Sustainability Times Magazine

Redefining Sustainability 3rd Edition

JULY – SEPTEMBER, 2026

ISSN: 3156-383X



The Green Runway:

Contextualizing Festus Keyamo's Recognition as

Sustainability Personality

THE CORE OF SUSTAINABLE LIVING:

Saying No to Single-Use Plastics

Nature:

Moving from Invisible Capital to Visible Capital

Understanding Habitat Banking:

A New Frontier in Conservation

The Sixth Mass Extinction is Here:

A CALL TO ACTION

14th Annual BusinessDay CEO Forum

The 18th BRICS Summit

THE 7TH AFRICA EMERGING MARKETS FORUM (AEMF)

Tel: +234 80 36831995; +234 80 33 42 46 14 https://thesustainabilitytimes.net E-mail akpofure@thesustainabilitytimes.net

SUSTAINABLE FUTURE ACADEMY LIMITED

Learn – Build – Innovate

At Sustainable Future Academy Limited

* We empower individuals and organizations towards a sustainable future through education and engagement.
* We equip individuals and organizations to contribute to a healthy planet.
* We are committed to integrating theory and practice to address environmental issues.
* We value sustainable research and innovation.
* We prioritize integrity, customer-centricity, professionalism, and team orientation.
* We catalyst for a sustainable future and a hub for green economy knowledge and skill development.

OUR SERVICES

Education and Training Programs: We have developed a wide range of courses and certification programs in the areas of; Sustainability, Environment, and Process Safety.

Consulting and Advisory Services: We provide expert advice to businesses and organizations seeking to integrate sustainability into their operations and strategies.

We conduct Environmental Studies (Environmental Impact Assessment, Environmental Entrepreneurship, Energy Audit, Sustainability Audit, Environmental Audit, Remedial Action for Impacted Site; Developing and implementing net-zero and decarbonization strategies; Biodiversity offsetting, Environmental Baseline Studies, Environmental Site Assessment, Climate Change Dynamics, Corrosion Control, Process Risk Assessment, Ergonomics Studies; Waste management optimization and recycling program implementation.

Research and Innovation Hub: We conduct research in developing innovative sustainable materials or technologies for Biofuel, Bioeconomy, Offshore Wing Energy Utilization, Eco-design Practices.

Conduct policy application research and publishing reports on sustainability trends.

Partnerships and Events: We organize conferences, workshops, Webinars and events on key sustainability issues.

We provide guidance on navigating complex regulatory environments and building trust with local communities and stakeholders.









Contact Us

Warri Main Office:
6 Terise Street, Off High Court Road,
Effurun GRA, Effurun Delta State.

Port Harcourt Office:
14 Calvary Street,Off Ogbatai Road
Woji Community, Port Harcourt Rivers State

info@sustainablefutureacademylimited.com

+234 80368 31 995; +23480 232 89899;
+234 803342 4614; +234 803 771 7026



Editor's Desk

Management Team

Publisher/Editor- In- Chief
Engr. (Professor) Akpofure Rim-Rukeh
FNES, COREN, FECRMI, FFCSN, FNiSafetyE, FNiCA

Managing Editor
Engr (Mrs) Mercy Goma Rim-Rukeh

Editorial Advisers
Dr. Ogbemi, Ogbiten Brickins
Dr. Imide Israel
Contributing Experts
Professor Doris Fovwe Ogeleka
Professor Iwekumo Ebibofe Agbozu
Professor Elias Emeka Elemike

Legal Consultant
Bar Oghenenyerovwo Ohre

Designers/Production
Henry Emeka Effi
David Ogheneovo Wetan
Anyaegbuna Chinedu Chaz

The Sustainability Times Magazine
Is Published by
Sustainable Future Academy Limited
6 Terise Street, Off Effurun High Court Road
Effurun GRA Effurun Delta State
Tel: +234 80 36831995; +234 80 33 42 46 14
https://thesustainabilitytimes.net
E-mail akpofure@thesustainabilitytimes.net

ENVIRONMENTAL SUSTAINABILITY:

The Urgency of Embracing Traditional Ecological Knowledge

The contemporary world is locked in a polycrisis—a web of interconnected ecological, social, and economic disruptions. Anthropogenic climate change accelerates at rates that outpace predictive models. Wildfires consume temperate and tropical forests alike. Topsoil depletion threatens global food security, and the sixth mass extinction event erodes the biological foundation of life on Earth. Modern environmental science faces unprecedented challenges in mitigating climate change, biodiversity loss, and ecosystem degradation. For decades, the global response to these crises has been anchored in Western scientific materialism without obvious improvement in the climate change debates.

Technocratic interventions often treat symptoms rather than systemic causes. Carbon capture technologies, geoengineering proposals, and market-based cap-and-trade systems attempt to fix ecological failures using the same economic and mechanical logics that created them. These frameworks lack the longitudinal perspective required to understand complex, localized ecosystem dynamics over centuries.

The limits of Western scientific resource management stem from its systemic biases. Bureaucratic resource management is often top-down and centralized. It assumes that ecosystems are linear, predictable systems that can be maximized for yield whether that yield is timber, fish, or agricultural commodities. This command-and-control approach routinely triggers the "pathology of natural resource management." By attempting to control natural variation (e.g., suppressing all forest fires or damming fluctuating rivers), management agencies reduce the systemic resilience of the ecosystem. When a disturbance inevitably breaches



these artificial controls, the resulting ecological collapse is far more severe. Furthermore, modern sustainability initiatives suffer from an acute shifting baseline syndrome. Because scientific data collection for most ecosystems began only in the 19th or 20th centuries, scientists accept a degraded environmental state as the natural baseline. This historical blindness leads to conservation targets that are chronically low.

The paradigm shift to turn to nature. Man in traditional Africa society is always in the quest to establish links and relationships with cosmic, spiritual and mystical powers and forces of nature. Within this idea, certain objects and plants as classified as "sacred". These objects and places are seen from the perspective of the divine and as such, they are not to be toyed with; they are given special reverence especially as objects of worship. Africans believe that spirits inhabit the sacred objects and places. Certain trees, animals, and places are regarded as totems. They are seen as sacred objects that symbolize something real for the people that entertain such belief. Conservation of nature and natural resources has been an important and integral part of diverse cultural practices in different ways, especially in rural and local communities in many parts of the world. This inextricable link between culture and biodiversity generally results in the establishment of sacred sites. These sites commonly called sacred groves, are protected by traditional societies due to cultural heritage and are pristine forest pockets, dedicated to local deities. Religious beliefs and myths are largely responsible for their conservation. Sacred groves are preserved and managed traditionally by local communities and are repositories of the biodiversity of surrounding areas. A large diversity of taxa has been recorded from these sacred groves across the world including birds, amphibians, small mammals, butterflies and even fungi. This model of biodiversity conservation, based on cultural and religious faiths led the concept of Traditional Ecological Knowledge (TEK).

Concurrently, another body of empirical observation has survived for millennia. Traditional Ecological Knowledge (TEK) represents a cumulative body of knowledge, practice, and belief regarding the relationship of living beings with one another and with their environment. TEK is evolved through adaptive processes and handed down through generations by cultural transmission. It is not a static relic of the past; it is a living, evolving science of survival.
Traditional Ecological knowledge (TEK) also known as traditional religious beliefs (TRB) refers to the established and long-standing beliefs, practices, and doctrines of a particular religion or faith system. These beliefs are deeply rooted in society and often play a significant role in shaping cultural norms and values. From time immemorial, African people are known to always interact with their environment in the areas of medicinal and herbal needs, food supply, conflict resolution and spiritual growth. Traditional belief knowledge is indeed the cornerstone for the building of our own identity and ensuring coherence of social structures

within communities.

The role of traditional beliefs in the conservation of natural resources especially plants with medicinal values, dates back to creation as explemified in the following:

Conservation of Natural Resources: At a global level, the rate of biodiversity loss has failed to decline over recent decades, despite commitment from world leaders to significantly reduce this rate of loss . It is therefore critical to utilise all available opportunities to conserve biodiversity, which is increasingly recognised as vital for human well-being. In traditional societies in particular, informal institutions such as social norms frequently guide human conduct towards the environment. Traditional belief knowledge is an important mechanism for biodiversity conservation when state capacity for enforcing regulations is limited. As they are self-enforced they provide for low monitoring and low enforcement costs, and therefore may offer an effective mechanism for biodiversity conservation.

Environmental Protection: Religious and spiritual beliefs often contribute to the protection of the natural environment. This may be achieved through promoting positive religious or spiritual associations with nature protection, which motivate environmental consciousness. For example, tree-ordination ceremonies in Thailand have acted as a socio-political tool to encourage authorities to mitigate environmental degradation. Other norms may achieve environmental protection through prohibiting certain behaviour - such norms may be classed as a social taboo. For example, in the Boabeng-Fiema Monkey Sanctuary in Ghana, a social taboo prohibits the hunting of the ursine black and white colobus, Colobus vellerosus, and the Campbell's monkey, Cercopithecus campbelli lowei. This social taboo is underlain by religious beliefs as these primate species are considered by the local traditional communities to be children of the gods.

Ceremonial practices: In most communities, annual festivals are organized to celebrate these gods and goddesses. For example, at Useifrun community in Ughelli South LGA of Delta State, the python god is released from its in the course of the annual where the "wives" do display dance with object.

Prohibitive practices: The spiritual connections associated with the sacred sites, and the belief that they represent the homes of the gods, compel people to revere and protect the natural environment, particularly at these sites. The indigenous people in Africa believe that the natural environment is in the care of these spirits, therefore their permission is sought before the trees, plants, river bodies and animals are touched. Consequently, these sacred natural sites are one of the most important practices by the indigenous people to ensure the protection of the environment, by preventing land use conversion to agriculture, and through prohibition of harvesting of natural resources. This practice can be described as a habitat taboo and can result in sanctuaries for wildlife, thus helping to conserve biodiversity as well as the other ecosystem services provided by the habitat. Indigenous communities also hold water bodies as sacred and as such strict taboos are often instituted to protect water resources from pollution. For instance, it is a taboo to defecate near water bodies.

Provision of Aesthetic Benefits: While members of traditional communities engage in these practices for religious purposes they also appeared to strongly value other cultural services that nature provides, such as the aesthetic benefits. The degree to which some parts of the surrounding landscape have been unaltered by development is an important facet of its value. Forest groves are very beautiful. These aesthetic, recreational and health benefits derived from the natural environment are not directly related to religion, however spirituality may be enhanced through such benefits. The beautiful landscapes provide the opportunity for one to think deeply about life. Sacred natural sites are also thought to protect the spiritual connections between people and their environment.

Traditional Healers and Health Care Delivery: Indigenous healers or traditional doctors play a significant and recognized role in health care provision in Africa. They engage in a broad array of practices; some identify themselves primarily as herbalists, others as spiritualists or diviners, and many as a combination of both. However, as the professionalization of traditional doctors has increased dramatically over the past two decades, some healers also refer to themselves as Traditional Healer Practitioners (THPs) in relationship to their particular traditional healers' organizations or associations.

Serves a source of Cultural identity: Traditional belief Knowledge are an important part of our lives, allowing us to connect with our history, values, and beliefs. They provide us with a sense of identity, community, and belonging. Traditional belief also provides us with a sense of belonging. They help create a shared identity within a group or community. Participating in traditional activities helps people feel connected and strengthens social bonds. These activities often provide a shared understanding of what it means to be part of a particular culture or group.

Promotion of acceptance and understanding between different cultures and communities. As we learn about other cultures and participate in their customs, we become more tolerant and understanding of the beliefs of others. This helps foster mutual respect and appreciation for the differences that exist between us all. Valuing your cultural traditions is essential for strengthening your connection with your heritage as well as promoting peace among different cultures.

TEK offers an antidote to this amnesia. Indigenous oral histories preserve ecological data regarding megafauna migrations, historical sea-level changes, fire frequencies, and species distributions dating back thousands of years. Without this long-term perspective, modern sustainability models operate in a historical vacuum. The practical application of TEK across diverse biomes reveals its capacity to restore balance where modern management has failed.

The Nexus Between SDGs and Traditional Belief Knowledge

Traditional Knowledge has proved to have provided problem-solving strategies for local communities, especially the poor. This is because the poor are usually familiar with indigenous practice and technologies. Traditional knowledge draws on local resources people that are less dependent on outside supplies, which can be costly, scarce and not regularly available. Many technologies project in the developing world fail due to lack of indigenous knowledge and beneficiary communities. Traditional Belief Knowledge (TBK) have a broad perspective of the ecosystems and of sustainable ways of using natural resources. Main elements of traditional belief systems are culture (traditional way of life) taboos, spiritual ecology. Culture must be integrated in the SDG framework transversally as it contributes to some if not all of the 17 Goals. Culture, the fourth pillar of development. Traditional Belief Knowledge is known to provide resources that can assist local problems, grow more and better food, maintain healthy lives, manage local affair etc., thereby contributing positively to the attainment of SDGs by 2030. There is no one among SDGs to whose achievements not imbedded in traditional knowledge either directly or indirectly.

The Federal Republic of Nigeria faces challenges of poverty, hunger,poor education, and health system and the existence of inequality. It is in this direction that the Nigeria government is mandating the existence of new thoughts and framework on how the Sustainable Development Goals (SDGs) can be implemented in the developing world such as Nigeria towards fulfilling the global mandate of the SDGs.

Conclusion- A Call to Action

As modern conservation efforts hit diminishing returns, embracing TEK is no longer an exercise in romantic nostalgia or historical tokenism. It is an urgent, pragmatic imperative for global environmental sustainability.

The path toward a sustainable future does not require discarding Western science, nor does it mean retreating into an idealized past. It requires cultivating epistemological pluralism—a paradigm where multiple ways of knowing coexist, respect one another, and collaborate to solve complex problems.

Western environmental science has provided the tools to measure the decline of the biosphere; Traditional Ecological Knowledge offers the ethical framework, historical perspective, and management practices needed to halt it. TEK reminds us that humanity is not an external manager of a mechanical Earth, but a deeply embedded strand in a reciprocal web of life.

The urgency of our environmental crisis demands that we break down the intellectual hierarchies born of colonialism. By braiding together the empirical rigor of Western science with the generational wisdom of Traditional Ecological Knowledge, humanity can develop the adaptive strategies necessary to restore balance to our shared planet. The survival of our global ecosystem depends on this reconciliation.





FROM THE

Publisher's DESK

Engr. (Professor) Akpofure Rim-Rukeh
Publisher/Editor-In-Chief

Data as a Strategic Asset:

Frameworks for Optimizing Nigeria's Marine and Blue Economy

Marine and blue economy data is any information used to measure, monitor, and manage human activities and natural resources in oceans, seas, coastal areas, and freshwater bodies. This data balances economic growth with environmental conservation to ensure long-term sustainability. Data is the foundational engine required to unlock Nigeria's estimated $296 billion marine and blue economy potential. Without high-quality data, the newly established Federal Ministry of Marine and Blue Economy cannot effectively measure, monitor, or monetize Nigeria's vast ocean resources.

Data-driven initiatives change marine management from guesswork to precision. This transition directly shapes investments, security, and sustainability across Nigeria's 853-kilometer coastline.

What data will do? Relevance of data to the development of Marine and Blue Economy include:

(i) . International investors require historical data to calculate risks before funding major infrastructure projects.

(ii) . Nigeria aims to create 3 million jobs and attract $2 billion in offshore renewable energy. Reliable baseline data proves these goals are realistic to global partners like the World Bank.

(iii) Clear data on cargo traffic trends and port performance metrics reduces capital costs for deep seaport expansion.

(iv) Deploying digital truck management systems in Lagos ports resolved decades of costly gridlocks.

(v) . Real-time cargo data prevents customs delays and streamlines vessel turnaround times.

(vi) Data guides the development of dry ports and barge operations along river channels.

(vii) Nigeria's domestic fish demand exceeds 3.6 million metric tonnes, but it produces only 1.4 million. Data tracks fish stock depletion to prevent overfishing by illegal foreign trawlers.

(viii) Partnerships like the USDA Food for Progress Programme use baseline surveys to map bottlenecks in coastal aquaculture value chains.

(ix) Geospatial and hydrographic data allows Nigeria to map out boundaries so shipping lanes, tourism, and oil exploration do not collide.

(x) . Surveillance data powered by the Deep Blue Project helped achieve zero piracy



incidents on Nigerian waterways.

(xi) Satellite and radar tracking allow agencies like NIMASA to instantly respond to oil spills or illegal vessel entry.

Driving the marine and blue economy requires a combination of **scientific marine data** (physical, chemical, and biological ocean properties) and **socio-economic maritime data** (industry turnover, jobs, and transport metrics) to balance growth with ecosystem health. Specifically, data types are;

(i) . Track wave heights and currents.

(ii) . Monitor sea surface temperatures.

(iii) Wind patterns to support safe shipping and wind speed for offshore renewable energy.

(iv) Monitor fish stock levels, marine biodiversity, and habitat health (like mangroves and coral reefs) to prevent over-exploitation.

(v) . Map seabed topography for safe navigation.

(vi) Evaluate mineral exploration, and deep-sea activities.

(vii) Testing water quality for pollutants and contaminants.

(viii) Track vessel traffic, cargo throughput, turnaround times, and passenger movements to maximize trade efficiency.

(ix) Measure catch volumes, processing capacities, and aquaculture feed production to ensure food security.

(x) . Quantify sector contributions to Gross Domestic Product (GDP), enterprise turnover, and job creation across emerging fields like marine biotechnology and coastal tourism.

Conclusion

Nigeria possesses an expansive 853km coastline and an Exclusive Economic Zone (EEZ) of over 200,000 square kilometres. However, its contribution to non-oil Gross Domestic Product (GDP) remains low. The core problem is knowledge gap because of lack of data. Nigeria cannot manage, monetize, or protect resources that it does not measure.

Secondary data extracted from Central Bank of Nigeria (CBN) statistical bulletins, Nigerian Ports Authority (NPA) annual reports, and National Bureau of Statistics (NBS) maritime shipping data and information obtained from Key Informant Interviews (KIIs) with officials from the Ministry of Marine and Blue Economy, NIMASA, marine biologists from NIOMR, and private clearing agents are not sufficient to drive the Marine and Blue Economy of Nigeria.

The Publisher of this Magazine strongly advocate for Advocate for the creation of a *National Marine Data Analytics Centre (NMDAC)* to unify port, biological, and security intelligence.

The Green Runway:

Contextualizing Festus Keyamo's Recognition as Sustainability Personality

Chief (Bar) Festus Egwarewa Adeniyi Keyamo SAN, CON, FCIArb (UK) the Honourable Minister of Aviation and Aerospace Development is Sustainability Times Magazine Sustainability Personality.

Festus Keyamo was born 21 January 1970, at Ughelli, a town in Delta State, Southern Nigeria to Pa Matthias Egharewa Keyamo and Mrs. Caroline Abeni Keyamo (née Ogunjobi). His parents' backgrounds reflect a rich intersection of different Nigerian cultures and regions. He hails from Erovie Quarters in Effurun, Uvwie Local Government Area of Delta State.

Festus Keyamo had his primary education at Model Primary School and secondary education at Government College, Ughelli, where he obtained the West African School Certificate in 1986. He later proceeded to Ambrose Alli University at Ekpoma, in Edo State where he received a Bachelor of Law degree in 1992 and was called to the Nigerian Bar in December 1993.

He began his legal career in 1993 at Gani Fawehinmi's Chambers in Lagos State. After he spent two years at Gani Fawehinmi's chambers, he left to establish Festus Keyamo Chambers with its head office located at No. 1 Festus Keyamo Lane, off Gbagada Expressway, Anthony Village, Lagos State, and branch offices at Abuja and Warri, Delta State. Keyamo has built a career that spans law, activism, politics, and governance. He successfully managed some of Nigeria's most controversial cases, including the prosecution of corrupt politicians and the defense of electoral mandates. His years of practice earned him the prestigious title of Senior Advocate of Nigeria (SAN) in 2017, the highest rank for legal practitioners in Nigeria, a recognition of his contributions to the development of law and justice.

Based on his fluency and good command of English and good knowledge of the political history of Nigeria, he was appointed Director of Strategic Communications for President Muhammadu Buhari's 2019 re-election campaign. After the successfully Presidential Election, He appointed Festus was nominated and appointed Minister of State for Niger Delta Affairs of the second administration of President Muhammadu Buhari. He was later redeployed to the Ministry of Labour and Employment barely a month after his initial appointment on 21 August 2019. With increasing political profile, he was appointed as spokesperson and director of public affairs for Bola Tinubu's presidential campaign in 2023. Thereafter, he was appointed as He was made Minister of Aviation and Aerospace Development by President Tinubu on 16 August 2023.

At the helm of affairs of the Federal Ministry of Aviation and Aerospace Development

When the Honourable Minister of Aviation and Aerospace Development, Festus Keyamo SAN assumed office in August 2023, he unveiled a clear and ambitious five-point agenda—a strategic roadmap designed to reposition Nigeria's aviation sector for global competitiveness and national prosperity. The Minister of Aviation and Aerospace Development, Festus Keyamo (SAN), operates on a **five-point agenda** aimed at transforming Nigeria's aviation sector into a safe, competitive, and globally compliant hub:

Strict Regulatory Compliance: Ensuring absolute adherence to national laws, local policies, and international safety obligations.
Infrastructure Upgrade: Renewing and modernizing airport terminals and runways to enhance passenger convenience and meet global standards.

Support for Local Airlines: Boosting the growth, capacity, and long-term financial sustainability of domestic airline operators.

Human Capacity Development: Training and optimizing aviation professionals to improve operational efficiency and safety management.

Revenue Generation Growth: Optimizing revenue collection systems and driving digital transformation to block leakages and attract private investments.

At the helm of affairs of the Federal Ministry of Aviation and Aerospace Development, he oversees reforms in local carrier policies and infrastructural upgrades. At the Ministry and across all parastatals of **Nigeria Civil Aviation Authority**

(NCAA); Federal Airports Authority of Nigeria (FAAN); Nigerian Airspace Management Agency (NAMA); Nigerian Meteorological Agency (NIMET); Nigerian College of Aviation Technology (NCAT); Nigerian Safety Investigation Bureau (NSIB); and African Aviation and Aerospace University (AAAU), he introduced and implemented sweeping sustainable regulatory and infrastructural reforms that aligned with President Bola Tinubu's Renewed Hope Agenda.

(i). African Aviation and Aerospace University (AAAU)

The African Aviation and Aerospace University (AAAU) in Abuja drives sustainable practices through the **African Centre for Climate Change and Aviation Decarbonization (ACCCAD)**, dedicated research units, and specialized academic programs. As a University, AAAU is championing research especially in the areas of Sustainable Aviation Fuels (SAF), eco-design initiatives of our airports targeting the net –zero target of Government. This is in addition to the conduct of workshops on extreme weather impacts and adaptive capacity for airport operations. Embedding environmental responsibility and climate resilience into programs like B.Sc. Meteorology and Aviation Business.

AAAU is also fostering partnership like with agencies like the National Environmental Standards and Regulations Enforcement Agency (NESREA) to promote cleaner industry rules. The African Aviation and Aerospace University (AAAU), Abuja, in collaboration with the Chartered Institute of Transport Administration of Nigeria (CIoTA), successfully hosted a special induction and workshop on 28th April 2028 at the Festus Keyamo Auditorium, AAAU Permanent Site. The event, themed "Sustainable Aviation Development and the Role of Professional Certification", was a huge success as the programme ended on a strong note of renewed commitment by stakeholders to drive innovation, strengthen collaboration, and uphold global best practices in advancing sustainable aviation and transport systems across Nigeria and Africa.

To strengthened its activities, AAAU entered into partnership with NiMet with the signing an Memorandum of Understanding MOU to enhance meteorology education, research, and practical training at the University. This is in addition to organization of joint training initiatives, and issuance of dual certification courses. NiMet had also supported the initiatives of AAAU by establishing an observatory station at AAAU to support hands-on learning.

(ii). Nigerian Safety Investigation Bureau (NSIB)

At the forefront of the Hon Minister vision was an uncompromising emphasis on "safety and regulatory compliance," ensuring that Nigeria not only met but consistently exceeded international benchmarks, particularly those set by the International Civil Aviation Organisation (ICAO). Recognising that safety is the heartbeat of aviation, he sought to elevate Nigeria's global standing through strict oversight and continuous improvements.

Sustainable practices in the Nigerian Safety Investigation Bureau (NSIB) focus on multimodal transport safety coordination, institutional independence, and strategic inter-agency partnerships. Operating under the NSIB Establishment Act 2022 to independently investigate accidents across air, maritime, rail, and road transport. Emphasizing proactive, preventive, and non-punitive analysis to extract vital safety lessons rather than assigning fault. The activities of the Bureau are basic on "what went wrong" principle process failure investigation with the purpose of preventing future re-occurrence.

To strengthened activities, NSIB have entered into partnership with the Nigerian Maritime Administration and Safety Agency (NIMASA) and National Inland Waterways Authority (NIWA) to create joint frameworks for data sharing, technical cooperation, and safer waterways. The Nigerian Safety Investigation Bureau (NSIB) and the Nigerian Maritime Administration and Safety Agency (NIMASA) have agreed to establish a joint framework for data sharing, safety investigations and technical cooperation aimed at strengthening maritime safety across Nigeria's waterways. The partnership also provided a platform for stronger inter-agency cooperation, information exchange and coordinated responses to future maritime incidents, reinforcing a shared commitment to safer waterways for transport, commerce and national development.

Collaborating with the Nigeria Civil Aviation Authority (NCAA) to institutionalize a comprehensive Disaster Victims' Family Assistance Programme.



Enugu Air Aircraft Skids Off Runway at Benin Airport

(iii). Nigerian Airspace Management Agency (NAMA)

The Nigerian Airspace Management Agency (NAMA) promotes operational and environmental sustainability through Performance-Based Navigation (PBN) routes, Continuous Descent/Climb Operations (CCO/CDO), and proactive infrastructure modernization. These initiatives optimize fuel efficiency, reduce carbon emissions, and maintain compliance with International Civil Aviation Organization (ICAO) standards.

PBN promotes shorter and more direct flight paths that minimize fuel burn employing the principles of mathematical modeling, network optimization, and advanced algorithms. Key models include the **Shortest Path Problem, Transportation Problem**, and **Traveling Salesperson Problem (TSP)**. These tools reduce total distance, travel time, and fuel costs.

Continuous Climb and Descent (CCO & CDO) drive eliminates stepped climbs and level-off approaches in terminal areas, significantly lowering aircraft greenhouse gas emissions and noise pollution near major airports like Lagos and Abuja.

One key operational activities that actually promote sustainability is the deployment of Arrival and Departure Manager Systems to sequence terminal traffic actively, reducing ground idling time and holding patterns.

Capacity building of Air Traffic Safety Electronics Personnel (ATSEP) is of interest to NNMA management. Training had focused on the adoption of modern technology in the fast evolving air traffic navigation global space. “In a world where technological evolution continues to redefine aviation, our responsibility is not only to keep pace but to lead with clarity, competence, and creativity” said the MD/CEO in a training session.

NAMA also conducts mandatory ground and airborne signal calibrations on critical navigational aids (ILS, VOR, DME) using dedicated inspection aircraft to ensure maximum fuel and energy efficiency of routing signals. The operation of a centralized National Air Traffic Management Centre that promotes regional airspace oversight, cut redundant facility energy waste, and optimize long-term operational durability is worthy of mention.

