable nature of these resources coupled with the on-going efforts by oil-importing economies, such as the United States of America, seriously engaged with research and development of renewable/alternative sources of energy geared towards reducing the current dependence on imported crude oil. A recent publication in Nigeria attested to the gradual reduction in the level of crude oil importation from Nigeria by USA, occasioned by the discovery and utilization of shale oil and gas. The question is – Are we governing the oil and gas sector properly to take advantage of the present and future revenue inflows to develop other sectors to sustain revenue generation within the dynamics of a competitive global economy? For example, the lingering debate on the Petroleum Industry Bill (PIB), which has taken close to 14 years, attests to the policy instability in the system to take care of the conflicting interests of the key stakeholders – the government and the International oil companies operating in Nigeria.

From the evaluation of the Resource Governance Index (RGI) of about 58 oil and gas resource-based countries by the National Resource Governance Institute (www.resourcegovernance.org), a research-based organization concerned with the promotion of the effective, transparent and accountable management of oil, gas and mineral resources for the public good, it was shown that Nigeria had a relatively weak RGI, which must be addressed. It has been shown that through capacity building, technical assistance, research, funding and advocacy, countries like Nigeria can still realize the development benefits of her natural resource wealth.

Furthermore, as revenue from oil and gas dwindles, the country is expected to pay due attention to the relatively neglected mining sector, another veritable source of income generation. There are several solid minerals spread over the country including gold, gypsum, uranium, coal, bitumen and tin. It is envisaged that through proper governance of the sector, the country can significantly increase income. The sector can also generate employment as borne out by countries like Australia whose mining sector employs 187,400 people directly, and a further 599,680 in support industries. In 2010, Canada employed 308,000 workers in mineral extraction, smelting, fabrication and manufacturing. This was in addition to many companies involved with the supply of engineering, geotechnical, environmental, financial and other services to mining operations the same year.

Strategic Objective

The overall strategic objective is to conduct research towards the development of evidence-based policies and programmes that will enable the country to sustainably realize the full benefits of her natural resources in terms of wealth and job creation as well as the development of non-natural-resource-based sectors of the economy.

Land Reform

The need for land reform has been raised at various fora, but not much has been done about it. The lack of action may not be unconnected with the lack of relevant research data on land reform. There is therefore the need to have extensive research in this area to address the various issues on the need for such reforms. In the area of land tenure system, for example, there is need for research on user rights and land consolidation.

Strategic Objective

The strategic objective of research into land reforms should be to provide appropriate data and information that allow for informed and effective land reform that answers the questions being raised.

Sub-Themes and Research Focus:

Sub-Theme	Research Focus
Oil, Gas and Mining Sector	Institutional and Legal setting for operation in the sector
	Manpower development policy and practice to support the sector and achieve high local content
	External and Internal factors impacting the diverse operations in the sector
	Linkage to the national economy
Land Tenure System	User rights
	Land consolidation
Land Use	Land use in urban areas
	Influence of culture and tradition on land use
Technology Use	Use of modern technology (such as GIS) in land reform and land use
Environmental Governance	Assessment of environmental policy and governance
	Policy research on housing and urban development

	International best practices and compliance with UN, regional and international conventions and protocols
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Blue Economy

The SDG No 14 (*Conserve and sustainably use the oceans, seas and marine resources for sustainable development*) has become very important because of the immense economic and developmental value that the ocean and other water bodies portends for the nation. There is the need to emphasize research in this area to achieve the goal of SDG 14 for our country.

Blue Economy is the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean ecosystem (World Bank). According to the European Commission, it covers all economic activities related to oceans, seas and coasts. The United Nations regarded Blue Economy as a range of economic sectors and policies that together determines whether the use of ocean resources is sustainable.

The World Wildlife Fund refers to the Blue Economy as any activity in the maritime sector that is either sustainable or not. Despite the level of adoption of this concept as goal of policy making and investment, there appears to be a lack of accepted definition. This situation makes the use of the oceans, seas and their coastal areas a subject of abuse.

The value of the ocean is vast. It serves as a connection between nations. Its huge stock of valuable resources and biodiversity are of immense economic benefits.