Strengthening Nigeria's Airspace, NAF and NAMA are into partnership for the purpose of building the Next-Generation Air Traffic and Radar Expertise. The Nigerian Air Force (NAF), through the Air Traffic Services

Training Centre (ATSTC), has reinforced its strategic role in enhancing Nigeria's airspace safety and security with the graduation of the Maiden Air Traffic Control and Surveillance Radar Course (ACSR 1/2024) for 20 Nigerian Airspace Management Agency (NAMA) ATCO cadets, alongside 29 Non-Commissioned Officers on Air Traffic Control Assistant/Base Operations Upgrading Course 9/2026.

(iv). The Federal Airports Authority of Nigeria (FAAN) FAAN actively drives environmental sustainability through core initiatives like its Sustainable Waste Management Programme, zero-emission electric transit services, and international environmental certifications.

The Sustainable Waste Programme was launched at Murtala Muhammed International Airport (MMIA) in Lagos with indoor, colour-coded recycling bins to encourage proper waste segregation.

Pursuing the net – zero policy of Government FAAN introduced zero-emission electric vehicles at Nnamdi Azikiwe International Airport in Abuja to cut fossil fuel reliance and lower carbon footprints. FAAN had also advanced structured decarbonization and emissions tracking across major Nigerian hubs under the Airport Carbon Accreditation framework.



ISO 14001 is the international standard for Environmental Management Systems, providing a framework for organizations to reduce waste, comply with laws, and improve environmental performance. ISO 14001 uses the Plan-Do-Check-Act cycle rather than setting fixed global targets.

ISO 9001 is the global standard for a Quality Management System (QMS), providing a framework to help businesses consistently meet customer and regulatory requirements while driving continuous improvement. Core operational principles of ISO 9001are; meeting and exceeding customer needs, creating a unified direction and purpose, ensuring staff are trained and valued, managing activities as interconnected processes, maintaining an ongoing focus on getting better, acting on data and metrics and managing stakeholder and supplier networks.



Attained ISO 14001:2015 (Environmental Management System) and ISO 9001:2015 (Quality Management System) via MSECB Canada to meet global environmental standards is a huge commitment to protection of the Nigeria. It takes the commitment of top management to achieve this feat. Nnamdi Azikiwe International Airport won the Airport Service Quality (ASQ) Award for Best Airport by Size and Region.



The Federal Airports Authority of Nigeria (FAAN) has reaffirmed its commitment to environmental sustainability and climate action as it joined the global community to commemorate the 2026 World Environment Day.

FAAN has made notable progress under the Airport Carbon Accreditation Programme, reducing carbon emissions at the Murtala Muhammed International Airport, Lagos, while pursuing Level 3 Carbon Accreditation for Lagos Airport and Level 1 accreditation for the airports in Abuja, Port Harcourt and Kano. FAAN is also working closely with the Nigeria Civil Aviation Authority (NCAA) to monitor carbon emissions and advance sustainable airport operations across the country.

The celebration of 2026 World Environment Day reinforced FAAN's commitment to building greener, more sustainable airports while supporting global efforts to address climate change.

FAAN is also placing people at the center of its sustainable transformation. Over the past two years, more than 3,000 employees have been trained and certified in critical areas including aviation security, firefighting, airport operations, and engineering. This workforce development strategy aims to "future-proof" Nigeria's airport operations, ensuring FAAN personnel meet international aviation standards. It reflects a



shift towards sustainable human capital investment as the foundation for airport modernization in Nigeria. 85% of FAAN's critical technical personnel are now trained and certified



Provision of Solar Panels: Nigeria is charting a bold new course for sustainable aviation. Minister of Aviation and Aerospace Development, Festus Keyamo, has instructed that the new airport terminal currently under construction in Lagos be fitted with solar panels to power sections of the facility. The directive was announced at the unveiling of the Federal Airports Authority of Nigeria (FAAN) Circular Economy Programme, a landmark initiative aimed at driving greener airport operations across the country. Speaking at the launch, Keyamo revealed that the instruction was issued at the design stage to guarantee that the new terminal aligns with global aviation sustainability standards. He explained that the roof of the new facility must be covered with solar panels capable of powering at least the non-aeronautical sections of the airport. The move reflects a growing global trend in which airports are steadily adopting cleaner technologies International Civil Aviation Organization (ICAO) and, guided by the priorities of the Airports Council International (ACI), both of which are placing increasing emphasis on green initiatives.

The Federal Airports Authority of Nigeria (FAAN) manages Airfield Ground Lighting (AGL) systems to support night flight operations, notably resolving a long-standing 14-year lighting gap on Lagos Airport's domestic runway 18L in late 2022. Runway can now be used for flight operations as necessary safety infrastructure e.g. approach lights, runway threshold lights, runway centerline lights, runway edge lights have all been fully installed.



(v). Nigerian Meteorological Agency (NIMET).

NiMet's primary contribution to sustainability is converting complex meteorological observations into actionable intelligence to fight climate change. **NIMET is** responsible for observing weather and climate, advising on meteorology, and issuing early warnings. NIMET operates as the national focal point for detecting and communicating climate hazards like floods, droughts, heatwaves, and heavy rains to protect vulnerable communities. Seasonal Climate Predictions (SCPs) and AgroMet tools of NIMET helps to guide farmers on planting schedules, minimize crop losses, and boost food security. NIMET also partners with different entities like the Nigerian Hydrological Services Agency to monitor sea surface levels, temperatures, and marine acidification for coastal management. The Nigerian Meteorological Agency (NiMet) and the Federal University of Petroleum Resources Effurun Delta strengthen their partnership to improve earth system



observations for the development of national socioeconomic sectors.



As part of the ongoing collaboration between the Nigerian Meteorological Agency (NiMet), and the Federal University of Petroleum Resources Effurun (FUPRE), Effurun, Delta State, both institutions on Thursday, 25th July, 2024 held a one-day workshop in the university on the downscaling of the 2024 Seasonal Climate Prediction (SCP) for Delta State.

In a keynote address, the DG/CEO of NiMet, Prof. Anosike, who was represented by the Director, Applied Meteorological Services, Mrs Glory Onyegbule, thanked the Vice Chancellor of FUPRE, Prof Akpofure Rim-Rukeh, for accepting to host the workshop which was aimed at building resilience among smallholder farmers to increase productivity by identifying adaptation options, best practices, and adaptation gaps for smallholder farmers.





Supporting the University research efforts in the area of meteorology the Nigerian Meteorological Agency (NIMET) donated an Automatic Weather Observation Station (AWOS) to the Federal University of Petroleum Resources, Effurun following the MoU entered between the two institutions and as part of the collaboration to develop and build synergy in the area of climate change research efforts. The AWOS (Automatic Weather Observation Station) is comprised of sensor units which captures and records real time data with a coverage area of 100Km and a temporal resolution of 10 minutes. The units namely the rain gauge which measures the amount of rainfall, the barometer which measures atmospheric pressure, wind vane which measures the wind speed and wind direction. The software for viewing the real time data is the easy log software.



Working across sectoral agencies NIMET provides vital weather intelligence to support aviation, marine operations, energy, and disaster risk management. Collaborates with bodies like the Financial Reporting Council (FRC) to align weather data with corporate sustainability reporting and climate risk management. Forging a Path Towards Sustainability: FRC and NiMet Partner to Promote Sustainable Practices







Dr. Olowo, the ES/DG of FRC and Professor Charles Anosike CEO/DG of NIMET

The Nigerian Meteorological Agency (NiMet) and the National Space Research and Development Agency (NASRDA) strengthen their partnership to improve earth system observations for the development of national socioeconomic sectors. Other areas of collaboration include meteorological support to the operationalization of hot-air balloons and knowledge and skills development, including training opportunities.

Supporting the Federal Government initiatives of Net – Goal on emission reduction, NIMET uses electric vehicles (EVs). NiMet deployed an eco-friendly fleet of zero-emission electric vehicles for its airside meteorological operations across Nigeria's five international airports (Lagos, Abuja, Kano, Port Harcourt, and Enugu). Airside Electric Vehicles (EVs) include specialized zero-emission ramp transport, baggage tugs, and utility vehicles. NiMet deploys Electric Vehicles for Airside Operations Across Five International Airports. Backed by dedicated charging stations at these airport facilities, this deployment cuts airport carbon footprints, reduces reliance on fossil fuels, and lowers airside noise pollution.



NiMet's predictive capabilities also extend directly into sustainable health tracking and natural resource preservation. NiMet embeds environmental health matrices into its climate output, producing predictive indices for diseases sensitive to weather changes, such as meningitis and malaria. In partnership with entities like the Nigerian Hydrological Agency (NIHSA), NiMet monitors ocean temperatures, currents, and acidification to support coastal management and protect Nigeria's vulnerable marine ecosystems.

The agency integrates Artificial Intelligence and data-driven tools into its meteorological modeling to provide highly accurate, science-based information that underpins national environmental resilience planning.

(vi). Nigerian College of Aviation Technology (NCAT)
The Nigerian College of Aviation Technology (NCAT) advances sustainability through academic research on Sustainable Aviation Fuels (SAF), institutional participation in global climate goals, and modernized simulator training. Actively participating in research initiatives and capacity-building to support the national transition toward green aviation and net-zero emissions.
The management of NCAT supports sustainable efforts by building capacity of workforce through, aligning local training frameworks with International Civil Aviation Organization environmental objectives. NCAT also regularly get involvement in international programs such as the ICAO Aviation and IATA training where safety and human factor principles are integrated into professional programs via newly established partnerships. Restoring and upgrading full flight simulators (such as the Boeing 737NG units) to reduce unnecessary live aircraft training hours and lower local carbon emissions.

Generally, The Nigerian College of Aviation Technology, Zaria, has upgraded critical infrastructure, secured key international accreditations and expanded its training capacity despite persistent funding challenges. According to him, NCAT remains Nigeria's only institution offering comprehensive aviation training, with over 200 courses covering pilot training, air traffic control, aircraft engineering and other aviation-related disciplines. He added that the college had retained its Platinum Membership and Centre of Excellence status while also securing accreditation from the United States-based Aviation Accreditation Board International. NCAT has restored its affiliation with the International Air Transport Association, allowing the institution to run globally recognised IATA-certified courses.

(vii). Nigeria Civil Aviation Authority (NCAA)
The Nigeria Civil Aviation Authority (NCAA) drives sustainability through carbon reduction initiatives, sustainable aviation fuel development, and regulatory frameworks. The agency enforces environmental rules to align national operations with global targets as it has adopted the Carbon Offsetting and Reduction Scheme for International Aviation to manage cross-border emissions. NCAA coordinates Nigeria's formal strategy on reducing carbon dioxide emissions across local airline operations.

Sustainable Aviation Fuel (SAF) initiative was recently launched a national high-level steering 7-man committee in July 2026 to transition local feedstocks into commercially viable Sustainable Aviation Fuel. Sustainable aviation fuel (SAF) is a cleaner, non-fossil jet fuel made from renewable materials like used cooking oil, agricultural waste, and captured carbon dioxide. It cuts lifecycle carbon emissions by up to 80% and works directly in current airplane engines without any changes. SAF mixes safely with standard jet fuel at levels from 10% up to 50% today, works safely in existing aircraft and airport fuel pumps and reduces carbon dioxide across its entire lifecycle from production to flight.

SAF presents Nigeria with a strategic opportunity to cut carbon emissions while attracting investment, creating jobs, strengthening energy security and unlocking value across the nation's agriculture, energy and industrial sectors.



Inaugurating the seven-man steering committee at high-level event organised by the Nigeria Civil Aviation Authority (NCAA), in partnership with the International Civil Aviation Organization (ICAO), the European Union (EU), and the European Union Aviation Safety Agency (EASA), the Minister of Aviation and Aerospace Development, Mr Festus Keyamo (SAN), noted that the committee will function as a national governance platform, providing strategic direction, coordinating implementation efforts, fostering collaboration among stakeholders, and overseeing the delivery of Nigeria's SAF Implementation Programme.

NCAA has also demonstrated its commitment to environmental issues by issuing explicit advisory circulars requiring airports and operators to manage localized environmental and noise impacts.

(viii). Airline Economic Conference held in Dublin, Republic of Ireland

For years, Nigeria's aviation sector has struggled to reclaim its lost glory, facing challenges ranging from financing constraints to aircraft leasing bottlenecks and insurance hurdles. However, at the 2025 Airline Economic Conference held in Dublin, Republic of Ireland, between January 12th and 15th, the world witnessed a renewed and rebranded Nigeria, a nation ready to take its rightful place as Africa's aviation hub.



At the forefront of this transformation was the Minister of Aviation and Aerospace Development, Festus Keyamo (SAN), who led a powerful delegation comprising top aviation stakeholders, industry investors, insurance practitioners, and five of Nigeria's biggest banks. This strategic move was aimed at showcasing Nigeria's commitment to the global aviation market, attracting investments, and reinforcing the nation's ability to compete favourably on the international stage.

- A major highlight of Nigeria's participation was the effort to position the country as a viable and credible destination for aircraft leasing and financing. In a sector where access to competitive aircraft

financing has often been a challenge, the Nigerian delegation engaged with leading aircraft lessors, insurers, and financial institutions to address long-standing concerns.

- One of the major breakthroughs from the conference was the commitment from Afreximbank, which announced plans to collaborate with Nigeria on aircraft financing and the plans to launch a leasing subsidiary that will soon deliver 25 aircraft to boost the Nigerian aviation industry.
- Similarly, international aircraft leasing giant Avolon has also bought into the Nigerian project, marking a significant milestone in attracting global partners to support the country's aviation sector.
- A major point of discussion at the Boeing-facilitated conference held at The Mansion House was Nigeria's recent improvements in regulatory compliance, particularly regarding the Cape Town Convention and the Aviation Working Group (AWG) compliance index.
- For years, Nigerian airlines have struggled with high insurance premiums, often forced to place their risks internationally due to low confidence in the local insurance market. However, at the Dublin conference, Nigerian insurance practitioners engaged in high-level discussions with global insurers to address these issues. With Nigeria's improved compliance records and stronger regulatory framework, the discussions paved the way for better risk assessment and potentially lower insurance premiums for Nigerian airlines. This is expected to ease financial burdens on operators, ensuring sustainable airline operations in the country.

The Nigerian delegation's presence at the Airline Economic Conference 2025 sent a clear and powerful message to the world. Nigeria is no longer a spectator in global aviation but a serious contender ready to lead the sector in Africa. Beyond securing international partnerships, the conference also exposed Nigeria's aviation industry to new opportunities, investors, and financial institutions, strengthening the country's air transport infrastructure and service delivery.

The 2025 Airline Economic Conference in Dublin was more than just another international aviation event. It was a watershed moment for Nigeria's aviation industry. Minister Festus Keyamo's bold leadership and strategic engagement with global aviation players has reinforced Nigeria's credibility, improved its compliance standing, and opened doors for massive investments.

(ix). The Cape Town Convention (CTC)

CTC is a strategic convention of minds and institutions committed to deepening Africa's participation in and benefit from the Global Aviation Financial Framework established under the Cape Town Convention and its aircraft protocol, the promise and power of the Cape Town Convention. CTC is concerned with the transformation of the landscape of aircraft financing and leasing by creating a predictable, transparent, and enforceable legal regime that reduces credit risks and enhances access to capital. CTC is a beacon of opportunity that signals to investors and financiers that our legal system is progressively reliable. Our legal system is dependable, our markets are stable, and our governments are committed to best practices in aviation asset management and protection. As at today, 28 African countries have ratified the Convention, reflecting a continental recognition that the CTC is not just a legal instrument; it is a catalyst for aviation growth, economic transformation, and connectivity across Africa. The Honourable Minister Festus Keyamo's government, in line with his five-point agenda for the aviation sector under the present administration led by His Excellency President Tinubu, signed the Cape Town Convention Practice Directions on 12 September 2024.

The Federal Government has reaffirmed its commitment to the Cape Town Convention by strengthening its implementation framework and improving Nigeria's compliance rating to

75.5 per cent. Nigeria's compliance rating with the Convention rose from 70.5 per cent to 75.5 per cent, reflecting significant progress under the administration of President Bola Tinubu. This breakthrough followed the decisive signing of the Irrevocable De-registration and Export Request Authorization (IDERA) by Minister Keyamo and the Director General of the Nigerian Civil Aviation Authority (NCAA), Capt. Chris Najomo. The impact was immediate and profound. Nigeria's compliance score under the Cape Town Convention climbed from 49% to 70.5%, and later to 75.5%, placing the country firmly in the "high compliance" category.

For the first time in years, Nigeria was no longer pleading for trust, it was earning it. The dividends of these reforms have moved swiftly from paper to tarmac. Local airline operators are now benefiting from dry leasing arrangements, a development that significantly reduces costs and operational risk. In a landmark moment, Nigeria's largest flag carrier, Air Peace, took delivery of its first dry-leased aircraft, a Boeing 737-700 from Aercap, with several other domestic airlines set to receive additional aircraft in the coming year.

One of his most defining achievements was Nigeria's removal from the AWG watch list of non-compliant countries under the Cape Town Convention, a long-standing stigma that had constrained aircraft acquisition and inflated operating costs for Nigerian airlines.

(x). Nigeria International Airshow

The inaugural Nigeria International Airshow took place from December 2 to 4, 2025, at the Nnamdi Azikiwe International Airport in Abuja. The historic maiden event featured aerial displays by the Nigerian Air Force, exhibitions from 40 global aerospace and aviation companies, and panels centered on African aviation infrastructure. The Nigerian Air Force performed dynamic flypasts, including an Augusta 109 LUH helicopter soaring across the Abuja skyline carrying the national flag and airshow emblem. Industry stakeholders like ExecuJet Nigeria, Air Peace, and Ibom Air hosted interactive showcases inside



Exhibition Hall 1. Panel discussions and leadership forums focused on financing airport development, Maintenance, Repair and Overhaul (MRO) facilities, and sustainable climate aviation policies.

Nigeria's first International Air Show achieved objectives in projecting national aviation capabilities, attracting investments, and accelerating sectoral growth.

(xi). Celebration of 100 Years of Aviation in Nigeria

In a rare and deeply thoughtful move, the aviation minister conceived and executed the celebration of 100 years of aviation in Nigeria, honouring 50 legends of the sector, men and women whose sacrifices and service laid the foundation of the industry. It was an unprecedented act of institutional memory and national gratitude, reinforcing the idea that progress must be rooted in history.

(xii). Tackling of Illegal Chartered Operations and Related Matters

For nearly 50 years, the standard practice in Nigeria was for private jet owners to **exploit regulatory loopholes and weak enforcement** to run massive, highly profitable commercial charter operations under the radar. Because regulators looked the other way, this unproductive market for air travel grew so large that the private jet fleet expanded to nearly three times the size of Nigeria's commercial airline sector.The unchecked historical practices included:

(i). Jet owners routinely registered their aircraft under **Private Non-Commercial Flight (PNCF) licenses** rather than commercial Air Operator Certificates (AOC). PNCF permits were significantly cheaper and intended strictly for personal business or flying family members. Operators used these cheap permits to secretly carry paying passengers, completely



avoiding the higher commercial licensing fees and the mandatory 5% ticket sales charge owed to the Nigerian Civil Aviation Authority (NCAA).

2. Some private owners did not even operate independently; they **colluded with holders of valid commercial Air Operator Certificates (AOCs)**. Legitimate airlines would disguise these unauthorized private charter flights under their own operating licenses in exchange for financial kickbacks.

3. Nearly 70% of the private jets operating in Nigeria were **registered in foreign countries**. This practice allowed owners to employ foreign crews and exploit regulatory grey areas between nations, making it incredibly difficult for the NCAA to track passenger manifests, cargo, or enforce local aviation laws.

4. Private aircraft operators historically bypassed standard customs procedures and passenger logging. Because operations were largely unmonitored—particularly at hubs like the **General Aviation Terminal in Abuja**—influential individuals utilized private flights as a secure, unvetted pipeline for money laundering, drug trafficking, and moving fugitives across borders.

"This practice has been on for many years before I became Minister, but I thought there was a need to confront it headlong" "When you cannot track them, it leads to money laundering, drug trafficking, illegal entry and exits into the country and all kinds of illegal activities". He stated that the issue of illegal charter operations by private jets and private aircraft owners in the country has been besetting the aviation sector, especially those who obtain licenses under the permit for Non-Commercial Flight (PNCF) and use the aircraft to do other illegal transactions. Keyamo maintained that President Bola Ahmed Tinubu-led government is poised to mitigate these acts and pledged that his Ministry will not fail to safeguard the aviation industry in line with the mandate of the Ministry.

(xiii). International Recognition of National Airports: Under Keyamo's leadership, more airports attained international designation, including the Mohammadu Buhari International Airport, Maiduguri, and the Victor Attah International Airport, Uyo. The Uyo airport, notably, boasts a 95% completed standard Maintenance, Repair and Overhaul (MRO) facility, a strategic asset with the potential to reduce capital flight and create high-value technical jobs.

Even more significant is Uyo's emerging capacity as a domestic-to-international passenger processing hub, a development that could reshape regional air travel dynamics in Nigeria's South-South corridor.

(xiv). Infrastructural Rehabilitation and Upgrade: The Ministry under the leadership of Festus Keyamo is undertaking a massive ₦919.11 billion phased infrastructural rehabilitation and upgrade program across major Nigerian airports.

Murtala Muhammed International Airport (MMIA), Lagos: ₦712.25 billion allocated for stripping down and rebuilding Terminal 1 (Wings D and E) down to its carcass, expanding Terminal 2, and adding supporting roads and bridges. An additional ₦49.8 billion is funding a 10.6km/14.6km perimeter fence, CCTV, and solar lighting. A new 8,000-sqm temporary departure terminal and an upgraded Pilgrims Terminal with a 300-seat waiting area and modern VIP lounges have also been completed.

Malam Aminu Kano International Airport, Kano: ₦46.39 billion allocated to rehabilitate Runways 06/26 and 05/23 and upgrade airfield lighting to CAT I level.

Port Harcourt International Airport: ₦42.15 billion assigned for runway and taxiway rehabilitation alongside lighting system upgrades to CAT I.

Lagos Domestic Wing: ₦44.13 billion for runway and taxiway rehabilitation with upgraded CAT II LED lighting systems, plus ₦26.27 billion for the rigid pavement reconstruction of Apron 6 to decongest the terminal.

(xv). Partnerships of the Ministry The partnership initiatives of the Ministry focus on international Original Equipment Manufacturer (OEM) collaborations, private-sector airport concessions, and local maintenance development.

OEM Outreach: Working visits led by Minister Festus Keyamo to major global aircraft



Festus Keyamo and Governor of AkwaIbom, Pastor Umo Eno

manufacturers including Boeing, Airbus, Embraer, and Bombardier's Laurent Beaudoin Completion Centre in Montréal, Canada, to support local fleet renewal and technical cooperation.

International Cooperation: Bilateral talks with the United States to expand aviation collaboration and mutual industry opportunities.

Airport Concessions: Partnering with private concessionaires, including the handover of facilities like Akanu Ibiam International Airport in Enugu, to drive private capital investment and modernization.

Strategic Think-Tanks: Collaborating with institutions like the Nigerian Economic Summit Group (NESG) to shape policy reforms and unlock public-private investment potential.

Maintenance Facilities: Supporting private-indigenous partnerships, such as the collaboration for XeJet's Maintenance, Repair, and Overhaul (MRO) and training facility in Abuja.

Stakeholder Symposia: Holding quarterly stakeholder and citizen engagements to align industry practices with international ICAO standards.

(xvi). International Route; Under his leadership, Nigeria's aviation sector recorded new milestones. He approved the Abuja–London route for Air Peace, expanding its international reach beyond Lagos–London. Through diplomatic negotiations, he secured a Heathrow slot for Air Peace under the Bilateral Air Services Agreement (BASA), strengthening Nigeria's presence in global aviation. He confirmed that Air Peace resolved safety concerns raised by the UK Civil Aviation Authority after inspections at Gatwick, ensuring compliance with international standards. He also addressed the issue of trapped airline funds by clearing a large portion of them, restoring confidence among foreign operators and boosting Nigeria's aviation reputation.

(xvii). Recently, in Brazzaville, Congo, Keyamo once again elevated Nigeria's prestige on the global stage when he signed a historic Letter of Intent on behalf of the Federal Government of Nigeria with the African Development Bank. The agreement seeks to advance the Integrated Aviation Transformation Programme across Africa, thereby opening a new chapter in continental aviation development. The significance of this diplomatic and economic engagement cannot be overstated. It places Nigeria at the centre of Africa's aviation transformation agenda and further validates the confidence international institutions now place in Nigeria's aviation reforms under Keyamo's stewardship. At the high-level dialogue session attended by the President and Governors of the African Development Bank, Festus Keyamo displayed the intellectual depth, diplomatic finesse, and strategic foresight for which he has become renowned. He articulated the enormous opportunities embedded in the AfDB's $7 billion aviation transformation initiative and positioned Nigeria as a ready and willing partner in the unfolding continental revolution.

One of the most profound aspects of Keyamo's presentation was his advocacy for the newly approved Nigeria Aircraft Leasing Company. In an era where many African airlines struggle under the crushing burden of aircraft acquisition costs, Keyamo's leasing initiative stands out as a transformative economic intervention capable of reshaping the continent's aviation economics. By urging the African Development Bank to mobilize capital support for the initiative, he demonstrated not only visionary thinking but also continental consciousness. He understands, as a learned silk, that Nigeria's progress is intrinsically tied to Africa's advancement. This initiative reflects a deep understanding of current global aviation financing systems.

(xviii). Clearing Foreign Airlines' Trapped Funds: Collaborating with the Central Bank of Nigeria, the Minister resolved the longstanding issue of

trapped funds, significantly boosting foreign airlines' confidence in Nigeria's aviation sector.

(xix) The Visit To Airbus In Toulouse, France: One of the very first trips the Honourable Minister undertook was a visit to Airbus in Toulouse, France. The visit tagged the Nigeria-France Bilateral Business Forum was aimed at strengthening cooperation and explore business opportunities in the aviation sector between both nations.

(xx). The Minister Signs MOU With Boeing To Enhance Aircraft Acquisition: The Minister, accompanied by a delegation of major airline operators, led a high-level visit to Boeing's headquarters in Seattle, USA, to sign a Memorandum of Understanding (MoU) aimed at advancing aircraft acquisition, safety practices, and other critical aspects of the aviation industry. The visit was initiated in response to an invitation from Boeing, demonstrating its commitment to strengthening its partnership with Nigerian airline operators.

(xxi). Boeing's Domestic Airline Training: As a result of these global compliance milestones, and according to some of the agreements with Boeing to enhance operational efficiency and help position Nigerian airlines for growth in the global aviation market, Boeing, and Cranfield University, a specialist postgraduate university in the UK have started to implement trainings with our domestic airlines, this is to fortify safety culture and operational excellence as agreed in the Seattle MOU. Working under the aegis of Boeing Global Learning Institute (BGLI), and themed: Advanced Leadership in Safety Excellence, the leading global aerospace company recently brought together Nigeria Airline Executives, postholders and management of various departments of domestic airline in a five-day in-person classroom training, aimed at improving their safety leadership skills.

(xxii). Increased Competition on UK-Nigeria Routes: Through a sustained diplomatic efforts with his counterpart in the UK, the Minister was able to negotiate reciprocity with the UK government, a landmark achievement that has seen one of Nigeria's flag carriers, Air Peace landing in Gatwick and Heathrow Airports thereby fostering competition and reducing airfares.

(xxiii). United States-Nigeria Open Skies Agreement: The Minister facilitated the implementation of this agreement, opening new opportunities for local airlines to operate on the Nigeria-U.S. route and enhancing bilateral trade.

(xxiv). Commissioning of E-Gates in Lagos: To enhance passenger facilitation and security, the Minister commissioned newly installed E-gates at the Murtala Muhammed International Airport. The Federal Government inaugurated new electronic gates (e-gates) at the departure wing of Murtala Muhammed International Airport (MMIA) in Lagos on December 20, 2024. The project was led by Aviation Minister Festus Keyamo and funded through a Public-Private Partnership with the United Bank for Africa (UBA) Group to streamline processing times and boost security. Key features are:



Automated Processing: Allows travelers to scan passports and complete biometric verifications (facial recognition, iris, or fingerprints).

Reduced Queues: Shortens wait times and minimizes manual touchpoints during immigration and security screening.

Enhanced Security: Integrates modern border management tech to track and flag security risks in real time.



The E- Gates

(xxv). Fly Nigeria Act Initiative: The Minister initiated the Fly Nigeria Act to mandate prioritization of Nigerian flag carriers for government-funded travel, a bold move to support local airlines and stimulate economic growth. He described the Fly Nigeria Act as a bold initiative to support the country's aviation industry, which he referred to as a 'Vital Pillar of the Nigerian economy'.

(xxvi).Federal Government - Bi-Courteny's Decades Long Concession Bottlenecks: The Honourable Minister was able to successfully broker a historic settlement between the Federal Government and Bi-Courtney Aviation Services Limited, bringing to a close, a protracted dispute, of almost two decades, surrounding the Murtala Muhammed Airport Terminal 2. Under the terms of the negotiated settlement, Bi-Courtney relinquished the exclusivity clause tied to the MM2 concession, handed back the MM1 Terminal to the Federal Government and also wrote-off the N132billion Supreme Court judgment debt previously owed by the Federal Government.

(xxvii). Approval Of Nigeria's Civil Aviation Masterplan-CAMP: As part of his 5-point agenda of improving the Nigeria's aviation industry, the Honourable Minister approved the development of the Nigeria's Civil Aviation Masterplan and the certified true copy of the Civil Aviation Masterplan-CAMP was presented to him recently by the International Civil Aviation Organisation-ICAO during the last session of the ICAO Global Implementation Support Symposium in Marrakech, Morocco.

(xxviii). Concession Of The Enugu Airport: The concession of the Akanu Ibiam International Airport, Enugu, which the Honourable Minister signed recently is part of the Federal Government's broader aviation sector reform agenda aimed at attracting private investment, improving infrastructure, boosting regional connectivity, and strengthening Nigeria's aviation competitiveness.

(xxix). Automated Immigration Process: The Ministry of Aviation and Aerospace Development through the able leadership of the Hon. Minister collaborated with the ministry of Interior to enhance easy entry and exit through automated immigration process. E-Visa System: Foreigners can now apply for short stay visas (30- 90) days online and receive approval within 48hrs and automated landing and exit cards: Non-Nigerians and dual citizens must complete their entry or departure cards online 72hrs before travel.

(xxx). Flag-Off The New Era Of Insurance Regulations: Hon. Minister recently flagged off the revised insurance regulations expected to boost boost the aviation sector, improve irrevocable Deregistration and Export Request Authorization, allow local operators to cede up to 90% of risk to international markets under certain conditions, in line with the Cape Town Convention. The policy is expected to enhance Nigeria's Gross Domestic Product (GDP), promote stability in the aviation insurance market, and reduce the cost of air tickets.

Awards and Recognitions

Festus Keyamo holds the national honor of Commander of the Order of the Niger (CON), awarded previously during the administration of President Muhammadu Buhari. He has also received subsequent public service recognitions, including the Excellence in Aviation Sector Reforms Award presented at the Nigeria Excellence Awards in Public Service (NEAPS).

Keyamo was named by the Legal Practitioners' Privileges Committee (LPPC), Nigeria in July 2017 as one of the outstanding Nigerian lawyers to be awarded the rank of Senior Advocate of Nigeria (SAN).

In 2017, Keyamo was also awarded the Global Human Rights Award by the United States Global Leadership Council in Washington for his efforts over the years in respect of protection and promotion of human rights and campaigning for accountable governments in Nigeria. Today, the name Festus Keyamo reverberates strongly across Africa's aviation ecosystem following his emergence as the African Champion of the Integrated Aviation Transformation Programme (IATP), a continental initiative

spearheaded by the African Development Bank.

Chieftaincy Installation

His legal activism during critical periods of Nigeria's democratic evolution earned him national prominence and admiration among progressive forces across the country. Yet, despite his towering national stature, Keyamo has remained deeply connected to his roots in Uvwie Kingdom in Delta State, without forgetting his western kith and kin. The traditional title conferred on Festus Keyamo by His Royal Majesty, Dr. Emmanuel Ekemejewa Sideso, Abe I, the Ovie of Uvwie Kingdom, is "Omorokaro of Uvwie Kingdom," which translates to "The Child Who Leads the Way."

In November 2023, following his appointment as the Minister of Aviation and Aerospace Development, the Ovie of Uvwie Kingdom hosted a grand civic reception at the royal palace in Effurun. The monarch used the event to celebrate Keyamo's track record and standing as an illustrious son of the soil.

Festus Keyamo is also known by another traditional title from Ogor Kingdom in Ughelli North Local Government Area: "Ogba-Uri," meaning "Strongman of the Law." In addition, the Ologun Festus Kayamo is also known as the Igoniniwei of Gbaramatu Kingdom. Igoniniwei is a prestigious traditional chieftaincy title in the Gbaramatu Kingdom, an Ijaw territory located in the Warri South-West Local Government Area of Delta State, Nigeria. Translating in the Ijaw language to "the man who knows the way," the title is bestowed upon individuals recognized for leadership, guidance, or strategic influence. The title was conferred by the paramount ruler of the kingdom, His Royal Majesty, Oboro-Gbaraun II (Aketekpe, Agadagba), the 26th Pere of Gbaramatu Kingdom in November 26., 2022, the prominent Nigerian lawyer and politician Festus Keyamo (SAN) was officially capped and conferred with the *Igoniniwei* title at the royal palace in Oporoza.

Demonstrating his active cultural role within the kingdom, Olorogun Festus Keyamo served as the Chairman of the Day during the Ovie of Uvwie's 18th coronation anniversary and 83rd birthday celebration in Effurun. During this high-profile royal event, Keyamo also presided over the official launch of the monarch's autobiography, *"Odyssey of Royalty"*.

Conclusion

As Nigeria continues its journey toward economic diversification and infrastructural modernization, aviation remains one of the most critical sectors for growth, connectivity, tourism, trade, and regional integration. In many respects, Keyamo represents the modern African technocrat intellectually sophisticated, globally connected, reform-driven, and unapologetically patriotic. At a time when Africa seeks transformative leadership capable of navigating complex economic realities, his role in continental aviation policy demonstrates the emergence of a new generation of Nigerian leaders capable of shaping Africa's future from positions of competence and strategic influence.

Festus Keyamo understands this reality profoundly. His policies are not only aimed at improving airports or airline operations; they are fundamentally designed to position aviation as a catalyst for economic expansion and continental integration.

Indeed, history will remember Festus Keyamo as one of the leading architects of Nigeria's aviation renaissance. His vision transcends bureaucracy. His approach combines legal intelligence, economic pragmatism, diplomatic engagement, and patriotic commitment. Through strategic partnerships, policy reforms, and international collaboration, he is steadily redefining Nigeria's role within Africa's aviation ecosystem. Under Keyamo's stewardship, Nigeria has begun to bridge this gap, demonstrating that African aviation can be both ambitious and sustainable.

Festus Keyamo maintains a private but balanced family life. He is married to Mrs. Love Keyamo, and together they have children. Despite the demands of his career, he openly acknowledges his family as a source of strength and grounding.

















Home Composting

as a Sustainability Lifestyle

In an era dominated by global climate anxiety, the search for meaningful environmental action often leads us to look outward. We advocate for systemic policy shifts, support large-scale renewable energy projects, and track corporate carbon footprints. Yet, one of the most radical and effective tools for ecological restoration can be found right under our noses, sitting on our kitchen counters and in our backyards. Home composting is more than just a waste management chore; it is a foundational sustainability lifestyle that allows individuals to participate directly in the circular economy.

What is Home Composting?

To adopt composting as a lifestyle, one must first understand it is not as a mechanical process, but as a biological partnership. Composting is the controlled, aerobic (oxygen-rich) decomposition of organic materials into a nutrient-rich soil amendment.

At the household level, this practice transforms everyday organic liabilities such as food waste, fruit peels, coffee grounds, eggshells, and yard trimmings into valuable ecological assets. Unlike natural decay in a neglected forest or the suffocating rot of a landfill, home composting is a deliberate, managed practice. It relies on a balanced ecosystem of microscopic organisms (bacteria and fungi) and macroscopic organisms (earthworms and insects) working together to break down complex organic matter into a dark, earthy substance known as humus (a natural nutrient rich material).

The Importance of the Practice

The modern household is a primary driver of resource consumption and waste generation. Globally, roughly one-third of all food produced for human consumption is lost or wasted. When we throw away organic matter, we are not just discarding food; we are throwing away the water, energy, and land resources used to grow it.

Implementing a home composting system is important because it intercepts this linear take-make-waste pipeline and promotes circularity. It shifts the household dynamic from passive consumption to active stewardship. By taking responsibility for our own organic waste, we reduce the burden on municipal infrastructure, lower our personal ecological footprints, and cultivate a deeper, more mindful connection to the



natural lifecycle of food and resources.

How Composting Drives Sustainable Living

Home composting contributes dynamically to the core pillars of sustainable living by addressing critical environmental vulnerabilities:

Supports Net-Zero Emissions: When food scraps are buried deep within a landfill, they are starved of oxygen. This triggers anaerobic decomposition, which produces methane gas (a greenhouse gas over 28 times more potent than carbon dioxide at trapping atmospheric heat). Composting keeps organic matter exposed to oxygen, virtually eliminating methane generation.

Shrinking the Transportation

Footprint: By managing waste exactly where it is generated, households eliminate the carbon-heavy logistics of waste collection. Every pound of waste composted at home represents fewer municipal trucks on the road, saving fuel and reducing urban air pollution.

Eliminating Chemical Dependence: Finished compost acts as a powerful, slow-release organic fertilizer. By using it in home gardens or houseplants, individuals can entirely bypass synthetic chemical fertilizers, which require heavy fossil-fuel energy to manufacture and frequently leach into local waterways, causing toxic algal blooms.

Enhancing Earth's Resilience: Compost significantly alters soil structure, acting like a sponge that increases water retention. In an age of erratic weather patterns, compost-rich soil reduces the need for frequent watering and shields local landscapes from severe soil erosion during heavy rains.

From Kitchen to Garden: How Home Compost is Produced

Producing high-quality compost at home is an elegant science, requiring a simple balance of four key elements: Nitrogen, Carbon, Oxygen, and Water.

1. The Ingredients: A successful home compost pile requires balancing two distinct categories of materials: (a). The Nitrogen-Rich food materials: These provide the protein and nutrients needed for microbes to grow and multiply. They include kitchen scraps (vegetables, fruits, coffee grounds), green garden waste, and fresh grass clippings. (b). The Carbon-Rich food materials: These provide the energy source for the microbes and create structural pockets for air. They include dry leaves, twigs, shredded unprinted cardboard, paper bags, and sawdust.

2. The Golden Ratio: The ideal recipe for a healthy compost pile is roughly three parts carbon rich food materials to one-part nitrogen rich food materials by volume. Layering these materials prevents the pile from becoming too wet or compacted, which would cause unpleasant odors.

3. Managing the Environment:
Moisture: Microbes need a damp environment to survive. A thriving compost pile should feel like a wrung-out sponge. Water should be added occasionally if the pile dries out.

Oxygen: Because this is an aerobic process, oxygen must be introduced regularly. This is achieved by mixing the pile every one to two weeks using a pitchfork or a rotating compost tumbler. Turning introduces fresh air, accelerating breakdown and neutralizing bad odors.

4. The Harvest
Over a period of two to six months depending on the climate and how frequently the pile is turned, the internal heat generated by microbial activity will subside. The recognizable food scraps will vanish, leaving behind a dark, crumbly, sweet-smelling soil amendment. Distributed across lawns, indoor potted plants, or backyard vegetable patches, this finished product completes the natural loop.

Conclusion

Choosing a sustainability lifestyle can often feel overwhelming, but home composting offers an immediate, tangible victory. It proves that sustainability is not defined by radical sacrifices, but by the thoughtful redirection of daily habits. By turning our waste into wealth, we do more than just heal a patch of earth; we cultivate a mindset of abundance, regeneration, and deep respect for the planet we call home.



Smart Agriculture

as a Sustainability Lifestyle

Meaning of Smart Agriculture

Smart agriculture also known as Climate-Smart Agriculture (CSA) or precision farming is an integrated approach to managing landscapes, croplands, and livestock that uses modern technology and data-driven insights to sustainably increase productivity.

At its core, this practice moves farming away from guesswork. Instead of treating an entire field or backyard garden uniformly, smart agriculture uses technology to look at the exact needs of individual plants or specific zones.

From Commercial Fields to the Home Lifestyle

While originally designed for large-scale commercial farms to optimize crop yields, smart agriculture has rapidly evolved into an accessible, daily sustainability lifestyle. When adopted by individuals and families, it manifests as Smart Homesteading or High-Tech Urban Gardening. Practitioners utilize micro-technologies to transform small spaces like suburban backyards, balconies, or indoor kitchens into highly efficient, automated food production units.

Key lifestyle technologies include:

(i). Small probes pushed into the earth to monitor moisture, temperature, and nutrient levels in real time.

(ii). Water lines controlled by microcomputers that only turn on when data shows the soil is dry.

(iii). Hydroponic and Aquaponics Towers: Soil-less vertical farming systems that cycle nutrient-rich water directly to plant roots using automated pumps.

(iv). Smart Weather Integration: Gardening apps that sync with local weather forecasts to automatically pause watering schedules if rain is expected.

Importance of Smart Agriculture

The importance of integrating smart practices into our food systems and our homes cannot be overstated. As the planet faces unprecedented environmental challenges, traditional, resource-heavy growing methods are no longer viable.

Radical Resource Efficiency: Traditional gardening and farming often rely on heavy watering and blanket fertilizing, both of which degrade the environment. Smart agriculture is vital because it introduces extreme resource efficiency. By utilizing automated, targeted delivery systems, growers use the absolute minimum amount of water and nutrients required for a plant to thrive. It completely removes the human error of over-watering and over-fertilizing.

Climate Resilience and Adaptation: Climate change has made weather patterns increasingly erratic, introducing sudden droughts, heatwaves, and unexpected frosts. Smart agriculture provides growers with the data and tools needed to adapt to these shocks in real time.

Whether it is a household automated shade cloth that deploys when a temperature sensor hits dangerous highs, or an indoor hydroponic setup completely insulated from outdoor droughts, smart farming ensures that food production remains steady despite shifting climate variables.

Localized Food Security: By breaking down the barriers of space and climate, smart agriculture allows food to be grown anywhere including dense urban environments far away from traditional farmland. This diminishes a household's reliance

on long, fragile commercial food supply chains. When individuals can reliably produce their own fresh greens, herbs, and vegetables on a balcony or in a kitchen, they establish a secure, hyper-local source of clean nutrition.

Contribution of Smart Agriculture to Sustainability

Smart agriculture is not just about using gadgets; it is a foundational pillar of sustainable living because it directly addresses the global crises of waste, carbon emissions, and ecosystem degradation.

Water Conservation and Scarcity Mitigation: Agriculture is responsible for roughly 70% of global freshwater withdrawals, much of which is lost to evaporation and inefficient application. A smart agriculture lifestyle fights this crisis directly.

Closed-loop hydroponic and aeroponic systems recirculate water continuously, consuming up to 95% less water than standard dirt-gardening methods. Outdoors, precision drip lines deliver water directly to the base of the plant root under the soil, virtually eliminating evaporation and cutting household outdoor water usage in half.

Eliminating Food Miles and Carbon Footprints: The average grocery store meal travels thousands of kilometers from the farm to the dinner plate, racking up massive transportation emissions. Furthermore, the mass production of synthetic chemical fertilizers is an incredibly carbon-intensive industrial process.

By growing food at home using smart technologies, individuals reduce their personal food miles to zero. Furthermore, because smart systems allow for highly precise organic nutrient dosing, the reliance on commercially manufactured, petroleum-based chemical fertilizers is completely eliminated.



Protecting Soil Health and Preventing Runoff: When standard gardens are over-fertilized, the excess chemicals wash away during rainstorms, causing agricultural runoff that poisons local waterways, streams, and marine life. Smart agriculture relies on exact, data-driven application. Plants are given only what they can immediately absorb. This protects the local soil biology from chemical burns and ensures that no toxic synthetic nutrients leak into the local water table or surrounding ecosystems.

Conclusions

Smart agriculture shatters the old myth that technology and nature are fundamentally opposed. Instead, it proves that when modern innovation is guided by ecological principles, it creates the ultimate framework for sustainable living. By using data to listen to what the Earth needs, human beings can shift away from exploitative habits and step into a lifestyle of precise, harmonious resource stewardship.

Adopting smart agriculture as a lifestyle is a powerful, proactive choice. It empowers individuals to transition from passive consumers into active, self-sufficient producers. As cities grow denser and global weather patterns become more unpredictable, the integration of data, automation, and home food production will cease to be a hobby, it will become a necessity. By embracing the smart homestead, we can safeguard our natural resources, slash our carbon footprints, and cultivate a resilient, sustainable future right from our own homes.

THE CORE OF SUSTAINABLE LIVING:
Saying No to Single-Use Plastics

Introduction
In the modern society of today, the notoriety of single –use plastics is very palpable. Single use plastics are petroleum-based materials designed to be used just once before disposal, these items encompass grocery bags, water bottles, food packaging, straws, and synthetic cutlery. The concept of sustainable living stands in direct opposition to this throwaway culture. At its core, sustainability requires humans to act as stewards of the Earth, meeting the needs of the present without compromising the ability of future generations to meet theirs. Ditching disposable plastics is not merely a lifestyle trend; it is the absolute foundation of ecological balance.

The Illusion of Recycling
For decades, global consumers operated under the assumption that the convenience of plastic could be mitigated by the simple act of recycling. However, this has proven to be a structural illusion. Data reveals that out of the staggering 500 million tonnes of plastic produced annually, only about 9% to 10% is successfully recycled on a global scale. The remainder is diverted to landfills, incinerated, or leaked



directly into ecosystems.

Because single-use plastics are cheap to manufacture from virgin fossil fuels, the economic incentive to collect and process them is incredibly low. Consequently, the non-use of single-use plastics has shifted from a voluntary eco-friendly preference to a critical imperative. Refusing these items cuts off the supply chain of pollution at the source, transitioning society away from a destructive linear economy (*take, make, waste*) and toward a sustainable, circular economy.

Environmental Impacts of Single-Use Plastics
The environmental legacy of disposable plastics spans centuries, systematically degrading the climate, destroying biodiversity, and infiltrating the human body.

Climate Change and Fossil Fuel Extraction
The lifecycle of single-use plastic is deeply intertwined with global warming. Plastics do not emerge from a vacuum; over 90% are derived from petroleum and natural gas. The environmental degradation begins at the extraction stage via fracking and oil refining, processes that release massive amounts of methane and greenhouse gases.

Carbon Emissions: The plastics industry generates approximately 2.7 billion

tonnes of greenhouse gas emissions per year. It has been ascertained that without immediate intervention, the global plastics sector is projected to consume 20% of total oil production and account for 15% of the global carbon budget by 2050.

End-of-Life Impacts: When plastic waste is incinerated, it releases toxic chemicals and carbon dioxide directly into the atmosphere; when left in landfills, its slow degradation continues to emit trace greenhouse gases for hundreds of years.

Threat to Biodiversity and Marine Ecosystems

Ecosystems across the globe are choking under the weight of mismanaged plastic waste. Every year, roughly 130 million tonnes of plastic enters our air, land, and water. The oceans have become the ultimate destination for this debris, where it inflicts physical and chemical devastation on marine life.

Physical Harm: Over 4,000 species are actively harmed by plastic pollution through entanglement and ingestion. Marine animals like sea turtles mistake plastic bags for jellyfish, leading to intestinal blockages and starvation.

Habitat Destruction: Discarded plastics smother critical habitats. They coat mangrove roots, elevate the transmission of deadly diseases in coral reefs, and ruin nesting sites for shorebirds and turtles.

Economic Toll: The degradation of marine environments is devastating to human economies. The accumulation of plastic in the oceans causes an estimated $500 billion to $2.5 trillion loss in marine ecosystem services every year, crippling global fisheries, coastal tourism, and natural carbon-sequestration sinks.

The Microplastic Peril and Human Toxification

Plastics do not biodegrade in a biological sense; instead, they undergo photodegradation, a process where exposure to sunlight breaks the material down into smaller and smaller fragments. These fragments, measuring less than 5 millimeters, are known as microplastics.

Food Chain Infiltration: Microplastics have permeated every layer of the global food web. They are consumed by zooplankton at the base of the food chain and bioaccumulate up into apex predators and commercial fish stocks. On land, agricultural soils are contaminated by plastic mulch films, which reduces crop yields by 5% to 10%.

Human Exposure: Humans ingest microplastics daily through drinking water, seafood, and even the air we breathe. Studies have successfully detected microplastics in 90% of human blood samples, as well as in lung tissues, livers, kidneys, and the placenta.

Chemical Leaching: The danger is amplified by the chemical additives used to give plastic its flexibility or durability. Carcinogenic compounds and endocrine disruptors (such as bisphenols and phthalates) leach out of these fragments, and are linked to reproductive disorders, immune system suppression, and neurological impairments.

3. Strategies to Avert the Use of Single-Use Plastics

Combating plastic pollution requires a multi-tiered approach that addresses individual habits, community initiatives, corporate accountability, and legislative action.

Individual Consumer Habits and the 4 Rs

The most immediate way to curb plastic pollution is by adopting the framework of the 4 Rs: Reduce, Reuse, Recycle, and Recover, with a fierce emphasis on *Reduction* and *Reuse*. Consumers wield immense power through their daily procurement choices.

Beyond these swaps, shifting consumer habits toward bulk purchasing at zero-waste stores drastically reduces the volume of flexible plastic wrapping brought into the home. Furthermore, consumers can address microplastic pollution by choosing clothing made from natural fibers like cotton, linen, wool, and hemp, which do not shed synthetic microfibers during laundry cycles.

Institutional and Corporate Strategies

While individual choices are crucial, systemic change cannot occur without the active participation of commercial enterprises and institutions. Corporations must move away from linear business models and take structural

responsibility for the entire lifecycle of their products.

Extended Producer Responsibility (EPR): Modern EPR policies legally mandate that manufacturers fund and manage the end-of-life collection and recycling of their packaging. This incentivizes companies to design packaging that is genuinely durable and easy to recycle.

Circular Industrial Design: Progressive brands are investing heavily in innovative material science. This includes partnering with biotech firms to implement advanced enzymatic recycling, which breaks down existing plastics back into their base monomers without degrading material quality.

Material Substitution: Industries are increasingly replacing petroleum plastics with fully certified, home-compostable bio-based materials derived from agricultural waste or seaweed. These alternatives provide the required structural integrity during use but break down naturally without leaving microplastic residues.

Legislative Actions and Global Policy

Voluntary reduction is insufficient to address a crisis of this scale; robust legislative intervention is necessary to level the playing field and enforce cross-border compliance.

Governments worldwide are deploying aggressive legal mechanisms to restrict plastic volumes. A premier template for this is the European Union's Single-Use Plastics Directive (SUPD). The directive implemented absolute market bans on the top ten most common disposable items found on European beaches—including plastic cotton buds, cutlery, plates, and straws.

Additionally, current legislation enforces strict separate collection targets (aiming for 90% collection of plastic beverage bottles by 2029) and mandates that new beverage containers contain at least 25% to 30% recycled content. On a wider scale, international efforts like the Global Plastic Treaty seek to establish legally binding global caps on virgin plastic production, providing a unified regulatory mechanism to close the plastic tap permanently.

Conclusions

The data surrounding the plastic crisis presents a clear ultimatum: humanity cannot maintain its current trajectory of waste generation without permanently destabilizing the biosphere. Global plastic waste generation has risen steadily, climbing to 227 million tons in 2026. Despite incremental improvements in regional waste management, the sheer volume of mismanaged plastic leaking into the environment continues to outpace infrastructure.

Leaving this issue unchecked means letting ecosystems degrade, accelerating climate change, and allowing chemical toxins to accumulate in human tissues. The practice of rejecting single-use plastics is an absolute baseline requirement for preventing ecological collapse.

A Call to Shared Responsibility

Eradicating single-use plastics from daily life requires a shared commitment across all sectors of society. Consumers must discard the culture of hyper-convenience, replacing disposable habits with conscious resource stewardship. Simultaneously, corporations must stop externalizing their environmental costs, investing instead in transparent, circular supply chains and sustainable packaging designs. Finally, governments must enforce strict regulations, remove fossil fuel subsidies, and penalize polluters.

Ultimately, selecting "The Core of Sustainable Living: Saying No to Single-Use Plastics" as an operational life path is a profound statement of values. It represents a collective shift from short-term convenience to long-term intergenerational survival. By systematically stripping single-use plastics out of our homes, workplaces, and economies, we can protect the vitality of our oceans, safeguard human health, and preserve a thriving planet.



Balancing Infrastructural Development in Developing Economies and Biodiversity Conservation: The Way Forward

Introduction

Developing economies face a profound double bind: the urgent imperative to build robust infrastructural frameworks to lift millions out of poverty, contrasted against the equally vital necessity of preserving the global strongholds of biodiversity located within their borders. Historically, infrastructure such as roads, dams, grids, and urban centers has acted as a primary driver of ecological fragmentation, habitat loss, and species extinction. This paper proposes a comprehensive strategic framework to reconcile these seemingly competing objectives. By examining the application of the Mitigation Hierarchy, Spatial Planning Innovations, Sustainable Project Financing, and Community-inclusive Governance, this article provides a blueprint for a nature-positive infrastructure paradigm. The core write up argues that smart, resilient infrastructure and biodiversity conservation are not mutually exclusive, but rather twin pillars necessary for achieving genuine, long-term macroeconomic stability and sustainable development.

The 21st century is witnessing the largest infrastructure expansion in human history, with the vast majority of this growth concentrated in developing economies across the Global South. Driven by rapid urbanization, population growth, and the legitimate pursuit of industrialization, nations in Africa, Asia, and Latin America are racing to close their infrastructural deficits. Roads, railways, hydroelectric dams, deep-water ports, and electrical grids are expanding at an unprecedented rate. These projects are crucial; they are the physical conduits for poverty alleviation, market access, regional integration, and basic human dignity, as articulated in the United Nations Sustainable Development Goals (SDGs).

However, this infrastructural boom directly intersects with the world's most critical biological strongholds. Developing nations host the vast majority of the planet's terrestrial and marine biodiversity, from the Amazon and Congo basins to the mega-diverse ecosystems of the Niger Delta area of Nigeria. Historically, infrastructure development has treated these ecosystems as blank spaces on a map or as minor externalities to be cleared. The consequences have been catastrophic: severe habitat fragmentation, the opening of pristine wilderness to illegal logging and poaching, disrupted hydrological cycles, accelerated species extinction rates and the creation of wildlife corridors.