By efficient management, and sustainable exploitation of resources in the oceans, seas, the Blue Economy could contribute up to \$1.5 trillion dollars to the global economy (OECD). The ocean may be considered the world's seventh largest economy.

In Nigeria, the ocean consists of the:

- Brackish or marine coastal waters extending 12 nautical miles to continental shelf
- Exclusive Economic Zone of 200 nautical miles and high seas beyond 200 nautical miles.

Why Blue Economy?

The oceans provides and affects the following;

- Climate change
- Harbour millions of diverse organisms of economic benefits
- Help to reduce carbon dioxide in the atmosphere and affect climate change
- Sources of food (animal proteins) for humans and provide raw materials for the food processing industry and animal husbandry.

- Sources of income and livelihood to many coastal communities because Nigeria has a coastline of 850 kilometers
- Ecotourism potentials and biological studies
- Transportation of cargoes and humans.

Threats to the Ocean and the Blue Economy

- Pollution and contamination
- Unsustainable exploitation of ocean resources
- Waste dumping and unsustainable waste management
- Insecurity

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➤ **Thematic Area 26: Science, Technology and Innovation System Management**

The need to manage science and technology to deliver innovation towards building a knowledge-driven economy cannot be overemphasized. Meeting sustainable development goals, particularly SDG Goal No. 9 (*Building Resilient Infrastructure, Promote Inclusive Industrialisation and Foster Innovation*) will require action on a number of dimensions, including harnessing and maximizing the potential of technological innovation through investing in scientific research and innovation. Too often, technologies are either not developed at all for lack of a sufficiently profitable market, or if developed, are not accessible or well-adapted to end-user needs. There is therefore a need to seek to advance knowledge and understanding of how to equitably improve the functioning of our national innovation system (NIS) for sustainable development technologies. This will necessarily involve studies of how well the NIS functions to meet sustainable development needs in key areas such as energy, food security, health care delivery, water supply, manufactured goods, etc.

The need for the above has not been lost to the federal government of Nigeria which established the National Centre for Technology Management (NACETEM) as an agency under the Federal Ministry of Science and Technology (FMST). The Agency was set up to, among others: serve as a training centre for the development of high level manpower in the Science, Technology and Innovation (STI) management to all tiers of government and the private sector; to conduct policy research, evaluation and review with a view to providing sound policy advice for dynamic technology-driven, knowledge-based development; and assist the various governments (Federal, State and Local) in the country in STI policy formulation and strategies for utilising such for development.

Strategic Objectives

➤ The kernel of the research on science and technology management is the examination of specific cases of “system interventions” (e.g., policy interventions, institutional innovations, new approaches to shaping the innovation process) intended to strengthen the national innovation system, with the broader aim of developing policy recommendations that draw from, and are generalizable across, multiple sectors. The findings will contribute to realizing the potentials of science and technology to meet the most pressing challenges of sustainable national development.

Sub-Themes and Research Focus

Sub-Theme	Research Focus
National Science, Technology and Innovation Policy	Evaluation of the National Science, Technology and Innovation policy in relation to meeting identified developmental goals
	Institutional framework for the management of NSTI policy implementation
Development of Science Technology and Innovation (STI) Indicators	Development of an acceptable set of STI indicators for monitoring, benchmarking, evaluating and forecasting STI performance in Nigeria for the overall planning purposes
National Technological and Innovation Capability	Technological skills gaps analysis in the different sectors of the economy
	Institutional framework for technological skills acquisition
	Assessment of innovation capacity and competitiveness indices in the key sectors of the economy

Thematic Area 27: Blue Economy

Blue Economy

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Threats to the Ocean and the Blue Economy

- Pollution and contamination
- Unsustainable exploitation of ocean resources
- Waste dumping and unsustainable waste management
- Insecurity

Sub-Themes and Research Focus

Sub-Theme	Research Focus
Coastal ecotourism	Ecotourism potential of the ocean and other water bodies
Fish and shellfish resources	Inventory of marine biodiversity
	Fisheries and shellfish resources inventorization
	Monitoring of breeding grounds of biodiversity
	Maximum sustainable yield of important fish resources in the inshore and offshore water bodies for their potential for economic activities and industrial support.
	Identification and management of invasive species in Nigeria's territorial waters

Marine pollution	Assessment of pollutants and contaminants and their effects of marine resources and their utilization.
Marine Transportation	Potentials of inshore water bodies for mass transit
	Cabotage law and its effect on the ownership of vessels and ship.
	Insecurity and violence.
Climate Change	Coastal resilience
	Ocean effects on coastal and riverine communities and their sustainable livelihood

Thematic Area 28: Clean and Affordable Energy

Energy generation and use are strongly correlated to all aspects of sustainable development. Interestingly, SDG No. 7 identifies affordable and clean energy as a key enabler in the global initiatives to reduce poverty and improve human and societal well-being.