This creates a systemic crisis. Developing nations cannot afford to halt infrastructure development, yet they cannot survive the long-term economic and ecological fallout of destroying their natural capital. A collapsing ecosystem offers no foundation for sustainable economic growth. Therefore, the central challenge of contemporary development planning is to transcend the outdated twin of development versus conservation. The path forward requires a fundamental shift toward an integrated paradigm: designing, financing, and constructing infrastructure that coexists with, and actively supports, biological systems.

The Ecological Toll of Linear and Point Infrastructure

To craft effective solutions, planners must understand exactly

how infrastructure disrupts ecological systems. Infrastructure typically falls into two categories, both of which pose unique threats to biodiversity if poorly managed.

Linear Infrastructure and Edge Effects

Linear infrastructure such as roads, highways, railways, pipelines, and power transmission lines is particularly destructive due to its geographic footprint. Rather than consuming a single block of land, linear projects cut through vast expanses of contiguous habitat, dividing single ecosystems into smaller, isolated fragments.

The Barrier Effect: Many species possess behavioral aversion to open spaces. A two-lane road can act as an impenetrable barrier to small mammals, amphibians, and insects, effectively isolating populations, restricting gene flow, and leading to localized inbreeding and vulnerability.

Edge Effects: The creation of a road or pipeline corridor alters the microclimate of the adjacent forest. Increased light penetration, wind exposure, and altered humidity levels penetrate hundreds of meters into the forest interior, destroying the microhabitats required by specialized species and facilitating the invasion of exotic, opportunistic species.

Conduits for Exploitation: Perhaps the greatest danger of linear infrastructure is its role as an entry point (corridor). Legal access roads built for logging, mining, or power line maintenance inadvertently provide illegal loggers, poachers, and land speculators with unprecedented access to formerly remote wilderness areas.

Point Infrastructure and Systemic Alterations

Point infrastructure refers to localized developments that cause intensive, concentrated environmental alterations, which can ripple across entire regional ecosystems.

Hydroelectric Dams: While framed as renewable energy sources, large dams permanently alter riverine ecosystems. They disrupt natural flood pulses, block the migratory routes of diadromous fish, trap vital nutrient-rich sediments, and flood thousands of hectares of terrestrial habitats upstream, while starving downstream wetlands of water and nutrients.

Extractive Ports and Industrial Zones: Mega-ports built to facilitate international trade alter coastal dynamics, causing severe marine habitat destruction, destroying mangrove forests and coral reefs through dredging, and introducing acoustic pollution that disrupts marine mammal communication and navigation.

The Strategic Framework: The Mitigation Hierarchy

The foundational operational philosophy for balancing infrastructure and biodiversity is the strict adherence to the Mitigation Hierarchy. This four-tiered framework provides a sequential decision-making process designed to achieve No Net Loss or, ideally, a Net Gain of biodiversity.

Avoidance: The Premise of Zero Impact

Avoidance is the most critical, yet most frequently bypassed, step in the hierarchy. It requires making the deliberate decision to alter the geographic route or location of a project to completely prevent impacts on highly sensitive habitats, such as primary forests, critical wetlands, or key migration corridors. Avoidance must happen during the pre-feasibility and conceptual phases of design before substantial capital is committed. If a road can be rerouted around an ancient elephant migration corridor rather than cutting through it, the long-term conservation and safety benefits outweigh the marginal increase in immediate construction costs.

Minimization: Eco-Sensitive Engineering

When a project cannot completely avoid a sensitive area due to overriding public interest or structural constraints, minimization strategies must be deployed to reduce the severity of the impact. This involves adopting advanced ecological engineering techniques:

Wildlife Crossing Structures: Designing dedicated underpasses, overpasses (ecoducts), and canopy bridges that allow wildlife to safely navigate over or under linear infrastructure.

Footprint Reduction: Using specialized construction methods, such as long-span bridges that cross valleys without placing structural pillars in sensitive riverbeds, or utilizing horizontal directional drilling for pipelines to bypass surface vegetation.

Operational Adjustments: Restricting heavy construction activities during critical species breeding or migration seasons, implementing strict speed limits, and utilizing directional, low-intensity lighting to prevent the disruption of nocturnal wildlife.

Rehabilitation and Restoration

Immediately following the construction phase, project developers must invest in restoring the ecosystems temporarily degraded by construction activities. This includes re-vegetating road embankments, stabilizing exposed soils with native plant species to prevent erosion, removing temporary access tracks, and clearing construction debris from local waterways to allow natural

ecological succession to resume.

Offsetting: The Last Resort

Biodiversity offsets represent measurable conservation outcomes resulting from actions designed to compensate for significant residual, unavoidable adverse impacts arising from project development. Offsets must only be utilized after the first three steps have been fully exhausted. An offset must abide by the principle of ecological equivalence (like-for-like), meaning that if a project destroys 50 hectares of a specific tropical dry forest, the offset must protect or restore at least an equivalent or greater area of the exact same forest type nearby, ensuring its long-term legal protection and management.

Spatial Planning Innovations: Landscape-Scale Governance

The traditional approach to infrastructure planning in developing countries is highly siloed. Ministries of transport, energy, agriculture, and environment rarely coordinate effectively, resulting in fragmented policies and overlapping, conflicting land claims. The way forward requires adopting systemic, landscape-scale planning frameworks.

Strategic Environmental Assessment (SEA)

Unlike traditional Environmental Impact Assessments (EIAs), which evaluate a single, isolated project after its parameters have already been decided, a Strategic Environmental Assessment (SEA) evaluates the cumulative impacts of an entire sector's policies, plans, and programs at a regional or national level. An SEA allows governments to look at the collective impact of building ten proposed dams along a single river basin or a network of five highways across a nation, allowing planners to identify cumulative thresholds beyond which the regional ecosystem will collapse.

Integrated Spatial Planning and Ecological Corridors

Governments must utilize advanced Geographic Information Systems (GIS) and remote sensing data to design national spatial plans that clearly delineate Go and No-Go zones for infrastructure. Crucially, these plans must map out and protect ecological corridors (strips of natural habitat that connect isolated protected areas). By embedding these corridors into the legal framework of national spatial planning, infrastructure can be directed away from these critical biological lifelines, preserving macro-level ecological connectivity across the country.

Financial Architecture: Leveraging Green Capital and Safeguards

Building sustainable infrastructure requires substantial capital, and the financial institutions backing these mega-projects hold massive leverage over how they are executed. Developing economies can tap into trillions of dollars of global institutional capital by aligning their projects with international environmental standards.

Community-Centric Infrastructure and Inclusive Governance

Infrastructure projects in developing economies are frequently top-down initiatives driven by federal governments and multinational conglomerates, often ignoring the local populations living in the targeted regions. Sustainable infrastructure must be community-centric, respecting the rights and leveraging the expertise of Indigenous Peoples and Local Communities (IPLCs).

Free, Prior, and Informed Consent (FPIC)

The legal principle of Free, Prior, and Informed Consent (FPIC) must be strictly applied to all infrastructure projects intersecting with traditional lands. Local communities must be fully informed about the long-term scope, scale, and potential impacts of a project before any construction begins. They must possess the sovereign legal right to give or withhold consent, ensuring that infrastructure development does not result in forced displacements or the destruction of sacred, highly biodiverse cultural landscapes.

Co-Management and Citizen Science

Local communities are the most effective on-the-ground guardians of biodiversity. Infrastructure projects should actively integrate local populations into their long-term operational and monitoring frameworks. By hiring community members to manage wildlife crossings, monitor eDNA in adjacent waterways, and patrol project perimeters against illegal poaching or logging, infrastructure developments can create sustainable, long-term green jobs, turning local communities into active stakeholders in both the economic asset and the surrounding ecosystem.

Sector-Specific Best Practices for the Global South

To operationalize these concepts, developing economies can deploy distinct, field-tested engineering and planning strategies across key infrastructure sectors:

Sustainable Transport: Smart Roads and Railways

Green Linear Infrastructure Design: Shifting from traditional asphalt cutting to elevated highway viaducts and extended tunnels when passing through forested topography. While initially more capital-intensive, this approach drastically reduces the physical footprint, eliminates the barrier effect for land mammals, and prevents soil erosion landslides common in mountainous developing regions.

Under-Canopy Transport Corridors: For railways, optimizing routes to follow pre-existing degraded agricultural lands or utility corridors rather than breaking open new frontiers in intact, primary forests.

Renewable Energy: Eco-Sensitive Grids and Hydropower Run-of-River Hydropower: Moving away from massive mega-dams that create vast reservoirs and shifting toward run-of-river or low-head hydro systems that generate electricity using the natural flow of the river, significantly reducing uphill flooding and allowing for easier implementation of effective fish ladders.

Solar and Wind Site Optimization: Avoiding the clearing of natural forests for solar arrays or wind farms. Instead, steering these renewable energy developments toward degraded agricultural lands, brownfields, or integrating solar panels over existing irrigation canals, which simultaneously reduces water evaporation.

Conclusion: The Way Forward for Sustainable Prosperity

The historical assumption that economic development must come at the direct expense of environmental integrity is an obsolete narrative that developing economies can no longer afford to follow. The way forward does not lie in halting the expansion of the vital roads, grids, and water systems needed to improve human life, nor does it lie in the unchecked exploitation of the remaining pristine ecosystems of the Global South.

The true way forward demands a sophisticated integration of ecological science, advanced spatial planning, strict financial governance, and community empowerment. Developing countries have a unique historical opportunity to leapfrog the archaic, highly destructive development paths taken by industrialized nations in the past. By hardcoding the Mitigation Hierarchy into national laws, utilizing Strategic Environmental Assessments to guide long-term growth, enforcing strict international financial safeguards, and co-managing landscapes with local communities, developing economies can build world-class, resilient infrastructure networks.

Ultimately, protecting biodiversity is not a luxurious luxury reserved for wealthy nations; it is an absolute foundational prerequisite for the economic survival and climate resilience of developing nations. Infrastructure built in harmony with nature secures clean water supplies, mitigates catastrophic landslides, protects agricultural pollinators, and buffers nations against the worst impacts of global climate change. By embracing this nature-positive infrastructure paradigm, developing economies can achieve a sustainable, authentic wealth that endures for generations.





Nature:

Moving from Invisible Capital to Visible Capital

Introduction

For centuries, the global economic engine has run on a profound paradox: it is entirely dependent on the natural world, yet it behaves as if nature does not exist. Every breath of clean air, every drop of clean water, the fertile soils that grow our food, and the stable climate that permits human civilization to thrive are the foundational assets of our existence. In economic terms, these are not mere scenic backdrops; they are the ultimate capital. Yet, on the standard corporate balance sheets and national accounts that dictate global flow of money, this capital has historically shared a single, catastrophic valuation: zero.

This is the phenomenon of Invisible Capital. Because nature's services do not come with an invoice, the market has traditionally treated them as infinite, free, and self-replenishing. We account meticulously for the depreciation of a factory drone, the depletion of a warehouse inventory, or the amortization of software code. Yet, the degradation of the topsoil that feeds us, the collapse of marine ecosystems that sustain coastal economies, and the destruction of forests that regulate the global water cycle are completely omitted from the ledger. We treat the liquidation of our planet's biological plumbing as income rather than the catastrophic drawdown of capital it truly is.

The consequences of this invisibility are no longer theoretical or distant. They are actively manifesting as systemic risks; supply chain failures, unprecedented insurance losses, runaway climate feedback loops, and accelerating biodiversity collapse. The old economic model, built on the assumption that nature is an infinite externality, is hitting a hard planetary ceiling.

This write up explores the necessary structural, philosophical, and economic migration currently underway: the journey from treating nature as **Invisible Capital** to recognizing, measuring, and valuing it as **Visible Capital**. Making nature visible is not a mere bureaucratic or accounting exercise. It is the defining paradigm shift of the 21st century—a fundamental rewriting of value that will determine whether human civilization can successfully align its economic incentives with the biological realities of the earth.

What is Natural Capital?

To transform nature from an abstract concept into visible capital, we must first break down what it actually does for the economy. Economists and ecologists categorize these contributions into ecosystem services, which fall into four main buckets:

Provisioning Services: These are the physical goods directly harvested from ecosystems. They include timber, clean fresh water, wild fish, medicinal plants, and agricultural crops. They are the easiest to value because they pass through markets, yet their underlying infrastructure (the ecosystem itself) remains unpriced.

Regulating Services: These are the invisible hands that keep the environment stable. They include the carbon sequestration of forests, the flood mitigation of wetlands, the crop pollination of wild insects, and the water filtration of healthy soils. Without these, the costs of artificial replication are staggering.

Supporting Services: These are the deep, underlying biological

processes that make all other life possible. Examples include nutrient cycling, soil formation, and primary production by plants via photosynthesis. They form the bedrock of the entire biosphere.
Cultural Services: These are the non-material benefits that enrich human life, spanning recreation, tourism, mental well-being, and spiritual connections to landscapes.

The Illusion of Abundance
Why did standard economics fail to see these critical systems? The answer lies in the history of industrialization. When modern economic theory was formulated during the Industrial Revolution, human populations were relatively small, and natural resources appeared practically infinite. The limiting factors to economic growth were human labor and manufactured machinery. Therefore, capital was defined strictly as human-made assets—factories, roads, and financial reserves.

Because nature was abundant, it had no marginal price. An economy only values scarcity. If clean water is abundant everywhere, its price is zero, regardless of how essential it is to survival. This created a profound cognitive distortion: the more we exploited nature, the wealthier we appeared, because we were converting the so called free natural resources into priced commercial commodities. The underlying engine of life was taken for granted, creating an illusion of endless abundance that persists in our market designs today.

The Tragedy of the Horizon
Compounding this illusion is a systemic temporal mismatch known as the Tragedy of the Horizon. The financial markets operate on exceptionally compressed timelines. Corporate earnings are judged quarterly; venture capital horizons span three to seven years; political cycles last two to five years.

Ecological systems, conversely, operate on decadal, centennial, or millennial horizons. A primary forest takes centuries to develop its complex biodiversity and carbon-storing capacity. An aquifer may take thousands of years to fill. When short-term financial incentives are applied to long-term ecological assets, the market invariably chooses immediate liquidation over long-term preservation. A standing forest yields no quarterly dividends; a logged forest produces immediate cash flow. This structural blindness forces rational actors to make ecologically suicidal decisions because the economic clock is ticking too fast to see the slow, catastrophic drawdown of natural wealth.

The Mechanics of Invisibility
GDP and Its Limitations
The primary metric by which global progress and national success are measured is Gross Domestic Product (GDP). Invented by Simon Kuznets in the 1930s as a tool to measure wartime production capacity, GDP calculates the total monetary value of all finished goods and services produced within a country's borders over a specific time period. Kuznets himself explicitly warned that the welfare of a nation could scarcely be inferred from a measure of national income. Yet, global policy has elevated GDP to the ultimate metric of human advancement.

GDP is fundamentally blind to asset depreciation when those assets belong to the earth. For example, if a nation clear-cuts an ancient, biodiverse rainforest, processes the timber, and exports it, its GDP goes up. The immediate financial transaction is recorded as a positive economic gain.

However, GDP completely fails to register the hidden negative side of the ledger: the permanent loss of water filtration, the destruction of ecotourism potential, the release of stored carbon, and the erasure of biodiversity. In standard national accounting, a country can completely liquidate its natural asset base and appear to be getting wealthier, right up until the moment of total systemic collapse. It is equivalent to a business executive selling off all the company's factory machinery and office buildings, registering the cash injection as pure profit, and declaring a record-breaking financial year.

The Challenges of Externalities
In classical economics, when an action by a producer or consumer inflicts costs on a third party without financial compensation, that cost is labeled an externality. Because the market fails to price these impacts, they sit entirely outside the financial decision-making process.

Consider a chemical factory situated upstream from an agricultural community. The factory dumps untreated waste into the river because doing so is the cheapest disposal method, thereby maximizing its internal corporate profits. The downstream farmers suffer reduced crop yields, and the local government must build an expensive water treatment plant funded by taxpayers.
In this scenario, the factory has successfully externalized its production costs onto society and the ecosystem. The market does not punish the factory; instead, it rewards it with higher margins and competitive advantages over cleaner competitors. By treating environmental degradation as a side effect rather than a core cost of doing business, the economic system systematically incentivizes the destruction of shared biological wealth.

Subsidizing Destruction

The market's blindness is not merely passive; it is actively weaponized through perverse government subsidies. Globally, trillions of dollars of public money are deployed annually to artificially lower the cost of resource extraction and environmental harm.

In industrial agriculture, subsidies frequently encourage the over application of chemical fertilizers and synthetic pesticides, which destroy topsoil microbiology and create massive oceanic dead zones through chemical runoff. In the fishing industry, capacity-enhancing subsidies fund massive, deep-sea trawlers that clear-cut ocean floors and decimate global fish stocks that would otherwise be economically unviable to target. These public interventions distort market signals, making it highly profitable to destroy natural capital and financially prohibitive to protect it.

The Turning Point: Why Visibility Can No Longer Wait

Systemic Financial Risks

The wall separating the economy from ecology has collapsed. Financial institutions are realizing that natural capital degradation is no longer just an ethical or environmental concern but a material risk to financial stability. The World Economic Forum continuously ranks biodiversity loss and ecosystem collapse among the top global risks by severity.

Consider the agricultural sector. Over 75% of global food crop types rely, at least in part, on animal pollination. The rapid decline of wild pollinator populations due to habitat loss and pesticide use threatens hundreds of billions of dollars in annual crop output.



Similarly, the insurance industry is facing an existential crisis. As wetlands are paved over, their natural ability to absorb storm surges disappears, causing property damage from floods to skyrocket. When nature loses its resilience, the frequency and severity of insurance claims break traditional actuarial models, threatening to make vast geographic regions completely uninsurable.

The Regulatory Shift

Governments and international bodies are stepping in to force visibility through compliance. The most significant development is the Taskforce on Nature-related Financial Disclosures (TNFD). Modeling itself after the successful climate-focused TCFD, the TNFD provides organizations with a standardized framework to report and act on evolving nature-related dependencies, impacts, risks, and opportunities.

Evolution of Global Sustainability Disclosure Framework

Under these frameworks, large corporations are increasingly required to map their entire supply chains to identify where they depend on vulnerable ecosystems and where their operations are actively destroying natural capital. The European Union's Corporate Sustainability Reporting Directive (CSRD) codifies this via the concept of double materiality: companies must report not only how environmental changes financially impact their business, but also how their business impacts the broader environment.

Consumer and Investor Awakening

Concurrently, the allocation of global investment capital is undergoing a generational shift. Institutional investors that are managing pension funds, endowments, and sovereign wealth are facing pressure to align portfolios with planetary boundaries. The rise of ESG (Environmental, Social, and Governance) investing, despite political friction, has fundamentally altered corporate behavior.

Asset managers are recognizing that companies with high negative impacts on nature face immense regulatory, legal, and reputational liabilities. A consumer brand caught sourcing palm oil from illegally deforested land faces immediate activist backlash, supply chain disruption, and divestment by major funds. The modern consumer, particularly younger demographics, increasingly demands transparency, turning nature-positivity into a vital competitive advantage for global brands.

Making Capital Visible: Tools, Metrics, and Frameworks

Natural Capital Accounting (NCA)

To manage what we measure, we must change how we measure. Natural Capital Accounting (NCA) is the systematic process of organizing data on biophysical stocks and flows of natural resources into financial structures. The gold standard for this methodology is the United Nations' System of Environmental-Economic Accounting (SEEA).

Unlike GDP, which only tracks monetary flows, the SEEA framework tracks both the physical extent and the qualitative condition of ecosystems over time. It documents how much forest, wetland, or clean water a nation possesses, monitors whether those assets are improving or degrading, and links that data directly to national economic planning. When integrated into national accounts, NCA allows policy makers to see the true trade-offs of economic development, ensuring that increases in manufactured capital do not come at the cost of catastrophic declines in natural assets.

The Commodification of Nature

One of the most controversial aspects of making natural capital visible is valuation assigning a specific monetary value to an ecosystem or species. Economists use several sophisticated methodologies to achieve this:

Replacement Cost Method: Calculating what it would cost to build artificial infrastructure to replace a service provided by nature. For instance, valuing a watershed by calculating the construction and operational costs of a technological water filtration plant of equivalent capacity.

Hedonic Pricing: Analyzing variations in market prices to value environmental attributes. For example, comparing the market value of real estate adjacent to a clean, preserved public park versus identical housing near an industrial wasteland.

Contingent Valuation: Utilizing structured surveys to estimate the public's Willingness to Pay (WTP) to preserve a specific ecological asset, or their Willingness to Accept (WTA) compensation for its loss.

This monetization strategy triggers fierce ethical debates. Critics argue that placing a price tag on nature commodifies the sacred, reducing the intrinsic value of ancient ecosystems to mere line items in a capitalist framework. They worry that if a forest's financial value as timber exceeds its calculated value as a water filter, the system will still dictate its destruction.

Proponents, however, offer a pragmatic counter-argument: in a global market economy, if an asset has no price, its operational price is treated as zero. Monetization is not about reducing nature to money; it is about using the language of the modern financial system to halt its blind destruction until a deeper cultural shift occurs.

The Role of Technology

The transition to visible capital is being supercharged by the digital revolution. Historically, tracking the health of a remote ecosystem was labor-intensive, expensive, and logistically challenging. Today, an interconnected suite of advanced technologies provides unprecedented transparency:

Satellite Imagery & Remote Sensing: Constellations of micro-satellites monitor global deforestation, localized pollution, and ocean temperatures in real time, exposing illegal extraction instantly.

Environmental DNA (eDNA): By analyzing a single bucket of water or sample of soil, scientists can sequence the genetic material left behind by wildlife, mapping the entire biodiversity profile of an ecosystem rapidly without intrusive tracking.

AI and Machine Learning: Advanced algorithms process massive streams of climate data, identifying subtle ecological degradation patterns long before they become visible to the human eye.

Blockchain & Smart Contracts: Distributed ledgers secure carbon and biodiversity credits, preventing double-counting, ensuring radical transparency, and automatically distributing funds to local conservationists when verifiable ecological milestones are hit.

Visible Capital in Action

Biodiversity Credits and Offsets

As natural capital becomes visible, new markets are emerging to trade it. The most prominent instruments are carbon credits and biodiversity credits. While carbon markets focus specifically on greenhouse gas mitigation, biodiversity markets seek to fund the broader restoration and protection of entire ecosystems.

However, these financial instruments are highly vulnerable to greenwashing. In many carbon offset schemes, corporations have purchased cheap credits from poorly managed or non-additional projects—schemes that protect forests that were never actually at risk of being cut down—allowing them to claim "net-zero" status while continuing to pollute.

To prevent these failures, the next generation of biodiversity markets requires strict verification protocols, ensuring that credits are only issued for long-term ecological gains verified by independent field data.

Regenerative Business Models
The ultimate goal of visible capital is the transition to a nature-positive economy (an economic system where businesses generate profit by actively improving, rather than depleting, the environment).

In agriculture, this is manifested as regenerative farming. By avoiding synthetic chemicals, utilizing diverse cover crops, and practicing rotational grazing, regenerative farmers restore the soil microbiome, increase water retention, and sequester carbon. Crucially, these practices lower input costs and increase resilience against extreme weather, proving that ecological restoration can be highly profitable.

In corporate supply chains, companies like Patagonia and Natura have built global brands by intentionally structuring their sourcing to support standing forests and indigenous communities, proving that corporate success can be directly tethered to the health of the biosphere.

Sovereign Wealth and Green Finance
Nations are also pioneering macro-financial innovations to protect their natural assets. One of the most effective tools is the debt-for-nature swap. In these arrangements, a developing nation's external debt is restructured or bought out by international organizations or commercial banks at a discount. In exchange, the country commits the resulting financial savings directly to funding domestic marine or terrestrial conservation projects.

Furthermore, the issuance of sovereign green bonds allows countries to raise capital directly from global investors to fund large-scale environmental infrastructure, renewable energy deployment, and ecosystem restoration projects. By linking a nation's sovereign creditworthiness to its stewardship of its natural assets, global finance is beginning to treat healthy ecosystems as the ultimate security.

Conclusion
As we stand at this historical crossroads, it is vital to recognize that making natural capital visible is not merely a technical exercise in resource accounting or currency creation. The ultimate limitation of economics is that it struggles to value things that are truly priceless. A monetary figure placed on a coral reef or an old-growth forest is always a conservative, imperfect understatement.
The true purpose of visible capital frameworks is to build a bridge. They translate the infinite, complex, and vital values of the living earth into a structured language that the current global economic operating system can comprehend, respect, and react to before it is too late.
Moving from invisible to visible capital represents the maturation of human civilization. It requires us to abandon the childish illusion that we are separate from nature, or that our economy can grow infinitely inside a dying biosphere.
By restructuring our national metrics, enforcing corporate transparency, eliminating destructive subsidies, and scaling nature-positive markets, we can build an economy where the protection of the earth is the highest point of leverage for financial success. The future belongs to an economic paradigm that values the planet not for its liquidated parts, but for its living, breathing, and beautiful whole.



The Contribution of Multilateral Environmental Agreements to the Growth of Sustainability



Introduction

This article provides a comprehensive evaluation of how Multilateral Environmental Agreements (MEAs) have catalysed, structured, and accelerated the global growth of sustainability. By examining core frameworks such as the Montreal Protocol, the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and the Basel, Rotterdam, and Stockholm Conventions, this paper illuminates the evolution of international environmental law from reactive, transboundary issue-management to a proactive, holistic paradigm of sustainable development. The article analyzes the institutional mechanisms through which MEAs drive change: technology transfer, financial environment (e.g., the Global Environment Facility and the Green Climate Fund), compliance regimes, and the domestic internalization of international norms. Furthermore, it addresses critical contemporary challenges, including fragmentation, enforcement deficits, and geopolitical friction, before proposing a strategic framework for the future optimization of MEAs within the context of the 2030 Agenda and beyond.

The concept of sustainability, while deeply rooted in indigenous resource management systems and early conservationist philosophies, underwent a fundamental institutional transformation in the latter half of the twentieth century. The catalyst for this transformation was the recognition that ecological degradation does not respect Westphalian sovereignty. Transboundary acid rain, industrial marine pollution, the depletion of the stratospheric ozone layer, and the systemic destabilization of the global climate system demonstrated that localized environmental management was structurally insufficient.

The baseline for modern global environmental governance was established at the 1972 United Nations Conference on the Human Environment in Stockholm. The Stockholm Declaration explicitly connected economic development with environmental degradation, laying the conceptual groundwork for what would later be formalized as sustainable development by the Brundtland Commission in its seminal 1987 report, “Our Common Future”. The report defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

To operationalize this definition on a global scale, the international community increasingly relied on Multilateral Environmental Agreements (MEAs). MEAs are legally binding treaties between three or more states that instrumentally govern human interactions with the natural world. From the 1992 Rio Earth Summit onward, MEAs transitioned from narrow, sector-specific conservation pacts into comprehensive frameworks designed to balance macroeconomic development with ecological preservation and social equity. This article argues that MEAs have been the primary institutional architects of the growth of global sustainability, embedding ecological boundaries into domestic legal frameworks, corporate behavior, and international financial systems.

Framework for Better



Understanding

To understand how MEAs contribute to the growth of sustainability, one must analyze them through the lenses of international relations (IR) theory and international legal philosophy. The efficacy and structure of MEAs are illuminated by three primary schools of thought:

Liberal Institutionalism

Liberal institutionalists argue that the international system, while anarchic, can achieve meaningful cooperation through the establishment of regimes. MEAs act as formal regimes that reduce transaction costs, alleviate information asymmetry, and mitigate the Tragedy of the Commons. By establishing clear rules, monitoring mechanisms, and iterative negotiating forums (Conferences of the Parties, or COPs), MEAs create stable expectations of reciprocity. This stability encourages states to invest in long-term sustainability initiatives without fearing that their geopolitical competitors will free-ride on their ecological restraints.

Constructivism and Norm Dynamics

Constructivist scholars emphasize the role of identity, norms, and ideas in shaping state behavior. From this perspective, MEAs are not merely utility-maximizing contracts; they are sites of norm generation and socialization. MEAs redefine what constitutes a responsible state. Concepts such as the Precautionary Principle, the Polluter Pays Principle, and Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC) originated within international discourse and MEA negotiations. Over time, these principles have been internalized by states, altering their national identities and domestic policy priorities, making sustainability a core component of state legitimacy.

Domestic Transnational Legal Process

The mechanism through which an MEA alters actual physical environments is often domestic internalization. As conceptualized by legal scholar Harold Koh, the transnational legal process involves an iterative interaction where international norms are debated, interpreted, and eventually integrated into domestic legal systems through judicial decisions, executive regulations, or legislative acts. MEAs act as the authoritative source text for domestic environmental law. Without the international mandate provided by an MEA, domestic environmental agencies often lack the political leverage required to pass stringent regulations against entrenched industrial interests.

Case Studies of PIVOTAL MEAs and Their Structural Impacts

| Multilateral Environmental Agreement (MEA) | Core Focus Area | Primary Legal Innovation / Mechanism | Direct Contribution to Sustainability |

Montreal Protocol (1987) - Stratospheric Ozone Protection; Phase-out schedules; Multilateral Fund; Trade sanctions; Complete eradication of 99% of ODS; dual climate benefit via GHG reductions.

UNFCCC Paris Agreement (2015) - Climate Change Mitigation & Adaptation; Nationally Determined Contributions (NDCs); Enhanced Transparency Framework; Mainstreamed Net-Zero targets; restructured global energy finance markets.

Convention on Biological Diversity (CBD) - Biodiversity & Genetic Resources; Access and Benefit-Sharing (Nagoya); Kunming-Montreal Framework; Set 30x30 conservation targets; integrated ecological accounting into GDP frameworks.

Basel, Rotterdam, & Stockholm Conventions- Hazardous Chemicals & Waste Management; Prior Informed Consent (PIC); elimination of POPs; transboundary movement tracking; Established lifecycle management of industrial toxins; drove green chemistry.

The Montreal Protocol: The Gold Standard of Environmental

Cooperation

Adopted in 1987, the Montreal Protocol on Substances that Deplete the Ozone Layer is universally acknowledged as the most successful MEA in history. Faced with definitive scientific proof that chlorofluorocarbons (CFCs) and other ozone-depleting substances (ODS) were destroying the stratosphere, the international community designed a legally binding framework with universal ratification.

The structural innovations of the Montreal Protocol were manifold. First, it utilized a dynamic, science-led adjustment mechanism that allowed phase-out schedules to be accelerated based on updated assessments by the Technology and Economic Assessment Panel (TEAP), without requiring a full re-ratification of the treaty by member states. Second, it addressed global inequity through the creation of the Multilateral Fund for the Implementation of the Montreal Protocol, which covered the incremental compliance costs of developing nations (Article 5 countries).

The contribution of the Montreal Protocol to sustainability is quantifiable and profound. It has successfully phased out more than 99% of controlled ODS. Models indicate that without the treaty, global skin cancer cases would have skyrocketed, and global agricultural yields would have collapsed due to intense ultraviolet radiation. Furthermore, because many ODS are also potent greenhouse gases, the Montreal Protocol avoided an estimated 135 billion metric tons of carbon dioxide equivalent emissions, making it one of the most effective historical drivers of climate change mitigation.

The UNFCCC and the Paris Agreement: Decentralized Global Transformation

The United Nations Framework Convention on Climate Change (UNFCCC), signed at the Rio Earth Summit in 1992, established the foundational architecture for global climate governance. Its early iterative step, the Kyoto Protocol (1997), attempted a top-down, legally binding emissions reduction model for developed countries. However, this approach suffered from structural rigidities and geopolitical friction, ultimately leading to the architecture of the Paris Agreement in 2015.

The Paris Agreement fundamentally inverted the Kyoto paradigm by introducing a hybrid model combining top-down long-term goals with bottom-up implementation instruments known as Nationally Determined Contributions (NDCs). Under Article 4 of the Paris Agreement, every party is legally required to prepare, communicate, and maintain successive NDCs that reflect its highest possible ambition. While the targets themselves are not strictly legally enforceable under international law, the process of reporting, monitoring, and updating them through the Enhanced Transparency Framework (ETF) and the Global Stocktake is mandatory.

The Paris Agreement has altered the trajectory of global macroeconomics, driving the growth of sustainability through several channels:

1. Market Signalling: By establishing a clear target to limit global warming to well below 2°C, and preferably 1.5°C above pre-industrial levels, the Paris Agreement sent an unequivocal signal to global capital markets. It effectively institutionalized the inevitable obsolescence of fossil-fuel-reliant business models.

2. Corporate Realignment: The agreement gave rise to private sector compliance architectures, such as the Science Based Targets initiative (SBTi) and the Task Force on Climate-related Financial Disclosures (TCFD), which translate international climate targets into corporate operational metrics.

3. Policy Proliferation: As of 2026, the vast majority of global GDP is covered by national net-zero targets established in direct alignment with the Paris Agreement's long-term objectives.

The Convention on Biological Diversity (CBD)

While the UNFCCC governs the atmospheric commons, the Convention on Biological Diversity (CBD) governs the biosphere. Opened for signature in 1992, the CBD outlines three overarching goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the utilization of genetic resources.

Historically, the CBD struggled with political marginalization compared to its climate counterpart. However, the adoption of the Kunming-Montreal Global Biodiversity Framework (GBF) in 2022 marked a historic turning point. The GBF established 23 action-oriented targets for 2030, most notably Target 3 (the 30x30 initiative), which commits the international community to protect at least 30% of the world's terrestrial, inland water, coastal, and marine areas through effectively managed, ecologically representative protected areas.

The CBD's primary contribution to the growth of sustainability lies in its paradigm shift regarding economic valuation. Through supplementary treaties like the Nagoya Protocol on Access and Benefit-Sharing, the CBD transformed biodiversity from a free economic externality into a highly regulated global asset class. It legally mandates that multinational corporations, particularly biotechnology and

pharmaceutical firms, compensate countries of origin and indigenous communities when utilizing genetic resources. This mechanism bridges the gap between environmental preservation, social justice, and economic sustainability.

The BRS Conventions

The management of hazardous chemicals and wastes represents a critical pillar of environmental sustainability, governed by an integrated triad known as the BRS Conventions:

The Basel Convention (1989): Regulates the transboundary movements of hazardous wastes and their disposal, preventing developed nations from using developing countries as unregulated industrial dumping grounds.

The Rotterdam Convention (1998): Establishes the Prior Informed Consent (PIC) procedure for certain hazardous chemicals and pesticides in international trade, ensuring importing states have the technical capacity and agency to reject toxic materials.

The Stockholm Convention (2001): Aims to eliminate or restrict the production and use of Persistent Organic Pollutants (POPs) highly dangerous chemicals that bioaccumulate through the food chain, persist in the environment, and travel vast distances.

Together, the BRS Conventions have fundamentally altered the landscape of industrial chemistry and waste management. They forced the transition away from "end-of-pipe" pollution control toward a holistic, lifecycle-based asset management approach. By restricting toxic inputs and mandating environmentally sound disposal practices, these treaties provided the regulatory impetus for the growth of the circular economy and green chemistry.

Mechanisms of Action: How MEAs Catalyse Structural Change

MEAs do not merely articulate aspirational goals; they employ specific, functional mechanisms that systematically drive the growth of sustainability across legal, financial, and technological landscapes.

Financial Architectures and Resource Mobilization

One of the most concrete contributions of MEAs is the creation of specialized international financial mechanisms designed to distribute capital from wealthy nations to developing economies. The Global Environment Facility (GEF) operates as a financial mechanism for five major MEAs, including the CBD, UNFCCC, and the Stockholm Convention. Since its inception, the GEF has allocated tens of billions of dollars in direct grants and co-financing for projects targeting biodiversity loss, climate change, land degradation, and international waters.

Similarly, the UNFCCC's Green Climate Fund (GCF) stands as the largest dedicated fund helping developing nations reduce their greenhouse gas emissions and enhance their adaptive capacity. These financial institutions reduce the capital risks associated with green infrastructure investments in emerging economies. By funding renewable energy deployment, climate-resilient agriculture, and marine sanctuary enforcement, MEA-linked financial architectures convert abstract international commitments into tangible local sustainability projects.

Technology Transfer and Capacity Building

The structural divide between the Global North and the Global South often manifests as a technological gap. Developing countries frequently lack the proprietary technologies required to bypass carbon-intensive or ecologically destructive stages of industrialization. MEAs systematically address this through codified mandates for technology transfer.

For instance, the Climate Technology Centre and Network (CTCN), the operational arm of the UNFCCC Technology Mechanism, facilitates the transfer of environmentally sound technologies for low-carbon and climate-resilient development. Under the Montreal Protocol, technical assessment panels directly shared engineering schematics and chemical formulations for alternative refrigerants. By neutralizing intellectual property barriers and funding local technical training, MEAs ensure that sustainability is not an exclusive luxury of wealthy states, but an accessible developmental path for all.

Domestic Regulatory Harmonization and the Level Playing Field

In a globalized marketplace, corporations frequently exploit regulatory discrepancies between countries, leading to a phenomenon known as the race to the bottom, where jurisdictions lower environmental standards to attract foreign investment. MEAs counteract this dynamic by establishing uniform international standards, effectively harmonizing regulatory frameworks across boundaries.

When a state ratifies an MEA, it commits to translating those international obligations into national statutory law. For example, compliance with the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) requires states to enact domestic legislation penalizing the possession or trade of protected specimens. As these laws proliferate globally, they create a standardized, predictable operational environment for

multinational corporations. By imposing a uniform baseline of ecological compliance, MEAs establish a level playing field where sustainable corporate operations are no longer penalized by unfair competition from unregulated actors.

Critical Challenges and Institutional Limitations

Despite their historical successes, the current regime of MEAs faces existential pressures that threaten to limit their future contribution to sustainability. To ensure their long-term viability, these structural deficits must be candidly diagnosed.

Fragmentation and Overlap

The historical evolution of global environmental governance has been ad-hoc, resulting in a highly fragmented architecture. Today, there are hundreds of distinct MEAs, each with its own independent secretariat, governance body (COP), and reporting requirements. This institutional fragmentation often leads to bureaucratic silos, policy contradictions, and operational inefficiencies.

For example, a reforestation project designed to maximize carbon sequestration under the UNFCCC could inadvertently introduce monoculture plantations of non-native species, undermining the biodiversity conservation mandates of the CBD. Furthermore, developing states frequently suffer from treaty fatigue, where their administrative agencies are overwhelmed by the overlapping, complex reporting requirements of multiple independent secretariats, diverting scarce resources away from actual implementation and enforcement.

Enforcement and Compliance Deficits

The fundamental limitation of international law remains its enforcement mechanism. Unlike domestic legal systems, which possess centralized enforcement apparatuses, the international system relies on state consent and peer pressure. Many MEAs lack hard coercive mechanisms to punish non-compliance.

The Paris Agreement's compliance committee, established under Article 15, is explicitly designed to be facilitative, non-adversarial, and non-punitive. While this collaborative design maximizes state participation, it leaves the treaty vulnerable to political volatility or domestic shifts in priorities. When states consistently fail to meet their self-defined NDCs without facing tangible legal or economic repercussions, the overall integrity and efficacy of the agreement are diminished.

Geopolitical Polarization and Equity Grievances

The trajectory of MEA negotiations is increasingly entangled with broader geopolitical tensions and long-standing North-South equity disputes. Developing nations argue that the historic accumulation of greenhouse gases and ecological degradation was driven overwhelmingly by the industrialization of the Global North, yet the catastrophic consequences are borne disproportionately by the Global South.

Promises of financial assistance such as the landmark commitment by developed nations to mobilize $100 billion per year in climate finance have historically been plagued by delays, accounting disputes, and structural deficits. This lack of financial follow-through has severely eroded trust within MEA negotiating rooms. As geopolitical competition intensifies, the consensus-based decision-making model of many MEAs risks gridlock, stalling the ambitious policy leaps required to address compounding ecological tipping points.

Strategic Imperatives for the Future of Environmental Governance

To maximize the contribution of MEAs to the growth of global sustainability in the decades ahead, the international community must transition from a model of fragmented management to one of integrated, resilient governance.

Enhancing Synergy Through Institutional Integration

The secretariats of major MEAs must systematically break down their institutional silos. The model demonstrated by the BRS Conventions which share a joint secretariat and hold back-to-back COPs should be adapted for the broader climate-biodiversity nexus. Future COPs for the UNFCCC and the CBD should be strategically aligned to develop co-beneficial frameworks, such as scaling up Nature-based Solutions (NbS) that simultaneously maximize carbon storage and restore degraded native ecosystems.

Strengthening Trade-Linked Compliance Regimes

To overcome the enforcement deficit, future environmental governance must explore the integration of MEA targets into international trade frameworks. A primary contemporary example is the deployment of Carbon Border Adjustment Mechanisms (CBAM). By placing a carbon tariff on carbon-intensive imports from countries without adequate climate policies, trade-linked compliance regimes use economic incentives to protect sustainable domestic industries while encouraging trading partners to rapidly align with international environmental standards.

Elevating Non-State Actors and Polycentric Governance

The traditional, state-centric model of international law must be permanently expanded to embrace a polycentric governance



paradigm. Subnational governments (cities and states), indigenous communities, corporate leaders, and civil society organizations are no longer peripheral observers; they are critical implementation engines. MEAs must formalize institutional pathways that allow these non-state actors to directly participate in compliance tracking, project execution, and policy innovation. Indigenous peoples, who steward over 80% of the world's remaining biodiversity, must be given central, recognized leadership roles in the implementation of frameworks like the CBD's 30x30 target.

Conclusion

Multilateral Environmental Agreements have served as the foundational infrastructure for the global growth of sustainability over the past five decades. From the historic success of the Montreal Protocol in sealing the ozone layer to the comprehensive economic restructuring driven by the Paris Agreement and the Kunming-Montreal Global Biodiversity Framework, MEAs have successfully transformed abstract ethical concerns into binding legal principles, financial resources, and technological realities.

While structural challenges like institutional fragmentation, enforcement deficits, and deep-seated geopolitical equity disputes persist, they do not invalidate the foundational utility of the MEA model. Instead, they underscore the urgent necessity for structural evolution. By strengthening institutional synergies, integrating trade-based compliance incentives, and embracing a polycentric governance model that empowers non-state actors, the international community can ensure that MEAs remain resilient, dynamic instruments capable of safeguarding the biosphere and fostering sustainable development for generations to come.



The Sixth Mass Extinction is Here: A CALL TO ACTION

Introduction

Planet Earth is quietly growing quieter. Across the globe, the dawn chorus of birds is thinning out, insects are vanishing from windshields, and coral reefs are bleaching into skeletal white ruins. This is not a slow, natural shift playing out over millions of years. It is a rapid, structural collapse of the global tree of life. Scientists now confirm that the Sixth Mass Extinction is no longer a distant warning. It is happening right now before our very eyes.

Historically, five catastrophic events have reshaped life on Earth. The most famous occurred roughly 66 million years ago, when an asteroid impact wiped out the dinosaurs. Today, the driver of the crisis is not an unguided space rock or a sudden volcanic eruption. The modern driver is human activity. Through deforestation, pollution, overexploitation, and climate change, humanity is wiping out species at up to 1,000 times the natural background rate. This structural collapse of biodiversity is an existential threat to the stability of human civilization.

Understanding the Anthropocene

Geologists and ecologists refer to our current epoch as the Anthropocene (the age where human activity is the dominant force shaping Earth's climate and environment). Unlike past extinctions, which were caused by physical planetary shifts, this crisis stems directly from global industrial systems.

According to data from the International Union for Conservation of Nature (IUCN) Red List, more than 45,000 species are currently threatened with extinction. This includes: 41% of all amphibians, 26% of all mammals, 12% of all birds and 37% of all sharks and rays

This crisis is not just about losing specific, high-profile animals like the Black Rhino or the Bengal Tiger. It involves the widespread collapse of entire biological populations. The World Wildlife Fund's Living Planet Index shows an average 73% decline in monitored wildlife populations between 1970 and 2020. This systemic loss across species groups signals deep imbalances in the ecosystems that keep us alive.

The Five Drivers of the Anthropocene Extinction

To address the crisis, we must first understand the five interconnected drivers behind it, as outlined by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES):

1. Habitat Loss and Ecosystem Fragmentation

The single greatest driver of biodiversity loss is how we use land. To feed and house billions of people, humans have cleared half of the world's habitable land, largely for agriculture and livestock. When a tropical rainforest is cleared for palm oil or cattle ranching, it does not just push animals out, it also destroys a complex web of life. The remaining natural spaces are left fragmented, isolated like islands in a sea of concrete and farmland. This leaves wildlife populations unable to migrate, find mates, or adapt to changing environments.

2. Overexploitation and Wildlife Trafficking

Humanity consumes resources far faster than Earth can naturally replenish them. Global industrial fishing fleets have depleted over a third of the world's fish stocks, leaving marine food chains close to

collapse. On land, the illegal wildlife trade driven by demands for exotic pets, traditional medicines, and luxury goods has pushed species like pangolins and elephants to the brink.

3. Anthropogenic Climate Change
Climate change acts as a threat multiplier, making existing environmental issues worse. As greenhouse gases trap heat in the atmosphere, global temperatures are rising at an unprecedented rate. Species are being forced to move toward the poles or higher up mountains in search of cooler climates. Those that cannot move fast enough, or have nowhere left to go, face extinction. In our oceans, rising temperatures and increased acidity have devastated coral reefs, which support a quarter of all marine life.

4. Environmental Pollution and Toxic Runoff
From deep ocean trenches to the high Arctic, human pollution has reached every corner of the planet. Micro-plastics are now found throughout the global food chain, causing developmental and reproductive issues in wildlife. Synthetic pesticides and agricultural runoff create massive dead zones (sections with no evidence of life) in our rivers and oceans, stripping the water of oxygen and killing off marine life.

5. Invasive Species and Biological Disruption
Global trade and travel have accidentally or deliberately introduced species into environments where they don't belong. Free from their natural predators, these invasive species can outcompete, prey upon, or infect native wildlife. For example, the accidental spread of the chytrid fungus through international trade has caused the decline or extinction of over 500 amphibian species worldwide, making it one of the worst biological invasions in recorded history.

Why Biodiversity Loss Matters to Human Survival
Many view wildlife conservation as a purely ethical or aesthetic concern (a desire to protect beautiful animals for future generations). However, biodiversity is actually the foundational infrastructure supporting human civilization. When we erode this biological foundation, we directly threaten our own survival systems.

The Collapse of Ecosystem Services
Ecosystem services are the natural processes that make human life possible, free of charge. They include:
Pollination: Over 75% of global food crops rely on wild pollinators like bees, butterflies, and bats. The ongoing decline of insect populations threatens global food security and agricultural economies.
Water Purification: Healthy wetlands, forests, and soil act as natural filtration systems, cleaning our water and managing floods.
Carbon Sequestration: Forests, oceans, and peatlands absorb massive amounts of carbon dioxide from the atmosphere, serving as our primary natural defense against runaway climate change.

The Rise of Zoonotic Diseases
As humans, clear wild lands and fragment natural habitats, we force wildlife into closer contact with livestock and human communities. This breakdown of natural boundaries creates ideal conditions for zoonotic spillover such as the transmission of viruses and bacteria from animals to humans. The emergence of Ebola has been traced to the destruction of the forest. Intact, biodiverse ecosystems naturally buffer these threats by keeping wildlife populations balanced and isolated. Destroying these systems increases the risk of future global pandemics.

A Call to Action: Systemic Solutions for a Dying Planet
Halting the Sixth Mass Extinction requires moving past minor adjustments and surface-level eco-friendly trends. Protecting the planet demands a structural overhaul of how our global economy interacts with the natural world.

1. The 30x30 Framework and Rewilding
The most direct way to protect biodiversity is to preserve its home. Under the UN Kunming-Montreal Global Biodiversity Framework, nations have committed to the 30x30 target. That is protecting at least 30% of the world's land and oceans by 2030.

To make this effective, we must look beyond isolated parks and focus on creating connected conservation networks. Rewilding projects aim to restore natural processes and reintroduce apex predators or key species (like wolves, beavers, or whales) to damaged landscapes. These keystone species kick start natural restoration, allowing entire ecosystems to heal themselves.

2. Rewiring the Global Economy
Our current economic systems treat environmental damage as an external cost, meaning businesses can destroy ecosystems without paying for the harm. We need to shift toward an economic model that prices the value of natural systems directly into global trade.

Subsidization Reform: Governments worldwide spend roughly $1.8 trillion every year subsidizing activities that harm

nature, such as fossil fuel production, destructive fishing, and industrial agriculture. Redirecting these funds toward sustainable farming and habitat restoration would instantly shift global market incentives.

Biodiversity Credits and Sovereign Wealth: Financial tools like habitat banking, green bonds, and debt-for-nature swaps allow developing nations to secure funding by protecting their natural assets, making conservation more profitable than resource extraction.

3. Transforming Global Agriculture

Because agriculture is the primary cause of habitat loss, fixing our food systems is central to protecting biodiversity.

Regenerative Agriculture: Shifting away from chemical-heavy monoculture farming toward agroforestry, cover cropping, and rotational grazing restores soil biology and creates space for wild species to return.

Dietary Shifts: Industrial livestock production uses up vast amounts of land and water resources. Moving global diets toward plant-based alternatives reduces the pressure to clear biodiverse forests like the Amazon for cattle feed.

4. Legal Rights for the Natural World

For centuries, Western legal systems have treated nature as property to be owned and exploited. A growing global movement is working to change this by granting Rights of Nature within national constitutions. Countries like Ecuador and New Zealand have granted legal personhood to specific rivers, forests, and ecosystems. This allows citizens to defend these natural entities in court, providing a powerful legal shield against destructive industrial projects.

Conclusion: The Choice Before Us

The Sixth Mass Extinction is an explicit warning sign, a clear indicator that human activity is pushing Earth beyond its natural carrying capacity. Unlike the species that vanished in past extinctions, we can see the crisis coming, understand its drivers, and possess the tools to stop it.

Our response to this crisis will shape the future of life on Earth. Protecting biodiversity is more than an act of charity for the planet; it is a fundamental act of self-preservation. By restoring wild spaces, reforming global food production, and pricing the value of nature into our economies, we can protect the delicate web of life that sustains us. The window of opportunity is closing fast, and the choice remains ours to make.



Are COP and Climate Diplomacy Failing the Planet?

Introduction

The world tracks climate change through a series of annual meetings known as the Conference of the Parties (COP). At these summits, world leaders stand before flags, deliver passionate speeches, and promise to save the Earth. Underneath the bright lights of the main stage, thousands of diplomats, lawyers, and policy experts engage in intense, round-the-clock negotiations. They argue over commas, debate definitions of text, and craft complex international treaties like the historic Paris Agreement. This elaborate process represents the pinnacle of modern climate diplomacy; the belief that global environmental destruction can be stopped through peaceful international cooperation, consensus, and international law.

Yet, outside the heavily guarded convention centers, a completely different reality unfolds. Global greenhouse gas emissions continue to climb to record highs year after year. Extreme weather events (from unprecedented heatwaves and catastrophic flooding to prolonged droughts) are no longer distant warnings; they are active crises destroying lives and economies across every continent. The stark contrast between the polite, slow-moving world of international diplomacy and the rapid, violent acceleration of planetary warming raises a painful, unavoidable question: Are COP and climate diplomacy failing the planet?

To answer this question, we must look beyond the hopeful public relations statements issued at the end of each summit. We must analyze the fundamental structure of the United Nations framework, examine the deep geopolitical divides that stall progress, and confront the powerful economic interests that protect the status quo. When we measure climate diplomacy not by its elegant promises, but by its actual atmospheric results, a troubling truth emerges. The current system of global climate governance is failing. It is a system built on voluntary compromises, crippled by national self-interest, and completely mismatched with the urgent, binding laws of physics.

The Evolution of Hope: The Promises of Climate Diplomacy

To understand why the current system is failing, we must first look at how it was designed and what it was meant to achieve. International climate diplomacy officially began in 1992 at the Earth Summit in Rio de Janeiro, Brazil. It was here that nations created the United Nations Framework Convention on Climate Change (UNFCCC). The core mission of the UNFCCC was noble and clear: to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human interference with the climate system.

To turn this framework into action, the UNFCCC established the Conference of the Parties (COP) as its supreme decision-making body. COP was designed to be an annual gathering where countries would meet to review progress, assess the latest climate science, and negotiate legally binding agreements to reduce emissions.

For more than three decades, this diplomatic framework has produced a few major historical milestones:

The Kyoto Protocol (1997): This was the world's first major climate treaty. It set legally binding emission reduction targets, but it had a fatal flaw: it only applied to a small group of developed countries, and the world's largest emitter at the time, the United States, refused to ratify it.

The Paris Agreement (2015): Celebrated as a massive diplomatic triumph, the Paris Agreement brought nearly every nation on Earth into a single pact. The goal was to limit global warming to well below 2 degrees Celsius, and ideally to 1.5 degrees Celsius, compared to pre-industrial levels.

The Paris Agreement changed the entire strategy of climate diplomacy. Instead of forcing top-down, legally binding targets on countries, it allowed each nation to voluntarily choose its own climate goals, known as Nationally Determined Contributions (NDCs). This flexible, bottom-up design was highly praised by diplomats. It was the only way to get

superpowers like the United States, China, and India to sign the same piece of paper. For a brief moment, it felt like global diplomacy had finally found a path forward to save the world.

The Structural Flaws: Why the COP System is Stuck

Despite the celebrations in Paris, the voluntary structure of modern climate diplomacy contains the very seeds of its failure. The COP system suffers from deep, built-in structural flaws that make it nearly impossible to deliver the rapid action the planet requires.

1. The Voluntary Trap and the Lack of Enforcement

The single biggest weakness of the Paris Agreement is that it completely lacks an enforcement mechanism. There are no fines, no trade sanctions, and no legal penalties for countries that fail to meet their climate goals. The entire system relies on a concept known as name and shame. Diplomats believed that if a country fell behind on its promises, global peer pressure and public scrutiny would force them to correct their course.

History has shown that this assumption was naive. In the real world of international politics, domestic economic growth and political survival almost always override international peer pressure. If a government finds it politically inconvenient or economically costly to cut emissions, it simply misses its targets with total impunity. A treaty without consequences is not a plan for action; it is merely an expression of good intentions.

2. The Tyranny of Total Consensus

At COP summits, decisions are made using a rule of absolute consensus. This means that every single country, out of nearly 200 nations in attendance, must formally agree to the final text before it can be adopted.