It is predicted that world electricity generation will increase from 4,719 Gigawatts in the year 2008, to 8,875 Gigawatts by 2035, with more than 80% of the projected increase earmarked to satisfy rising energy demands from developing countries like Nigeria and other nations in Sub Saharan Africa. Current environmental awareness coupled with the global drive towards low carbon emission sources means that the bulk of this future energy must be derived from clean and renewable sources. There is indeed no doubt that scientific innovation will play a fundamental and critical role in this challenging and complicated transition to the clean energies of the future. Unfortunately, Nigeria and other Sub Saharan African countries seem to lack sufficient skilled human resources as well as the technological, educational, physical and economic infrastructures to effectively adapt knowledge and innovation for efficient exploitation of the abundant clean energy resources in the region. Nigeria for instance has the potential to truly become largest economy in Africa, but irregularities in the power sector have continued to constrain sustained economic development. Presently in Nigeria, electricity access to the population is less than 45%, with barely 4,000 MW of the installed capacity of 12,522 MW in operation. Interestingly, Nigeria has an assumed potential for concentrated solar power and photovoltaic generation in the region of 427,000 MW, which has remained largely unexploited.

Indeed, there is really no shortage of energy in the sub region, which has an abundance of renewable energy resources (solar, wind, biomass, hydrothermal). What is lacking is the requisite skilled human resources as well as the technological, educational, physical and economic infrastructures for efficient and inexpensive exploitation of the available resources, to effectively navigate this challenging and complicated transition from the conventional to clean energies. There is therefore a strong local need for access to tailored solutions in exploiting the abundant renewable energy resources. Since solutions currently developed for other markets cannot be directly used and integrated, due to a number of reasons, including difficulties in technology and knowledge transfer, failure to adapt to local climate and local supply of materials.

Strategic Objectives

The objectives include:

1. To promote initiatives and projects that fill the growing education, skills and information gap in the field of renewable and other clean energy sources in the country and in this way address the development challenge of poor availability and access to energy.
2. To develop novel technologies and new materials for efficient exploitation of the Nigeria's abundant energy resources.
3. To extend the research objectives in Thematic Area No. 4 (Power and Energy) under SETI, through greater emphasis on the development of the rural and domestic energy systems

Sub-Themes and Research Focus

Sub-Theme	Research Focus
Low cost technologies for rural electrification	New technologies for the supply of off-grid power in remote regions and in stand-alone devices that supply “residual” electricity with low maintenance and costs, such as for smallholder farm settlements.
	Converting waste to energy
	Cutting edge technologies in electricity generation, transmission and distribution
	Novel indigenous energy materials.
	Local materials for production of energy devices like solar panels
	New conversion technologies to enable more innovative exploitation of the abundant renewable energy resources in the region.
	Materials substitution to enhance performance and reliability in renewable energy systems (hardware, modules, components).
	Development of new carbon-based materials for storage systems from abundant local carbonaceous materials and agricultural wastes, adapted to local resource, market and climate requirements.

	Investigation of degradation mechanisms of renewable energy devices and infrastructure in indigenous service environments, in order to develop more degradation resistant and reliable energy systems
Energy for domestic use	Energy efficient cooking fuels Novel low emission cooking stoves
Energy Systems analysis and modelling	Relationship between generation and distribution
	Converting waste to energy, Cutting edge technologies on electricity
	Institutional and Legal settings for efficient operation of the Nigerian energy sector
	Application of data analytics and artificial intelligence for improving renewable energy systems
	Studies of government policies on renewable energy; including challenges hindering full-scale implementation
	Identifying possible routes to achievement of set targets on renewable energy.
	Analysis and modelling the transition to renewable energies in Nigeria