While this rule sounds fair and democratic, in practice, it gives a single country the power to hold the entire world hostage. Oil-producing states or nations heavily dependent on coal can threaten to veto the entire agreement if the language harms their economic interests. This is why final COP documents are obviously weak. The text must be watered down to the lowest common denominator just to ensure that every country agrees to sign it. The rule of consensus replaces urgent, science-based targets with weak, political compromises.

3. The Grand Illusion of Carbon Accounting

Climate diplomacy has created a complex web of carbon markets, net-zero targets, and offset mechanisms that often obscure real progress. Many nations and corporations proudly declare Net-Zero by 2050 targets to win positive media coverage. However, these long-term pledges are frequently pushed far into the future, leaving current leaders free to avoid making difficult choices today.

Furthermore, carbon offsetting schemes often allow wealthy nations to pay for forest preservation projects in developing countries instead of actually cutting emissions at home. Many of these projects are plagued by poor regulation, double-counting, and a lack of permanence. Climate diplomacy has accidentally built a giant bureaucracy of carbon accounting that allows leaders to look busy while atmospheric carbon levels continue to rise.

Geopolitical Gridlock: National Self-Interest vs. Global Survival

Climate change is a global problem, but the world is still governed by individual nation-states, each fiercely protecting its own wealth, security, and political dominance. When climate negotiations enter the room, they run directly into a wall of geopolitical conflicts.

The Wealthy North vs. The Developing South

The deepest divide in climate diplomacy is the historic conflict between developed nations (the Global North) and developing nations (the Global South). This tension is rooted in a fundamental issue of justice:

The Global North (such as the United States, Europe, and the United Kingdom) built its enormous wealth over the last two centuries by burning fossil fuels, making them historically responsible for the vast majority of carbon trapped in our atmosphere.

The Global South contains the nations that have contributed the least to global emissions, yet they are suffering the first and worst consequences of climate change, such as rising sea levels, crop failures, and extreme heat.

Developing countries argue that it is deeply unfair for wealthy nations to demand that poor nations stop using cheap fossil fuels to lift their populations out of poverty, especially when wealthy nations refuse to provide adequate financial help. This debate centers on the UNFCCC principle of Common but Differentiated Responsibilities (CBDR). While all countries must fight climate change, they have different levels of

responsibility based on their history and wealth.
Unfortunately, developed nations have consistently failed to meet their financial promises. For example, a famous 2009 pledge by wealthy countries to provide $100 billion annually to help poor nations adapt to climate change was delayed for years. This persistent broken promise has shattered trust between negotiating groups, turning COP summits into bitter arguments over money rather than collaborative planning sessions for the planet.

The Superpower Rivalry
True global climate action requires seamless cooperation between the world's two largest emitters: The United States and China. When diplomatic relations between these two superpowers break down over unrelated issues like trade, technology, or territorial disputes, climate diplomacy immediately stalls.

Climate action cannot be isolated from broader geopolitical realities. When global tensions rise, climate cooperation is often the first thing to be sacrificed, proving that national security and economic rivalries still rank far higher on the priority list of world leaders than global ecological survival.

The Capture of the Commons: Corporate Interests and Fossil Fuel Influence
The failure of climate diplomacy cannot be blamed entirely on politicians and diplomats. The entire system has been heavily influenced and compromised by the fossil fuel industry, which has a massive financial interest in delaying the transition to clean energy.

The Invasion of Lobbyists
In recent years, COP summits have seen an explosion in the number of attendees representing oil, gas, and coal industries. Thousands of fossil fuel lobbyists register for these conferences, often outnumbering the official delegates of entire continents or vulnerable island nations.

These lobbyists do not attend COP to help save the planet; they attend to protect their business models. They work behind the scenes to influence negotiators, weaken the language of agreements, and promote unproven technologies like carbon capture and storage (CCS) as a justification for continuing to drill for oil and gas.

Host Countries with Conflicting Interests
The integrity of climate diplomacy has been further challenged by the choice of host countries for COP summits. When major oil-producing nations host the world's premier climate conference, it creates an undeniable conflict of interest.

During these summits, the presidency of the conference who normally wields immense power over the agenda and final text is often led by individuals with deep ties to state-owned oil companies. It is highly unrealistic to expect a summit to produce a bold, ambitious plan to phase out fossil fuels when the meetings are organized and led by entities whose wealth depends entirely on selling those exact same fuels.

Real-World Consequences of Diplomatic Delays
While diplomats spend decades debating whether to use the phrase “phase-out" or "phase-down" of fossil fuels, the real world pays a devastating price for their inaction. The atmosphere does not care about diplomatic compromises or political timelines; it only responds to the physical laws of chemistry and physics.

Every year that climate diplomacy stalls results in real-world destruction:
The Disappearance of Island Nations: Low-lying island states like Tuvalu, Kiribati, and the Maldives face an existential threat. For these nations, a 1.5-degree Celsius increase in global temperature is not a political target but a literal survival line of their homeland. The failure of global diplomacy to rapidly curb emissions means these unique cultures and sovereign nations could be swallowed by the ocean before the end of the century.

Mass Climate Migration: As agricultural lands dry up and historic water sources disappear, millions of people are being forced to flee their homes. This displacement creates massive humanitarian crises and strains infrastructure in receiving regions, sparking political instability and border conflicts.

Economic Crises and Ruined Livelihoods: Extreme weather is tearing apart supply chains, destroying crops, and driving up insurance costs worldwide. The financial toll of repairing communities after repeated natural disasters is draining national budgets, leaving less money available for education, healthcare, and infrastructure.

The slow, incremental pace of climate diplomacy is fundamentally incompatible with the accelerating speed of planetary warming. Diplomacy

moves at the speed of human bureaucracy, while climate change moves at the terrifying speed of exponential ecological collapse.

Is COP Completely Useless? The Case for the Defense

To be fair and accurate, we must acknowledge that climate diplomacy has not been an absolute, total failure. If we look closely at what the world would look like without the UNFCCC and the COP process, we can see that these institutions have provided some vital benefits.

Setting the Shared Standard

Before the Paris Agreement, the world was on a path toward a catastrophic 4 degrees or 5 degrees Celsius of warming by 2100. Today, thanks to the commitments made through the COP framework, that projected trajectory has been lowered to around 2.4 degrees to 2.7 degrees Celsius.

While this level of warming is still incredibly dangerous and unacceptable, it represents a significant improvement from a completely unguided path. The COP system has successfully established 1.5 degrees Celsius as the universally accepted target for a safe planet, giving activists, courts, and local governments a clear benchmark to hold their leaders accountable.

A Vital Voice for the Vulnerable

COP is one of the very few international forums where small, economically disadvantaged nations can stand on an equal footing with global superpowers. The alliance of small island states and vulnerable nations has used the COP platform to successfully change the global conversation.

For instance, at COP27, decades of intense diplomatic pressure from developing nations finally resulted in the creation of a historic Loss and Damage Fund. This fund was designed to provide financial assistance to poor countries suffering from irreversible climate disasters. This was a major diplomatic victory that would have been impossible without the structured framework of the United Nations.

Driving the Green Market Transition

The clear, long-term goals set at COP summits have sent a strong signal to global markets, investors, and corporations. By making it clear that the world is transitioning to a low-carbon economy, climate diplomacy helped spark a massive boom in renewable energy technology.

The cost of solar power, wind energy, and lithium-ion batteries has plummeted over the last decade, making clean energy cheaper than fossil fuels in many parts of the world. Diplomacy created the political framework that gave businesses the confidence to invest heavily in green innovation.

How to Fix a Broken System

If climate diplomacy is failing but remains absolutely necessary, the solution cannot be to simply abandon the system entirely. Instead, we must radically reform and redesign global climate governance to give it real power, speed, and accountability.

1. Shift from Voluntary Pledges to Carbon Tariffs

To fix the lack of enforcement, ambitious countries should move away from purely voluntary agreements and form Climate Clubs. A Climate Club is a coalition of nations that agree to set high, shared standards for cutting emissions.

If a country outside the club wants to sell its goods to club members, its products face a penalty tariff at the border. This completely changes the economic math for world leaders. It turns cutting emissions into a competitive trade advantage and punishes polluters directly through their wallets, introducing a powerful enforcement tool that the current COP system lacks.

2. Reform the Consensus Rule

The United Nations must reform the rule that requires absolute consensus for every decision. While protecting the voice of every country is important, the current system allows a tiny handful of oil-producing states to block progress for the entire planet.

Moving to a system of qualified majority voting would allow major agreements to pass even if a few fossil-fuel-dependent nations object. This reform would prevent final texts from being continually watered down and allow ambitious policies to be adopted much faster.

3. Ban Fossil Fuel Lobbyists from the Negotiating Table

The UNFCCC should treat fossil fuel corporations exactly how the World Health Organization treats tobacco companies. Tobacco lobbyists are legally banned from participating in public health negotiations because their business goals directly conflict with public health.

The same rule must apply to climate diplomacy. Companies that make their profits from oil, gas, and coal should be excluded

from crafting the policies designed to eliminate their products. COP summits must be preserved as clean spaces for genuine public interest and scientific reality.

4. Connect Global Diplomacy to Local Courts

The promises made by world leaders at COP summits should be legally binding under their own domestic laws. Around the world, citizens and environmental groups are increasingly using a country's international climate pledges as legal grounds to sue governments in domestic courts.

When a supreme court orders a government to cut emissions to honor its international commitments, climate diplomacy gains real teeth. By turning international promises into domestic legal requirements, we can bridge the gap between global diplomacy and local accountability.

Conclusion: The Verdict on Climate Diplomacy

Are COP and climate diplomacy failing the planet? The honest answer is a nuanced but definitive yes.

The system is failing because it is moving at an agonizingly slow pace while the ecological crisis accelerates around us. It is failing because it allows empty promises to substitute for immediate action, and because it prioritizes political compromise over scientific necessity. By allowing economic self-interest, geopolitical rivalries, and corporate lobbying to stall progress, climate diplomacy has squandered decades of precious time that the planet could not afford to lose.

However, recognizing this failure does not mean we should abandon international cooperation. In an interconnected world, no single nation can isolate its atmosphere or fix the climate alone. We cannot afford to walk away from diplomacy, but we can no longer tolerate diplomacy as an empty ritual or a form of political theater.

The COP framework must be radically transformed from a polite debating society into a powerful, accountable governing body. We must introduce real economic consequences for polluters, remove the influence of fossil fuel interests, and replace voluntary goals with binding agreements. Time is running out, and the laws of physics will not wait for diplomats to agree. If we do not courageously reform the tools of global diplomacy today, we will be forced to watch them fail the planet entirely tomorrow.



Image: The Climate Changed Oak Tree in Kew Gardens, London, on 22 June 2026 at the start of London Climate Action Week. Photo by Brook Mitchell / AFP via Getty Images.



Understanding Habitat Banking:

A New Frontier in Conservation

Meaning and Definition

Habitat banking is an institutionalized, market-based conservation mechanism designed to mitigate the ecological footprint of industrial and urban development by trading quantified environmental assets. At its core, habitat banking operates on the principle of compensatory mitigation, that allows for the consolidation of fragmented environmental initiatives into largescale, professionally managed conservation areas. Under this framework, a specialized operator, which can be a private landowner, a conservation organization, or a public authority proactively restores, enhances, or establishes a dynamic ecosystem on a designated parcel of degraded land.

Once the ecological improvement or uplift of the proposed area is certified and verified by independent ecologists and regulatory bodies, it is translated into a standardized accounting currency known as biodiversity credits or biodiversity units. These units represent a quantifiable increase in ecological function, species richness, and habitat quality. Developers who are legally required or voluntarily committed to offsetting the unavoidable, residual environmental damage caused by their construction, mining, or infrastructure projects can purchase these preestablished units from the habitat bank. The transfer of these units legally shifts the long-term ecological liability from the developer to the bank manager, ensuring a standardized, market-driven approach to achieving a No Net Loss (NNL) or, more progressively, a Biodiversity Net Gain (BNG) outcome for the natural environment.

How It Works

The operationalization of a habitat bank involves an intricate interplay between ecological science, real estate law, and financial asset management. The entire lifecycle operates through five distinct sequential phases:

1. Site Identification and Baseline Assessment

The process begins when a landowner or a conservation developer isolates a tract of ecologically degraded land such as depleted agricultural fields, exhausted commercial quarries, or mismanaged wetlands. Ecologists conduct rigorous baseline surveys using standardized metrics, such as the statutory

framework provided by Natural England's Biodiversity Metric in the United Kingdom or the hydrogeomorphic assessments utilized by the United States Army Corps of Engineers (Note: Nigeria is yet to develop statutory framework). This stage maps the existing vegetation, soil quality, water systems, and species diversity to calculate the starting ecological value of the site in distinct units.

2. Management Planning and Legal Securing

The bank operator drafts an exhaustive, long-term habitat management and monitoring plan spanning at least 30 to 100 years. This plan details exactly how the land will be transformed whether through reforesting with native broadleaf trees, rewetting peatlands, or sowing species-rich meadows. To guarantee that this land cannot be sold or redeveloped for commercial use later, the property is legally bound by structural instruments such as Conservation Covenants or deed restrictions. These covenants are permanently tied to the land registry, ensuring that subsequent owners remain legally bound to protect the restored ecosystem.

3. Credit Quantification and Registration

Once the regulatory body approves the management plan, the projected ecological uplift is converted into marketable units. Regulators apply mathematical formulas that account for the difficulty of restoring specific habitats, the time it takes for ecosystems to mature, and the spatial significance of the location. The approved units are then logged into a centralized, transparent registry platform such as those operated by Terrasos in Latin America or the national statutory registries in Europe to prevent double-counting and ensure full traceability.

4. Market Transaction and Transfer of Liability

When a developer initiates a project, they must follow a strict mitigation hierarchy: avoid environmental damage; minimize on-site impact; restoration and offset residual losses off-site. If on-site space is limited, the developer browses the registry or utilizes an environmental broker to find a matching habitat bank within an acceptable geographic range. When a transaction is finalized, the developer pays for the units, the registry permanently retires those specific units, and the legal responsibility for the environmental mitigation officially transfers to the habitat bank operator.

5. LongTerm Maintenance, Monitoring, and Verification (MRV)

The bank operator uses the funds generated from credit sales to implement the physical restoration work. Over the multi-decade lifespan of the contract, the bank undergoes regular verification audits. Ecologists and remote sensing drones assess the site to confirm it is successfully hitting its biological milestones. If the bank fails to reach these targets, regulators can freeze unallocated units, levy financial penalties, or draw from mandatory performance bonds to fix the habitat.

Benefits and Advantages

Landscape-Scale Ecological Resilience

Traditional, project-specific mitigation typically forces developers to squeeze small patches of landscaping directly inside an industrial or residential site. These isolated green strips rarely last, as they are exposed to heavy human activity, chemical runoff, and extreme habitat fragmentation. Habitat banking solves this by pooling financial resources to create large, contiguous nature reserves, usually exceeding 10 to 20 hectares. These large spaces support complex food webs, allow wider wildlife migration corridors, and withstand extreme climate events far better than small, disconnected plots.

Elimination of the Temporal Loss of Biodiversity

In traditional mitigation schemes, a developer cuts down a forest first and promises to plant new trees elsewhere afterward, creating a multi-year gap where local wildlife loses its food and shelter. Habitat banking eliminates this temporal gap. Because banks are incentivized to establish ecosystems ahead of time to generate sellable units, the new habitat is often fully functional, stable, and occupied by wildlife long before a developer breaks ground on a construction site.

De-Risked and Simplified Development Workflows

For urban planners and corporate developers, managing a long-term conservation project internally is a significant regulatory burden. They often lack the ecological expertise needed to navigate complex environmental laws, leading to project delays and legal liabilities if the mitigation fails. By purchasing certified units from a habitat bank, developers instantly transfer all long-term legal and operational risks to expert land managers. This simplifies the permitting process and ensures predictable project timelines.

New Income Streams for Rural Economies

Habitat banking turns conservation into an active, profitable business model for farmers, indigenous communities, and rural landowners. Instead of clearing marginal or degraded land for low-yield crops, landowners can lease or convert their fields into biodiversity banks. This provides a steady, guaranteed income stream over decades, funding green jobs in rural areas focused on ecological restoration, forestry, and environmental land management.

Disadvantages

It is a License to Contribute to Biodiversity Loss

The most significant criticism of habitat banking is that it risks commodifying nature into a simple line item on a corporate balance sheet. Critics from various environmental groups argue that by creating a frictionless marketplace for biodiversity units, society normalizes environmental destruction. Wealthy corporations might view buying credits as a simple cost of doing business, allowing them to bypass the harder work of avoiding damage in the first place, using habitat bank purchases as a form of corporate greenwashing.

Geographic Displacement of Local Ecosystems

Nature provides vital, immediate benefits to local communities, including flood protection, air filtration, and recreational spaces. If a developer tears down a mature woodland in an urban center but offsets it by funding a habitat bank 50 miles away in a rural area, the local community suffers a total loss of their immediate natural environment. This geographic separation can worsen environmental injustice, leaving urban areas more vulnerable to heat islands and flash floods while shifting all ecological benefits far away.

The Core Challenge of Ecological Equivalence

Ecosystems are highly complex networks of unique soils, ancient fungi, and specific microclimates that take centuries to form naturally. Habitat banking works on the assumption that a loss in one location can be perfectly balanced by an improvement somewhere else. However, science shows that replacing an ancient, irreplaceable forest or a delicate wetland with a newly created, human-managed habitat rarely achieves true ecological equivalence. Important, localized species can still be lost forever during the transition.

Challenges Facing Its Implementation

1. Metric Flaws and Over-Simplification

Developing a single,

standardized mathematical tool that accurately measures biodiversity across different types of terrain is an ongoing challenge. Current metrics often favor simple, fast-growing habitats like basic grasslands or scrublands because they carry low delivery risks and generate quick units for bank operators. More complex, distinct habitats that require precise conditions such as specialized mosaic environments or slow-growing mature woodlands remain in short supply. This structural imbalance can distort the market, making it harder for developers with highly specific offsetting needs to find true matches.

2. Ensuring Long-Term Permanence and Governance

Keeping a habitat bank protected and managed for 30 to 100 years requires flawless legal and financial systems. Over such a long period, banking companies can face bankruptcy, land ownership can change hands, and local government budgets for enforcement can be cut. If a habitat bank operator runs out of money or stops managing the land 15 years into a 30-year agreement, restoring the lost biodiversity becomes incredibly difficult, exposing the entire system to long-term compliance failures.

3. Supply Bottlenecks and Geographic Restrictions

The global biodiversity credit market is scaling rapidly, with projections estimating it will grow from $3.6 billion in 2026 to $22.1 billion by 2035. However, the physical supply of certified habitat land is struggling to keep pace with demand. Stringent planning rules, slow regulatory approval processes, and a lack of available large tracts of land create significant supply bottlenecks. When local planning authorities insist that offsets must be placed near the original development site, it restricts options further, occasionally driving up unit prices and delaying key infrastructure projects.

4. Climate Change and Environmental Vulnerability

A habitat bank is bound to a fixed physical location, making it highly vulnerable to the accelerating impacts of climate change. A catastrophic wildfire, an extended drought, or a shifting climate zone can destroy decades of ecological progress in a single season. If a bank's habitats are wiped out by extreme weather, determining who is legally and financially responsible for replacing those lost biodiversity units remains a complex question that current environmental laws are still trying to resolve.

Conclusion

Habitat banking represents a pragmatic approach to environmental conservation, actively bridging the gap between economic development and ecological preservation. By translating biodiversity into a clear, standardized economic asset, the system shifts conservation from a voluntary corporate expense into an investable, long-term market framework. Its ability to create large, interconnected nature reserves ahead of development offers a clear improvement over traditional, fragmented on-site mitigation.

However, the framework is not a complete solution for global environmental loss. Its long-term success depends on strict government regulation, scientifically sound metrics, and clear rules that prevent the geographic displacement of local ecosystems. Habitat banking must never be used as a convenient shortcut to bypass the essential work of avoiding and minimizing environmental harm. If managed under strict, transparent regulatory frameworks, it will serve as a vital tool for ensuring that future economic progress no longer requires the destruction of the natural world.



Sustainable Aviation Fuel (SAF) Programme

On Monday, July 20, 2026, Nigeria officially launched its national Sustainable Aviation Fuel (SAF) program during a major high-level summit at the International Conference Centre (ICC) in Abuja. The SAF Programme aimed at reducing carbon emissions in the aviation sector and positioning the country at the forefront of Africa's green aviation transition.

The programme was unveiled by the Nigeria Civil Aviation Authority (NCAA) in partnership with the International Civil Aviation Organisation (ICAO), the European Union (EU) and the European Union Aviation Safety Agency (EASA).

As part of the initiative, the federal government inaugurated a seven-member National High-Level Sustainable Aviation Fuel Steering Committee, presented the National SAF Feasibility Study and launched the ICAO-supported SAF Business Implementation Study.

Speaking at the event, the Minister of Aviation and Aerospace Development, Festus Keyamo, represented by the Director of Air Transport Management in the ministry, Mohammed Ahmed Tijani, said the steering committee would serve as the national governance platform for implementing Nigeria's sustainable aviation fuel programme.

According to the minister, the committee will provide strategic direction, coordinate implementation efforts, strengthen collaboration among stakeholders and oversee the delivery of the country's SAF implementation programme.

Keyamo described the initiative as a major milestone in Nigeria's efforts to build a resilient, competitive and environmentally sustainable aviation industry.

He said sustainable aviation fuel offers Nigeria an opportunity to reduce carbon emissions while attracting investment, creating jobs, enhancing energy security and unlocking economic value across the country's agriculture, energy and industrial sectors. He urged members of the steering committee to carry out their responsibilities with dedication, innovation and a strong sense of national purpose.

Also speaking, the Director-General of Civil Aviation, Capt. Chris Najomo, described the launch as a defining moment in Nigeria's aviation sustainability journey, saying the country was transitioning from planning to implementation. Najomo explained that the National SAF Feasibility Study was developed under ICAO's Assistance, Capacity-building and Training for Sustainable Aviation Fuels (ACT-SAF) Programme, with funding from the European Union and technical support from EASA.

According to him, the study provides an evidence-based roadmap for converting Nigeria's abundant feedstock resources into commercially viable sustainable aviation fuel production.

He reaffirmed the NCAA's commitment to coordinating stakeholders and serving as the secretariat of the National High-Level Sustainable Aviation Fuel Steering Committee to ensure the successful implementation of the programme. Najomo also expressed appreciation to ICAO, the European Union and EASA for their continued technical and financial support toward advancing sustainable aviation in Nigeria.



Liberia–Nigeria Trade
and Investment Forum (LNTIF 2026)

The inaugural Liberia–Nigeria Trade and Investment Forum (LNTIF 2026) took place on July 15, 2026, at the Lagos Continental Hotel in Victoria Island, Lagos, Nigeria. Organised by the Government of Liberia through its Embassy in Nigeria and the Office of the Honorary Consul General of Liberia in Lagos, the event brought together over 500 delegates, including prominent government leaders, private sector investors, and policymakers.

The forum operated under the theme, "Building Bridges for Shared Prosperity: Strengthening Liberia–Nigeria Trade and Investment Partnership." Its core goals included:

Boosting Bilateral Trade: Creating paths to improve sub-regional commerce, noting that Nigeria's exports to Liberia stood at a relatively low $21 million in 2024.
Attracting Capital Mobilisation: Positioning Liberia as a preferred investment destination by leveraging Nigeria's industrial, innovative, and financial capacity.

Showcasing Economic Reforms: Pitching Liberia's upgraded ease-of-doing-business initiatives, Atlantic coastline access, and youthful workforce to international partners.

Targeting Critical Growth Sectors: Opening dialogue for joint operations across agriculture/agribusiness, renewable energy, manufacturing, infrastructure, ICT, and tourism.

Leveraging AfCFTA: Harnessing regional integration under the African Contonental Free Trade Area (AfCFTA) to expand West Africa's cross-border competitiveness.
Key Outcomes of the meeting are:
(i). Highlighting statements by Liberia's Honorary Consul, Dapo Akinosun (SAN), the forum formally marked a transition from mere political friendship to binding commercial ties.

(ii). Deliverables concluded with a collective focus on finalizing new Memoranda of Understanding (MoUs) designed to map shipping routes, set up cross-border manufacturing factories, and



create immediate job opportunities.

(iii). The event institutionalized networking protocols, allowing prospective Nigerian partners to actively connect with the National Investment Commission of Liberia regarding tax incentives and infrastructure development projects.

(iv). Liberian delegates highlighted their rollout of digital business registries to guarantee transparency for incoming Nigerian transport, logistics, and agro-economy partners.







THE 7TH AFRICA EMERGING MARKETS FORUM (AEMF)

The 7th Africa Emerging Markets Forum (AEMF) held between July 29–30, 2026 at CBN Headquarters in Abuja, Nigeria, was a high-level economic summit convened to address Africa's positioning within a shifting global economy. Co-organized by the Central Bank of Nigeria (CBN), the Emerging Markets Forum, and the Centre for the Study of the Economies of Africa (CSEA), the forum served as a collaborative platform for global policymakers, central bankers, and private sector leaders.

The official theme of the event was "Building Resilience Amidst Geoeconomic Uncertainties". Discussions focused heavily on navigating global economic fragmentation, cross-border inflation, and structural macroeconomic challenges.

The forum featured an array of prominent continental and global figures:

Dr. Ngozi Okonjo-Iweala – Director-General of the World Trade Organization (WTO).

Olayemi Cardoso – Governor of the Central Bank of Nigeria.

Chief Olusegun Obasanjo – Former President of Nigeria.

Taiwo Oyedele – Nigeria's Minister of Finance and Coordinating Minister of the Economy.

Harinder S. Kohli – Founding Director & Chief Executive of the Emerging Markets Forum.

Jason Miller – Former U.S. White House Advisor.

V. Shanker – CEO of Gateway Partners.

Dr. Kingsley Udeh – Minister of Science, Technology, and Innovation.

The core target of the 7th AEMF was to move African nations "from competition to collaboration" to protect economic growth. Strategic objectives included:

Boosting Intra-Regional Trade: Driving full, barrier-free implementation of the African Continental Free Trade Area (AfCFTA).

Attracting Foreign & Domestic Investment: Funneling capital directly into critical sectors like infrastructure, agriculture, fintech, green energy, and manufacturing.

Enacting Policy Coordination: Formulating unified monetary and fiscal policy framework strategies to handle food price volatility and global inflation.

Fostering Digital and Human Capital Expansion: Empowering small and medium enterprises (SMEs) via fintech access and driving regional labor mobility.

Key Takeaways & Highlights of the event are:

The Cardoso–Okonjo-Iweala Dialogue: The event was headlined by a flagship fireside conversation emphasizing that African economies must maintain domestic reform momentum and aggressively deepen regional trade integration to insulate themselves from external shocks.

Push for Financial Sovereignty: Panels mapped out pathways to build more robust domestic capital markets, optimize cross-border digital payments, and lower reliance on foreign currency vulnerabilities.

Focus on Industrialization & Youth: Former President Obasanjo led sessions emphasizing that long-term African economic resilience relies on massive shifts toward localized manufacturing and capturing the demographic dividend of Africa's expanding youth workforce.

Active Deal Rooms: Beyond policy debates, the forum hosted collaborative deal rooms that facilitated tangible cross-border investment partnerships in logistics, clean energy, and healthcare services.

7TH AFRICA EMERGING MARKETS FORUM

Theme: BUILDING RESILIENCE AMIDST GEOECONOMIC UNCERTAINTIES

FEATURING



Olayemi Cardoso
Governor,
Central Bank of Nigeria



Ngozi Okonjo-Iweala
Director-General,
World Trade Organization



Taiwo Oyedele
Minister of Finance/Coordinating
Minister of the Economy, Nigeria



Harinder S. Kohli
Founding Director and Chief Executive,
Emerging Markets Forum

29th&30th July, 2026
9:00AM Daily
Central Bank of Nigeria (CBN) Auditorium

FOR ENQUIRIES:
DR CHIZOR UBA +234 803 909 5000
MRS SYLVIE NAVILLE +33 681 569 030

ATTENDANCE IS STRICTLY BY INVITATION.
WATCH LIVE ON THE BANK'S WEBSITE AND OFFICIAL SOCIAL MEDIA CHANNELS.
Youtube @cenbank
Facebook @cenbankng
www.cbn.gov.ng

POWERED AND SUPPORTED BY:

Centre for the Study of Economies of Africa

Emerging Markets

14th Annual BusinessDay CEO Forum

The 14th Annual BusinessDay CEO Forum was held on Thursday, July 16, 2026, at the Eko Hotels and Suites in Victoria Island, Lagos. The event gathered top corporate executives, public policymakers, and international development partners to deliberate on Nigeria's economic path. The core theme of the forum was "From Stability to Shared Prosperity". Discussions focused on transitioning Nigeria's macroeconomic landscape from recent stabilization reforms into long-term, inclusive economic growth.

The event featured prominent leaders across government, finance, and private sectors:

Olayemi Cardoso – Governor of the Central Bank of Nigeria (CBN)

Taiwo Oyedele – Chairman of the Presidential Fiscal Policy and Tax Reform Committee

Frank Aigbogun – Publisher of BusinessDay

Lolu Alade-Akinyemi – Group Managing Director and CEO of Lafarge Africa PLC (HBM Nigeria)

Yomi Olugbenro – CEO of Deloitte West Africa

Elsie Attafuah – Resident Representative of the United Nations Development Programme (UNDP) Nigeria

Nabila Aguele – Chief Executive of Malala Fund Nigeria

Olapeju Ibekwe – CEO of Sterling One Foundation

Key Takeaways included:



Nigeria's foreign reserves rebounded significantly from a negative $4 billion to nearly $40 billion following aggressive monetary reforms.

(ii). Addressing Overregulation: Panelists discussed the "true cost of overregulation," noting that bureaucratic bottlenecks and administrative redundancies have historically stripped trillions of Naira from Nigerian businesses.

(iii). Youth & Innovation: Leaders emphasized that transitioning to shared prosperity relies heavily on leveraging the country's youth demographic, fostering local innovation, and strengthening public-private collaborations.

(iv). Inclusive Industry Growth: Corporate executives stressed the responsibility of private businesses to partner with the government to ensure economic progress translates directly into community development and inclusive wealth.





The 18th BRICS Summit

The 18th BRICS Summit concluded on 12–13 September 2026 at the Bharat Mandapam convention centre in New Delhi, India. Operating under India's 2026 Chairship, the summit brought together delegates from full member states, partner nations, and international organizations under the theme "Building for Resilience, Innovation, Cooperation, and Sustainability".

BRICS began as a cooperative bloc formed by Brazil, Russia, India, China, and South Africa. Its key objectives include:
Global Governance Reform: Advocating for changes to Western-dominated organizations like the UN Security Council, IMF, and World Bank to grant greater representation to developing countries.

Economic Cooperation: Enhancing trade, developing alternative financial networks, and expanding local-currency transaction systems.

Global South Coordination: Providing a collective geopolitical and economic voice for emerging markets.
The summit was chaired by Indian Prime Minister Narendra Modi. A galaxy of world leaders attended the physical meeting in New Delhi, including:
Xi Jinping (President of China)
Vladimir Putin (President of Russia)
Cyril Ramaphosa (President of South Africa)
Masoud Pezeshkian (President of Iran)
Prabowo Subianto (President of Indonesia)
Abdel Fattah El-Sisi (President of Egypt)
Abiy Ahmed Ali (Prime Minister of Ethiopia)
Anwar Ibrahim (Prime Minister of Malaysia)
Sheikh Khaled bin Mohamed bin Zayed Al Nahyan (Crown Prince of Abu Dhabi, UAE)
António Guterres (United Nations Secretary-General)
Mauro Vieira (Foreign Minister of Brazil, representing President Lula)

Nigeria participated as an official BRICS Partner Country, a status it formally secured in January 2025. At the New Delhi summit, Nigeria was represented by Vice President Kashim Shettima on behalf of President Bola Ahmed Tinubu. In an interview on 15 September 2026 with DD India, Vice President Shettima clarified that Nigeria is not rushing to become a full BRICS member. Instead, the government is focusing on maximizing the trade, investment, and bilateral advantages of its current partner status while maintaining its historic non-aligned foreign policy alignment.

The event concluded with the unanimous adoption of the comprehensive New Delhi Declaration. The main outcomes included:

Pushback Against Unilateral Trade Measures: Leaders strongly objected to protectionist barriers and unilateral carbon borders, such as the EU's carbon taxes, arguing they unfairly penalize developing nations.

Local Currencies & De-dollarization: The bloc agreed to accelerate local-currency cross-border trade settlements to enhance financial independence.

Middle East & Geopolitics: The joint declaration called for diplomatic restraint and humanitarian resolutions regarding the crisis in West Asia, balancing internal divisions by avoiding direct condemnation of specific actors.

Technology & Critical Minerals: Prime Minister Modi and other leaders warned against the "weaponization of technology and critical minerals," pushing for equitable access to resources vital for the green transition.

Nigeria-India Economic Deals: On the sidelines, Nigerian delegates emphasized the country's position as a strategic gateway to the African Continental Free Trade Area (AfCFTA). Discussions focused on boosting trade and securing Indian investments across agriculture, infrastructure, and digital technology.







The Function, Impact, Prosperity, Resilience, and Equity (FIPRE™) Framework: From Principles to Practice (Volume II)

Building a decision architecture that turns ESG commitments into infrastructure that endures

By Dr. Eugene O. Itua

Volume I established why infrastructure must be judged by the lasting value it creates. Volume II explains how to put that ambition into practice: bring the evidence together, protect minimum standards in every dimension and carry commitments from the drawing board into the life of the asset.

Imagine a flood barrier that protects a city's commercial centre but leaves neighbouring low-income settlements exposed. The engineering works. The economic returns look attractive. Yet the project leaves a serious question unanswered: whose safety counts?

That is the kind of decision FIPRE™ is designed to bring into view before an investment becomes difficult to change. Its five dimensions are Function, Impact, Prosperity, Resilience and Equity. FIPREG™ adds explicit Governance assessment where institutional weaknesses could undermine delivery.

Volume I, "Translating ESG commitments into better infrastructure decisions", argued that technical completion alone is an incomplete measure of success (Itua, 2026). An asset may meet its design specification while degrading ecosystems, excluding communities, imposing unaffordable maintenance costs or failing under foreseeable climate conditions. It traced these failures to fragmented decisions: specialists contribute valuable work, but their findings often meet too late to change the project.

Volume II builds on that diagnosis. The task is to connect engineering, environmental and social assessment, economics and governance at the points where choices remain open. A decision architecture gives that integration a practical form: shared questions, written scoring rules, evidence standards, accountable reviewers and checkpoints throughout the asset's life. The central challenge becomes concrete: what must a project demonstrate before it earns the right to move to its next stage?

Begin with the service people need

Infrastructure matters because of what it enables. A road connects farmers to buyers. Electricity keeps a clinic operating. Drainage protects homes and livelihoods. Thacker et al. (2019) found that infrastructure directly or indirectly influences 72% of Sustainable Development Goal targets. The quality of infrastructure decisions therefore reaches well beyond the asset itself.

The starting question should be whether the proposed investment is the best way to meet an evidenced need. Could repairing an existing system deliver more value? Would a different location reduce exposure? Could restoring a wetland complement engineered drainage? Comparing options early

preserves choices that become expensive once contracts and designs are fixed.

For African institutions, the challenge is to connect development priorities with the realities of maintenance budgets, climate exposure, affordability and institutional capacity. Nigeria's NDC 3.0, submitted in 2025, provides an updated national climate-policy context for those choices (Federal Republic of Nigeria, 2025).

FIPRE draws on engineering studies, environmental and social assessment, financial appraisal and consultation. It organises their findings around a common decision. Applicable laws, design standards and lender safeguards continue to govern the project; a favourable score cannot override them (World Bank, 2017).

Seven principles for better decisions

The original argument rests on seven principles. Together, they keep the assessment focused on choices and consequences.

1. **Integrate existing work.** Use engineering studies, safeguards, financial appraisal and procurement records to answer common questions. Preserve their distinct professional and legal requirements.
2. **Decide early.** Test locations, technologies and delivery models before the preferred design becomes difficult to change. Sustainability should influence the option chosen.
3. **Protect every minimum.** A strong economic case cannot cancel an unacceptable social, environmental or resilience failure. Each dimension must stand on its own evidence.
4. **Match evidence to the claim.** Record what is known, what remains uncertain and what further investigation the decision requires.
5. **Make assessment independent.** Separate appraisal from project promotion where possible, declare conflicts and require independent review when roles overlap.
6. **Follow the asset.** Revisit the assessment during construction, operation and retirement. Promises made at approval should remain visible after commissioning.
7. **Keep requirements current.** Review relevant development, disclosure and financing standards as they evolve. Alignment must be demonstrated against the applicable requirements.

These principles also clarify responsibility. Specialists supply and challenge evidence; the authorised decision-maker records whether the proposal can proceed, must change or should stop.

Ask five questions together

Figure 1 translates the framework into questions a project team and an affected community can both recognise. Each question addresses a different part of the investment's long-term performance.



Figure 1. Five questions for infrastructure decisions and the Governance check
Source: Author. Governance screening applies to every project; material red flags require explicit FIPREG assessment.

Function asks whether the asset will deliver the right service. Evidence should establish demand, safety, technical performance and credible arrangements for operation and maintenance. A new water treatment plant, for example, needs dependable power, distribution connections, trained operators and an identified maintenance budget. Capacity on the drawing board is only part of the answer.

Impact examines consequences for people and nature. Assessment should cover biodiversity, pollution, cumulative effects and emissions from construction and operation. It should also consider materials over the asset's life: can components be repaired, reused or recovered, and who will manage waste and restoration? A project cannot claim environmental value by moving damage beyond its boundary.

Prosperity asks whether economic value will endure. Jobs, productivity and access to markets matter alongside financial viability, affordability and fiscal exposure. Appraisal should test demand and cost assumptions, identify public guarantees and consider who carries the risk if revenue falls or maintenance costs rise.

Financial viability does not mean that every public service must recover its full cost through user charges. A subsidised water scheme may create substantial public value. The assessment should establish whether its funding is credible over time and whether tariffs, subsidies and maintenance obligations can be sustained without excluding the people it is intended to serve.

Resilience asks whether services can withstand disruption and adapt. Designs should be tested against plausible future climate conditions and other disruptions, including power failures, cyber incidents and supply-chain shocks. The assessment should explain expected service interruptions, recovery arrangements and the scope for later adaptation, rather than treating today's conditions as permanent.

Equity asks who benefits and who bears the costs. It examines access, affordability, displacement, compensation and the ability of affected people to influence decisions and obtain remedy. Benefits should be examined across income groups, locations, genders, ages and disability needs. Promised jobs also deserve scrutiny: who can access them, what skills are required and what remains after construction?

Digital technology also needs this scrutiny. Smart meters and electronic payments may improve service management, but unreliable connectivity or inaccessible payment channels can exclude users. Their value depends on practical arrangements for security, continuity and access, including workable alternatives for people who cannot use digital services.

These questions often intersect. Flooding is a Resilience concern when it threatens a road, an Impact concern when the road obstructs drainage, and an Equity concern when the resulting damage falls disproportionately on poorer households. The same study may inform several dimensions. Evaluators should cross-reference it while avoiding duplicate credit for the same benefit.

The assessment must also follow dependencies. A resilient hospital needs reliable water, power and access. Protecting the building alone may leave its essential services exposed, a systems concern emphasised in the World Bank's Lifelines report (Hallegatte et al., 2019).

Make the weakest dimension visible

FIPRE scores each dimension from 1 to 5 against written, context-specific rubrics. A score of 3 represents the minimum acceptable level under the applicable rubric. The defining rule is straightforward: any dimension below 3 requires

redesign before the proposal can qualify to proceed. A project that cannot resolve the deficiency should be declined.

Consider the hypothetical flood barrier. Suppose its scores are Function 4, Impact 3, Prosperity 4, Resilience 4 and Equity 2. The proposal fails because Equity falls below the floor. Strong performance elsewhere cannot change that decision. Extending protection, changing the alignment or combining the barrier with neighbourhood drainage could be explored, with costs and consequences reassessed across all five dimensions.

Suppose the revised option extends protection and adds local drainage, with funded maintenance and documented arrangements for affected households. Independent review then assigns scores of Function 4, Impact 3, Prosperity 3, Resilience 4 and Equity 3. The proposal clears the numerical floor and has an Estimated Total Infrastructure Value (ETIV) of 17 out of 25. Prosperity has fallen because the broader scheme costs more, but the project now meets the minimum in every dimension.

These numbers are hypothetical; they are not findings from an actual project. They show why the individual profile matters more than an attractive total. The first option cannot qualify through its attractive returns; the revised option becomes eligible for further decision-making, subject to sufficient evidence and applicable approvals.

The rule does not remove difficult choices. Extending flood protection may increase costs or transfer risk elsewhere. Each feasible option must be assessed again, with affected communities involved. If no option meets the minimum conditions, decision-makers need to reconsider the project's scope or delivery approach rather than adjust the scores to secure approval.

ETIV is an assessment index, not a financial valuation. It summarises the five scores only after the floor is cleared. Comparisons require consistent rubrics, assessment stages and evidence standards. The full profile remains essential: a total cannot explain which commitments are fragile or what must improve.

Evidence needs its own scrutiny. FIPRE records confidence alongside performance, using grades from A, independently verified evidence, to D, unsupported assertion. The assessment protocol must define the intermediate grades and the evidence required at each stage. Every score should identify its source, date, responsible party and limitations.

A flood model may be technically sound yet rely on outdated rainfall records; a consultation report may omit the households most exposed. Review must therefore examine relevance, coverage and uncertainty as well as whether a document exists. Insufficient evidence should trigger further investigation or deferral, rather than being mistaken for proof of poor performance or permission to proceed. Community testimony, documented consultation and verifiable benefit-sharing commitments are particularly important where project sponsors claim broad support. Record disagreements between evaluators and resolve them through evidence-based review before the decision is finalised.

Check whether the institutions can deliver

Governance already runs through FIPRE through evaluator independence, evidence records and review. FIPREG makes it an explicit sixth dimension, organised around five components: institutional capacity (G1), procurement integrity (G2), contract governance (G3), regulatory compliance (G4), and the reliability of measurement, reporting and verification (G5).

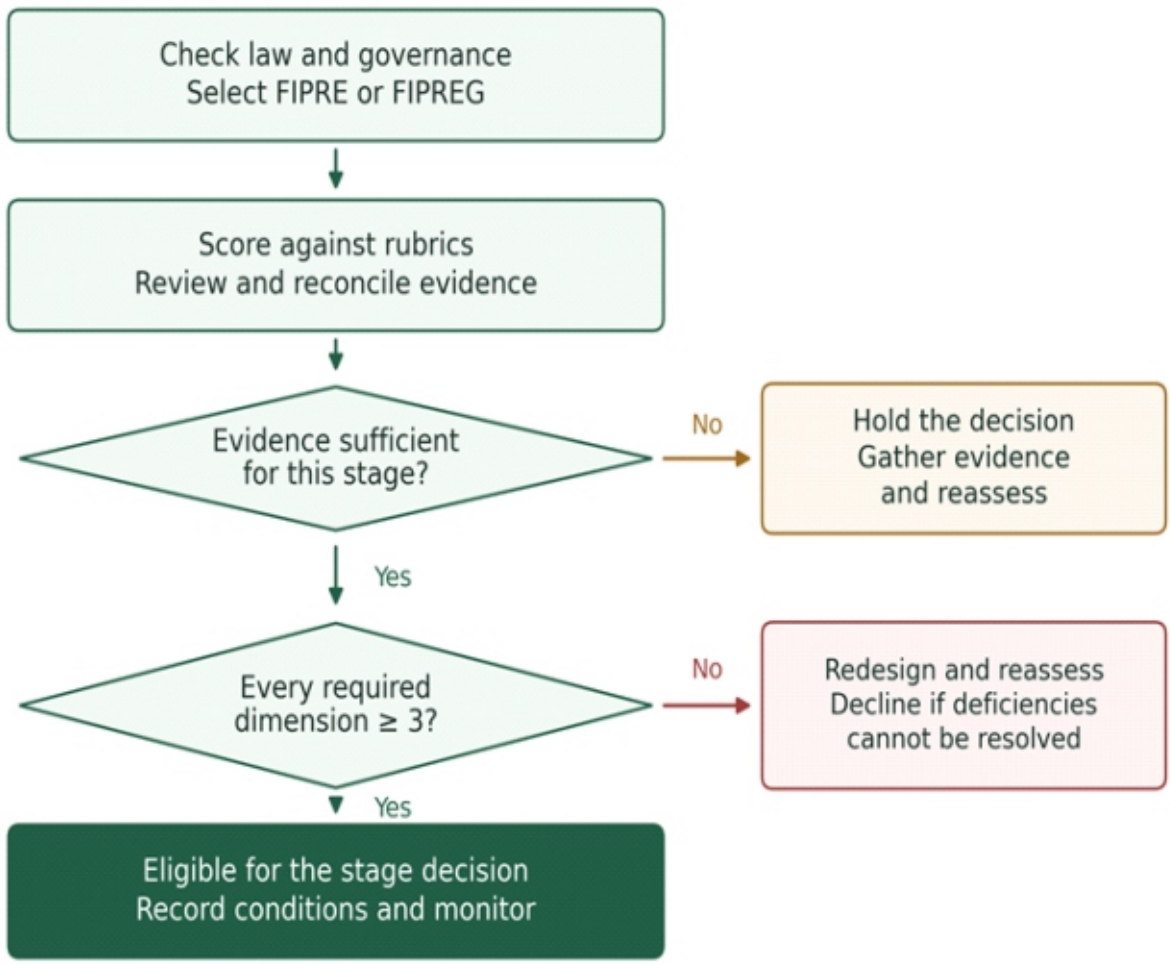
The practical questions are direct. Does the asset owner have the staff and authority to maintain the service? Can procurement decisions be reviewed? Do contracts allocate responsibilities clearly? Can the regulator enforce standards? Can reported performance be checked against reality? A well-designed asset remains vulnerable if these arrangements cannot deliver what its appraisal assumes.

Every project should face a governance screen. Unexplained sole-source procurement, undisclosed conflicts of interest, opaque contracts or inadequate audit capacity warrant escalation to FIPREG. A screening concern requires investigation; established illegality requires action under the applicable law. Neither can be neutralised by strong engineering or economic scores.

Under FIPREG, Governance must meet the same minimum floor. Its component findings should remain visible so that serious integrity failures are not concealed by an overall rating. Assessors should declare conflicts of interest, and appraisal should receive independent review where evaluators are also involved in promoting or designing the project.

The Governance assessment should remain distinguishable from the five-pillar profile. After all six dimensions clear the floor, FIPREG can report a six-dimension total, TIV-6, out of 30. It should not be ranked directly against a FIPRE ETIV out of 25; the scales contain different information. In both cases, decision-makers need the individual scores, evidence grades and outstanding conditions.

Figure 2 shows the resulting decision pathway. Evidence gaps, performance failures and eligibility lead to different actions. The pathway repeats as the project moves through its lifecycle.



74**Figure 2. Turning an assessment into a decision**
Source: Author. Passing the assessment does not replace statutory approval, lender due diligence or professional judgement. Confirmed legal non-compliance blocks progression.

Keep the questions alive after approval

The lifecycle begins with strategic alignment, or Gate 0. Does the proposal serve an evidenced public priority, and are its essential connections and recurrent costs planned? A port without onward transport or a power plant without a transmission connection may be a poor investment before detailed design begins.

The depth of assessment then follows the decision. At concept and pre-feasibility stages, teams compare alternatives and identify major risks. At feasibility, they undertake fuller assessment and independent review. At financing and approval, they translate agreed measures into named responsibilities, budgets, conditions and monitoring commitments. Each checkpoint should leave a record of the evidence considered and the reasons for progression or redesign.

Construction then tests whether those commitments are delivered. Operation tests whether the promised service continues. Decommissioning requires safe retirement, material recovery where feasible, site restoration and management of residual liabilities. This lifecycle perspective is consistent with ISO 55000:2024 (International Organization for Standardization, 2024).

For the flood barrier, monitoring would need to track protection across neighbourhoods, drainage performance, maintenance expenditure and unresolved grievances. A completion certificate alone would not show whether the intended service and distribution of benefits had been delivered. Monitoring should be able to change a decision. If flood exposure rises, maintenance funding disappears or access becomes unaffordable, the responsible institution needs a defined response, an accountable owner and a deadline. Depending on the finding, that response may involve additional investigation, corrective investment, redesign or suspension of an unsafe activity.

A small drainage project and a national power programme will need different resources and evidence. Both should address the relevant dimensions. A rapid screen identifies questions for further work; it does not carry the authority of a completed appraisal. Assessment effort may increase again when new hazards, design changes or operating failures emerge.

Put responsibility alongside the score

Institutional adoption needs a clear home. A planning or investment unit can coordinate the assessment, with engineers, economists, environmental specialists, climate analysts and social practitioners examining the same proposal. Affected communities contribute knowledge about service failures, access and local conditions that technical datasets may miss. Their participation should inform design, with a record of how concerns were addressed.

The asset owner should accept responsibility for the commitments it will inherit. Procurement teams should translate relevant measures into specifications and contracts, while finance teams confirm their funding. The final decision record should identify who will verify delivery and who can require corrective action. This connects appraisal to the people who must act on it.

Integration into existing appraisal and investment processes is preferable to creating parallel reporting. Institutions can reuse relevant evidence while retaining a clear audit trail, appropriate confidentiality and accessible explanations of decisions. Data gaps and limited staff capacity should shape a realistic improvement plan, with the most consequential uncertainties addressed before commitments become irreversible.

Give finance a clearer basis for decisions

For financiers, a useful assessment makes commitments specific. Who funds maintenance? Which resilience measures must be completed before disbursement? How will affordability and community outcomes be checked? What happens if conditions are not met?

FIPRE and FIPREG can help organise evidence for these decisions and expose gaps earlier. Their practical contribution should be measured through documented applications, including changes in preparation costs, financing readiness and delivered outcomes. Existing infrastructure research supports integrated appraisal, while the effectiveness of these particular frameworks requires its own evidence.

Project evidence may also inform sustainability reporting. However, an assessment score does not establish compliance with IFRS S1, which concerns material sustainability-related information affecting an entity's prospects (IFRS Foundation, 2023). Institutions retain responsibility for reporting boundaries, materiality judgements and the requirements of their financiers and regulators.

A portfolio view can also reveal shared vulnerabilities: several assets may depend on the same overstretched maintenance budget, exposed power connection or contractor. Those relationships can be missed when you review each investment separately. Portfolio analysis should retain comparable project profiles and their underlying assumptions, rather than collapse unlike projects into a reassuring average.

Start with a pilot and learn from delivery

Adoption can begin with one project and a multidisciplinary team. Keep the original proposal, revised design and evidence register, with the reasons for each decision. Review whether the assessment changed the design, clarified accountability and produced consistent judgements across evaluators, and record the time and resources required. Follow the asset into operation to compare promised performance with delivery. These records would give future users a stronger basis for judging the framework's contribution and planning wider adoption.

The method remains sensitive to judgement, data quality and the suitability of sector rubrics. Publishing assessment assumptions and recording outcomes over time would strengthen its credibility. Training can build familiarity, while dependable application requires practice, supervision and review.

Natural Eco Capital and the Africa Green Economy and Sustainability Institute support organisations interested in assessment, institutional integration and training. Institutions can explore a pilot through eugeneitua@ecopital.com or eitua@agesi.africa. The author developed FIPRE and FIPREG and has a commercial interest in their training, application and licensing.

Volume III will examine applications in transport, energy, water and flood management, and digital infrastructure. It will carry this series from the case for change in Volume I, through the decision method developed here, to the choices practitioners face in particular sectors. For now, the practical test is available to any project team: can you explain, with evidence, how the proposed asset will serve people reliably, manage its impacts, create durable value, withstand disruption and share benefits fairly? Where the answer is weak, the opportunity is to improve the project while choices remain open.

About the author

Dr. Eugene O. Itua is Chief Executive Officer of Natural Eco Capital Limited and Executive Director of the Africa Green Economy and Sustainability Institute. He works on climate finance, infrastructure sustainability, and environmental governance across Africa and created FIPRE™ and FIPREG™.



Energy Insufficiency in Nigeria:

Can Bioenergy Resources Close the Gap?

Introduction

Nigeria faces a severe and chronic electricity and modern energy crisis. Despite holding vast crude oil and natural gas reserves, the national grid frequently collapses, leaving over 40% of the population without access to electricity. The rural areas suffer the most, relying heavily on the primitive combustion of solid biomass like firewood. This article evaluates whether bioenergy resources can successfully bridge this massive energy deficit. By analyzing agricultural residues, municipal solid waste, livestock manure, and other energy crops, this write-up outlines the technical, economic, environmental, and institutional dimensions of implementing bioenergy solutions in Nigeria. The ultimate finding is that while bioenergy possesses the theoretical capacity to completely close the rural-urban energy gap, severe infrastructural bottlenecks, weak regulatory frameworks, and financial constraints must be solved first.

The Landscape of Energy Insufficiency in Nigeria

To understand the potential of bioenergy, one must first examine the structural failures of the current Nigerian energy system.

Current Grid Capacity vs. Actual Demand

Installed Capacity: The country has an installed grid capacity of roughly 12,500 Megawatts (MW).

Operational Generation: Actual daily power generation fluctuates poorly between 3,500 MW and 5,000 MW.

Suppressed Demand: True economic demand for electricity is estimated to exceed 40,000 MW.

The Deficit: This creates a massive structural gap of over 35,000 MW, stifling industrial growth.

Systemic Failures of the National Grid

Transmission Bottlenecks: The radial transmission grid is highly fragile, leading to frequent total grid collapses.

Gas Supply Deficits: Thermal plants, which supply over 75% of grid electricity, routinely face gas pipeline vandalism and pricing disputes.

Distribution Losses: Distribution Companies (DisCos) suffer from poor collection efficiency, aged transformers, and widespread power theft.

The Rural-Urban Energy Divide

Urban Areas: Urban centers experience rolling blackouts (load shedding), forcing businesses to rely on expensive, polluting diesel and petrol generators.

Rural Areas: Over 60% of rural communities are completely disconnected from the national grid, relying on kerosene lamps, candles, and wood.

Traditional Biomass Dependence: Upward of 70% of the total population relies on traditional biomass for cooking, causing severe deforestation and indoor air pollution.

Conceptualizing Bioenergy: Types and Technologies

Bioenergy refers to renewable energy derived from biological materials known as biomass.

Unlike fossil fuels, bioenergy can form a closed-loop carbon cycle when managed sustainably.

Direct Combustion (Thermal Energy)

Mechanism: Burning raw biomass materials directly in the presence of oxygen to produce heat.

Applications: Traditional cookstoves, industrial brick kilns, and biomass-fired steam boilers for electricity generation.

Efficiency: Traditional open fires have extremely low efficiency (around 10%), wasting valuable resources. Modern pellet stoves increase efficiency above 80%.

Anaerobic Digestion (Biogas Production)

Mechanism: Microorganisms break down biodegradable material in the absence of oxygen.

Outputs: Biogas (mainly methane, CH4, and carbon dioxide, CO2) and nutrient-rich digestate (organic fertilizer).

Feedstocks: Animal dung, food waste, sewage sludge, and wet agricultural processing wastes.

Thermochemical Conversion (Gasification and Pyrolysis)

Gasification: Converts biomass into syngas (carbon monoxide and hydrogen) by heating it at high temperatures with controlled oxygen. Syngas can power modified gas turbines.

Pyrolysis: Thermal degradation of biomass in the complete absence of oxygen, producing bio-oil, biochar, and syngas.

Biochemical Conversion (Liquid Biofuels)

Bioethanol: Produced via the fermentation of sugars and starches found in crops like cassava, sugarcane, and sweet sorghum.

Biodiesel: Produced via transesterification of vegetable oils and animal fats, using crops like jatropha, oil palm, and used cooking oil.

Mapping Nigeria's Bioenergy Resource Base

Nigeria possesses an extraordinary volume of biomass resources distributed across its diverse ecological zones.

Agricultural Residues

Nigeria is a top global producer of several staple crops, generating millions of tons of agricultural waste annually.

Cassava Peels and Stems: As the world's largest producer of cassava, Nigeria generates over 15 million metric tons of peels annually, which are currently left to rot or burn openly.

Rice Husks and Straw: Accelerated domestic rice production in states like Kebbi, Kano, and Ebonyi yields millions of tons of rice husks at milling clusters, perfect for localized gasification.

Maize Cobs and Stalks: Abundant across the Middle Belt and Northern regions, providing high-calorific feedstock for direct combustion or gasification.

Oil Palm Biomass: In the Southern rainforest belt, oil palm processing yields empty fruit bunches (EFB), palm kernel shells (PKS), and palm oil mill effluent (POME). PKS is a highly sought-after solid fuel.

Municipal Solid Waste (MSW)

Urban Waste Generation: Major cities like Lagos, Ibadan, and Kano generate thousands of tons of waste daily. Lagos alone produces over 13,000 metric tons of waste per day.

Organic Fraction: More than 50% to 60% of municipal waste in Nigeria is organic food and biodegradable matter.

Energy Potential: Landfill gas capture and waste-to-energy incineration plants could easily generate hundreds of megawatts while solving urban sanitation crises.

Livestock and Animal Manure

The Livestock Population: The northern savanna regions host millions of cattle, sheep, goats, and poultry.

Abattoir Wastes: Large-scale centralized abattoirs (e.g., in Lagos and Kano) discard massive volumes of blood and dung, which can feed heavy-duty anaerobic digesters to run localized mini-grids.

Dedicated Energy Crops

Jatropha Curcas: Introduced in the mid-2000s as a non-edible oil crop for biodiesel. It grows well on marginal, degraded lands without competing with food crops.

Sweet Sorghum: Provides both food grain and high-sugar stalks suitable for ethanol production.

Technical and Theoretical Evaluation: Can It Close the Gap?

To determine if bioenergy can close Nigeria's 35,000 MW gap, we look at quantitative estimations and spatial dynamics.

Total Energy Potential Quantification

Biomass Availability: Academic estimates show Nigeria produces over 150 million metric tons of biomass wastes annually.

Power Generation Potential: If fully harnessed through a mix of biogas, gasification, and direct combustion, this waste could theoretically generate between 10,000 MW and 25,000 MW of continuous electricity.

Complementary Role: While bioenergy alone might struggle to safely carry the entire industrial load of 40,000 MW without depleting forests, it can fully close the rural and peri-urban household gap, freeing up the national grid for heavy industries.

Baseload Capabilities

The Intermittency Problem of Solar/Wind: Solar and wind power depend on weather conditions and require costly battery storage systems.

The Bioenergy Advantage: Biomass is a controllable, dispatchable source of energy. Bioenergy plants can run 24/7 as baseload power stations, mirroring fossil-fuel performance.

Decentralization and Off-Grid Mini-Grids

Grid Bypass: Setting up bioenergy mini-grids bypasses the broken, expensive national transmission network entirely.

Localized Production: A rural community can use an anaerobic digester fed with local cattle dung and crop residues to power its own micro-grid, ensuring complete energy independence.

Socio-Economic and Environmental Dimensions

The deployment of bioenergy brings wide-ranging impacts beyond simple electricity generation.

Rural Economic Development and Job Creation

Agricultural Value Chain: Collecting, sorting, processing, and transporting biomass requires significant manual labor, creating thousands of rural jobs.

Smallholder Revenue: Farmers can sell agricultural wastes (cobs, husks, peels) to bio-refineries, creating an entirely new revenue stream from items previously considered trash.

Environmental Protection and Climate Mitigation

Methane Reduction: Unmanaged livestock manure and landfill wastes rot openly, releasing methane (a greenhouse gas 28 times more potent than carbon dioxide). Diverting this to biogas digesters mitigates climate change.

Deforestation Control: Providing clean biomass pellets and biogas for cooking will drastically reduce the demand for charcoal and firewood, halting the rapid desertification of Northern Nigeria.

Public Health Outcomes

Indoor Air Pollution: Indoor smoke from traditional wood stoves kills tens of thousands of Nigerian women and children annually.

Sanitation: Utilizing urban organic waste and abattoir effluent for energy drastically reduces the contamination of local water tables and prevents cholera outbreaks.

Crucial Challenges and Bottlenecks

Despite the immense potential, bioenergy development in Nigeria remains critically stunted due to structural roadblocks.

Lack of Available of Land

Land Competition: Utilizing fertile lands to grow dedicated energy crops (like cassava for ethanol or oil palm for biodiesel) threatens domestic food security in a nation experiencing high food inflation.

The Solution Requirement: Focus must strictly remain on non-edible residues, marginal lands, and post-harvest wastes rather than primary food crops.

Feedstock Supply Chain Logistics

Fragmentation: Agriculture in Nigeria is dominated by smallholder farmers scattered across vast rural terrain with zero transport infrastructure.

Collection Costs: Gathering loose agricultural wastes from thousands of small farms and transporting them to a central power plant can be cost-prohibitive due to terrible rural roads.

Seasonal Variations: Crop residues are highly seasonal. A biomass plant must have massive storage facilities to survive the off-season periods when crops are not being harvested.

Technical Capacity and Technology Transfer

Lack of Domestic Expertise: Nigeria lacks specialized domestic manufacturing for high-efficiency gasifiers, anaerobic digesters, and turbines.

Import Dependence: Most advanced parts must be imported, exposing projects to extreme foreign exchange volatility and lack of local maintenance technicians.

Historical Project Abandonment: Dozens of government-funded institutional biogas digesters across Nigerian universities and rural communities sit abandoned today due to simple maintenance failures.

Financial and Investment Barriers

High Initial Capital Expenditures (CAPEX): Building a modern, grid-tied biomass gasification or waste-to-energy plant requires huge upfront investments.

High Cost of Capital: Local banks offer loans at crippling interest rates (often exceeding 25-30%), making long-term renewable energy projects financially unviable without foreign grants or development finance.

Institutional and Regulatory Deficits

Weak Policy Implementation: Policies like the National Biofuels Policy and Incentives (2007) and the National Renewable Energy and Energy Efficiency Policy (NREEEP) look excellent on paper but lack implementation structures.

Tariff Distortions: The absence of clear, attractive feed-in tariffs (FiT) for biomass-generated electricity discourages independent power producers (IPPs) from investing.

Comparative Analysis: Bioenergy vs. Other Renewables in Nigeria

Criteria	Bioenergy (Biomass / Biogas)	Solar Photovoltaic (PV)	Small-Scale Hydro	Wind Energy
Availability	Continuous (Baseload capable)	Intermittent (Daytime only)	Seasonal (Water flow dependent)	Highly Intermittent
Storage Need	Low (Feedstock is the storage)	Very High (Requires batteries)	Medium (Dams/Reservoirs)	High (Batteries required)
Capital Cost	Medium to High	Medium (Falling rapidly)	High	High
Grid Bypass	Excellent (Local Mini-Grids)	Excellent (Home systems/Mini-Grids)	Good (Localized)	Poor (Requires specific sites)
Secondary Benefits	Organic fertilizers, waste sanitation	Minimal secondary products	Irrigation and water supply	Minimal secondary products
Main Drawback	Complex supply chain logistics	No power at night without batteries	Location-constrained	Highly site-specific (mainly North)

Strategic Roadmap and Policy Recommendations

To successfully transition bioenergy from a theoretical concept into a practical solution for Nigeria's power crisis, systematic steps must be taken.

Creating Robust Feedstock Supply Networks

Agricultural Processing Hubs: Locate bioenergy plants inside or adjacent to major agro-processing clusters (e.g., rice mills in Kano, oil palm clusters in Edo, cassava processing zones in Oyo). This eliminates rural transport costs.

Biomass Aggregation Businesses: Encourage private youth cooperatives to specialize in collecting, compacting, and delivering agricultural waste to energy plants.

Establishing Clear Financial Incentives

Tax Holidays: Grant comprehensive import duty waivers on specialized bioenergy equipment (digester membranes, gasifiers, specialized generators) and provide multi-year corporate tax holidays for bioenergy IPPs.

Dedicated Green Funds: Leverage the Central Bank of Nigeria (CBN) and the Bank of Industry (BoI) to establish low-interest (single-digit) long-term credit lines specifically tailored for bioenergy mini-grids.

Strengthening Regulatory Frameworks

Feed-In Tariffs: The Nigerian Electricity Regulatory Commission (NERC) must implement guaranteed, profitable feed-in tariffs for biomass power fed directly into the national grid or regional sub-grids.

Enforcing Waste Management Policies: Enforce strict municipal waste sorting laws in major cities. Force large markets and abattoirs to segregate organic waste, making

feedstock acquisition predictable and cheap for waste-to-energy developers.

Boosting Research, Development, and Local Capacity
Vocational Training: Introduce specialized bioenergy engineering courses within National Board for Technical Education (NBTE) curriculums to train a workforce of local maintenance technicians.

Local Fabrications: Subsidize local foundries and research institutes (such as the National Center for Energy Research and Development) to design and manufacture standardized, small-scale biomass gasifiers and digesters using local materials.

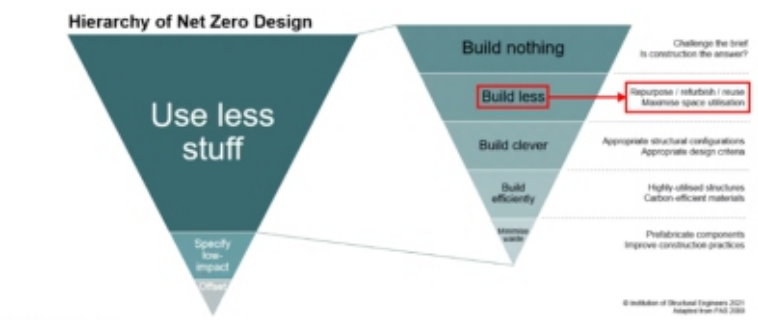
Conclusion
Bioenergy resources possess the true technical capability to significantly close Nigeria's energy insufficiency gap, particularly within rural, peri-urban, and agricultural communities. While it may not entirely replace large fossil-fuel and hydro installations for heavy industrial applications, bioenergy offers a perfect, decentralized, baseload-capable alternative that can relieve the national grid. By effectively utilizing millions of tons of agricultural residues, municipal solid waste, and livestock manure, Nigeria can simultaneously solve its electricity crisis, clean up its environment, boost rural incomes, and curb rampant deforestation. However, this potential will remain trapped on paper unless the Federal Government takes immediate, aggressive steps to clear financial bottlenecks, build domestic technical skills, and enforce stable, attractive regulatory frameworks for private developers. The path forward requires moving away from traditional wood combustion and pivoting directly toward clean, modern bioenergy technologies.

How Poor Construction Limits Sustainable Redevelopments

Introduction
As we move through 2026, sustainability has become an increasingly important topic across a wide range of industries, including agriculture, manufacturing, finance, energy, technology, healthcare, and construction. This growing focus is also being driven by global sustainability initiatives, such as the United Nations Sustainable Development Goals (SDGs) and the G7 2030 Nature Compact.

Across these sectors, corporations, institutions, and governments are taking steps to reduce their environmental impact and find more sustainable ways of working. The construction industry is no exception. However, while much of the discussion around sustainable construction focuses on new technologies, materials, and design approaches, less attention is sometimes given to the quality of construction itself.
This article explores how poor construction practices and inadequate construction quality can limit opportunities for sustainable redevelopment, with a particular focus on building structures in Nigeria. It considers how decisions and practices during the initial construction of buildings can influence their ability to be adapted, reused, or redeveloped sustainably in the future.

Sustainable Redevelopments
Firstly, what are the opportunities for sustainable redevelopments in the construction industry? The Institution of Structural Engineers produced "The Hierarchy of Net Zero Design" which provides basic guidance on how engineers can construct whilst keeping the environmental impact to a minimum.



Hierarchy of net zero design

The Institution of Structural Engineers 2021 - Adapted from PAS 20280



The focus of this article is "Build Less". Building less can simply be summarised as repurposing, refurbishing, and reusing existing structures. This eliminates possible embodied carbon generated from the demolition of existing buildings and the construction of a new one. We will use an example to better explain this process and the challenges that poor construction can present in sustainable redevelopments.

For example, a client has an existing 20 year old 5 storey concrete framed hotel building in the heart of a city. The client no longer wants to run a hotel enterprise and instead, they want to create a new building offering office spaces for companies and people working in the city centre. The client wants to demolish the existing hotel and construct a new office building.

Using the Hierarchy of Net Zero, the first step should be to build nothing and challenge the brief. The role of the engineer should be to communicate to the client that there is an opportunity to build less and reuse the existing concrete frame of the hotel building; this provides a far more sustainable approach than demolishing and building new, as it greatly reduces embodied carbon.

The option to reuse the existing concrete frame presents new challenges that need to be resolved. A structural appraisal, and condition survey will need to be carried out on the existing concrete frame. This will involve the review of the structural drawings, material tests, and surveys to confirm that the drawings match what was constructed.

Construction Practices and Quality

The article "Critical factors affecting construction quality in Nigeria: evidence from industry professionals" by Lukumon O. Oyedele et al. stated that following their study, the five most important factors affecting construction quality in Nigeria are:

- Poor quality of materials delivered to site
- Low level of skill and labour experience
- Poor inspection and testing
- Poor site installation procedure
- Lack of quality assurance

These factors significantly impact the suitability of existing structures for repurposing or refurbishment, as they introduce defects, accelerate deterioration, and shorten the structure's overall design life.

Continuing with our example, if the building was constructed according to the structural designs/drawings and specifications then the design for repurposing the concrete frame is straightforward and can be carried out. However, if the structural frame was not constructed as per the original design intent then the possibility for utilising it is affected and can prevent a sustainable redevelopment from being carried out.

This can result in a significant number of remedial measures, repairs, strengthening, and improvement works required on the building. A client is highly unlikely to go down the road of spending resources on remedial actions on the building when the option to demolish and build new is available.

As a result, a 20 year old building structure which should have been constructed with a design life of over 50 years does not reach half of it before it will be demolished.

Conclusion

In conclusion, while sustainable redevelopment through repurposing and refurbishing is a powerful tool for reducing embodied carbon and aligning with global sustainability goals, its success is fundamentally dependent on high-quality initial construction. In Nigeria, the prevalence of poor construction practices can make some possible opportunities for sustainable redevelopments unviable. Ultimately, to achieve a truly sustainable construction industry, we must prioritize long-term building quality from the outset, ensuring that today's structures are durable enough to serve as the foundation for tomorrow's adaptive reuse projects.

Ray Akpofure Rim – Rukeh
Writes from London

THE DELTA STATE ECONOMIC AND INVESTMENT SUMMIT 2026



The Delta State Economic and Investment Summit was held from August 3–5, 2026 with a theme that centered on "*Harnessing Our Strengths, Unlocking Our Potential,"* with a definitive mandate to transition the state beyond its traditional oil and gas dependency. The event which held at Dome Events Centre in Asaba brought together a high-profile lineup of public leaders, global policymakers, and corporate titans.

The event which was at the instance of the executive governor of Delta State HE Right Honourable Sheriff Oborevwori was attended by industry and policy players. The key industry and policy players who attended and drove the discussions at the event include: Senator Kashim Shettima - The Vice President of Nigeria served as the Special Guest of Honour; Sir Monday Onyeme - The Deputy Governor of Delta State; Prof. Chukwuma Charles Soludo - The Executive Governor of Anambra State; Prof. Taiwo Oyedele - The Minister of Finance and Coordinating Minister of the Economy; Chief Samuel Ogbuku - The Managing Director and CEO of the Niger Delta Development Commission (NDDC), H.E. Aiyub Omar - The Ambassador of Malaysia to Nigeria, who led trade delegations exploring local free trade zones.

Global Economic, industry and corporate players at event are; Dr. Ngozi Okonjo-Iweala -The Director-General of the World Trade Organization (WTO) delivered the keynote address; Prof. Patrick Loch Otieno (PLO) Lumumba - The renowned Pan-African scholar served as a guest speaker; Chief Tony Elumelu -The Founder and Chairman of Heirs Holdings; Engr. Austin Avuru - Prominent energy mogul and founder of AA Holdings, who served as the Chairman of the Occasion; Dr. Kingsley Emu - Secretary to the Delta State Government (SSG) and Chairman of the Summit Organising Committee and **International Investment Delegations** - Over 40 corporate representatives and prospective investors from **Brazil, China, Malaysia, and the United States**.

Discussions focused on agriculture and livestock development, the energy ecosystem, the blue economy and transport infrastructure, solid minerals and mining, the digital economy and innovation, as well as investment-related legal frameworks, and other enormous untapped opportunities capable of transforming its economy. Key sustainable outcomes of the summit are:

(i) . The provision of $100 million viability gap fund designed to specifically de-risk strategic private sector investments, acting as a financial buffer for sustainable industrial development.

(ii) .The adoption of a systemic administrative sustainability policy target to establish a centralized investment hub. This will streamline regulatory approvals and radically improve the local ease of doing business.

(iii)Partnerships aimed at making power accessible and affordable. The state should prioritized independent energy frameworks, including an initiative with the World Bank and Rural Electrification Agency targeting green power access for 25 communities.

(iv)Strategic frameworks were solidified to enhance electricity distribution networks, backing local manufacturing hubs like the Kwale Free Trade Zone (KFTZ) visited by international delegates during the summit.

(v) The government adopted a dual-purpose policy to open up underutilized arable lands within forest reserves for commercial farming. This simultaneously expands food production and removes criminal cover to boost regional security.

(vi) Policy actions were formalized to upgrade cassava and rice processing capacities through agricultural value-chain partnerships, directly leveraging previous diplomatic expansions with Brazil.

(vii) Moving beyond crude exploitation, a sustainable policy layout was designed around Delta's 160 kilometres of Atlantic coastline. Strategic investments will target maritime safety, eco-logistics, and coastal infrastructure to capitalize on its four distinct seaports of Burutu, Koko, Warri and Sapele.

Delta State Economic and Investment Summit 2026 in Asaba shiftes focus from opening ceremonies to investment negotiations.

Delta State Government

Cordially invites all relevant stakeholders and the general public

To

Delta State Economic and Investment Summit 2026

Theme: Harnessing our Strengths, Unlocking our Potentials

Date: August 3-5, 2026 Venue: The Dome Event Centre, Asaba Time: 10 am daily

Connect your ideas with capital, forge strategic partnerships, and give your business a boost.



HIS EXCELLENCY
KASHIM SHETTIMA GCON
VICE PRESIDENT, FEDERAL REPUBLIC OF NIGERIA
GUEST OF HONOUR



HIS EXCELLENCY
RT. HON. (ELDER) SHERIFF F.O. ODORIEVWORI (JP) FICMC, FNIM
GOVERNOR, DELTA STATE
CHIEF HOST



DR NGOZI OKONJO-IWEALA,
Director-General,
World Trade Organization (WTO).
Keynote Speaker:



ENGR. AUSTIN AVURU
Executive Chairman
AA Holdings



PROF. TAIWO OYEDELE,
Honourable Minister of Finance
and Coordinating Minister
of The Economy



DR JUMOKE ODUWOLE MFR,
Minister of Industry
and Investment



PROFESSOR PATRICK LUMUMBA
Guest Speaker:

Delta State
ECONOMIC &
INVESTMENT
Summit 2026

Autism: The Shift to Social Acceptance

(The 16th Annual GTCO Autism Conference)

Autism Spectrum Disorder (ASD) or simply **Autism** is a lifelong neurological variation that shapes how a person experiences, perceives, and interacts with the world. It is not a disease to be cured, but a natural difference in human development. Because autism is a spectrum, it affects every individual uniquely, meaning strengths and support needs vary widely from person to person. Manifestation of signs include; non-verbal communication, making eye contact or reading subtle social cues, repetitive movements (like hand-flapping or rocking), under-sensitivity to lights, sounds, and textures.

Modern advocacy focuses on moving past basic awareness toward true inclusion and acceptance. This means building a society that accommodates neurodiversity rather than forcing autistic individuals to suppress their natural traits. It is in this regard that Guaranty Trust Holding Company Plc (GTCO) through its Orange Ribbon Initiative organised the 16th Annual GTCO Autism Conference that was held at Adeyemi Bero Auditorium, Alausa Secretariat, Ikeja, Lagos from July 27 to July 28, 2026, under the theme **"Acceptance in Action: From Family to Classroom to Workplace to Public Spaces"**.



The aim of the Conference was to move the conversation around autism from basic awareness to real-world, practical inclusion across public and private spaces. The programme serves as a major focal point in West Africa for neurodiversity, shifting the conversation from basic autism awareness to driving practical, everyday social inclusion.

The key personalities who shaped the 2026 conference include:

Oyinade Adegite: Head of Group Corporate Communications at GTCO Plc. She served as a primary voice for the event's vision.

Oluwatosin Onobanjo: Corporate Communications Officer at GTCO Plc, who coordinated media briefings and operational execution for the regional project.

Cornelius Onuoha: Managing Director of RedGecko Public Relations Ltd. He managed the strategic public alignment and communication channels for the conference.

Dr. Eziafakaku Nwokolo: A prominent Board Certified Behavior Analyst (BCBA)She led discussions on evidence-based practices for inclusive education and domestic interventions.

Solape Azazi: An International Behavior Analyst who facilitated workshops focused on sensory adaptations in public spaces and childhood developmental sciences.

Osezusi Bolodeoku: An International Behavior Analyst who provided expert insights into early childhood intervention and

communication strategies for non-verbal individuals.

Remi Olutimayin: An autism self-advocate, copywriter, and the founder of Voice Acting Africa. He shared his unique lived experiences as a neurodivergent creative professional, emphasizing how workplaces can adapt to support autistic adults.

The 2 -Day event provided free one-on-one evaluations for families with medical and developmental specialists, including speech therapists, behaviour analysts, developmental psychiatrists, occupational therapists, psychologists, and parent counsellors.

The 2026 programme gathered leading local and international developmental sciences experts to tackle real-world barriers. The event focused on five key practical pillars:

Early Intervention: Methods to identify and support developmental needs in toddlers and young children.

Behavioural Therapy & Communication: Sharing specialized therapeutic strategies and speech tools to assist non-verbal or differently-abled individuals.

Inclusive Education: Equipping teachers and school administrators with methodologies to handle sensory and cognitive differences in regular classrooms.

Workplace & Public Space Adaptation: Encouraging corporations and public venues to rethink hiring practices, design low-sensory environments, and promote supportive infrastructure.

Caregiver & Family Support: Offering mental health resources and specialized counseling to parents and guardians.

Autism: Inclusiveness and Social Acceptance

True inclusion means building a world where autistic individuals are valued for exactly who they are. Social acceptance moves us past basic awareness and into real action. Acceptance is not about changing autistic people to fit the world. It is about changing the world so everyone has a place to belong.

Awareness means knowing autism exists. Acceptance means welcoming autistic people into our communities without asking them to hide their traits.

We can all take practical steps to make our schools, workplaces, and neighborhoods more welcoming.





The 49th Nigeria Annual International Conference and Exhibition (NAICE 2026)

The 49th Nigeria Annual International Conference and Exhibition (NAICE 2026) was successfully hosted by the Society of Petroleum Engineers (SPE) Nigeria Council. The flagship energy event took place from August 3–5, 2026, at the Expo Centre, Eko Hotels & Suites in Victoria Island, Lagos, Nigeria. The theme of the Conference: "Thriving in the Evolving Global Energy Landscape: Collaborative Growth and Resilience."

The main focus of the Conference are: Exploring policy certainty, digital transformation, cost-effective capital, and the role of hydrocarbons in Africa's energy transition.

The keynote speakers and high-level industry address leaders for the 49th Society of Petroleum Engineers (SPE) Nigeria Annual International Conference and Exhibition are:
The Honourable Minister of State for Petroleum Resources (Gas), Rt. Hon. Ekperikpe Ekpo, was present and actively participated in the event. His speech endorsed Nigeria's gas-led energy transition with emphasis on driving strategic partnerships, policy implementation, and expanding Nigeria's domestic gas utilization.
Engr. Effiong Okon (CEO of Seplat Energy Plc) – Delivered a central keynote address on the conference theme, *"Collaborative Growth and Resilience in an Evolving Global Energy Landscape"*.
Mrs. Oritsemeyiwa Amanorisewo Eyesan (CCE at NUPRC) – Featured as the Keynote Speaker for Panel Session II, focusing on *"Building Resilient Energy Systems in a rapidly Evolving Landscape"*.

Engr. Bashir Bayo Ojulari (GCEO of NNPC Limited) – Delivered the opening ceremony's official Industry Address.

Program Highlights
The three-day itinerary brought together global engineering professionals, policymakers, and industry regulators through several specialized events:

Technical Sessions: Dozens of research papers covering reservoir description, deepwater operations, and AI data science.

Workshops: Targeted sessions for Young Professionals, Women Leadership Programs, and Topical Issues.

Exhibitions: Showcases by major energy operators like Heirs Energies, NipeX, and international sponsors.

Family Programs: Interactive "Energy4Me" science sessions and recreational spaces for attending families.

Key Takeaway from the Conference:
(i). Stakeholders declared that Nigeria cannot rely on resource ownership alone to attract funds. Capital will naturally flow to jurisdictions where rules are predictable and projects remain commercially viable.

(ii). The conference urged regulators like the NUPRC and NMDPRA to maintain collaborative engagements with operators. This ensures effective compliance under the Petroleum Industry Act 2021 (PIA) while avoiding double taxation issues.

(iii). With international oil companies (IOCs) divesting from onshore assets, local companies now handle roughly 60% of Nigeria's oil production.

(iv). The communique resolved that local operators must aggressively strengthen their operational efficiency, enhance financial credibility, and properly manage decommissioning and

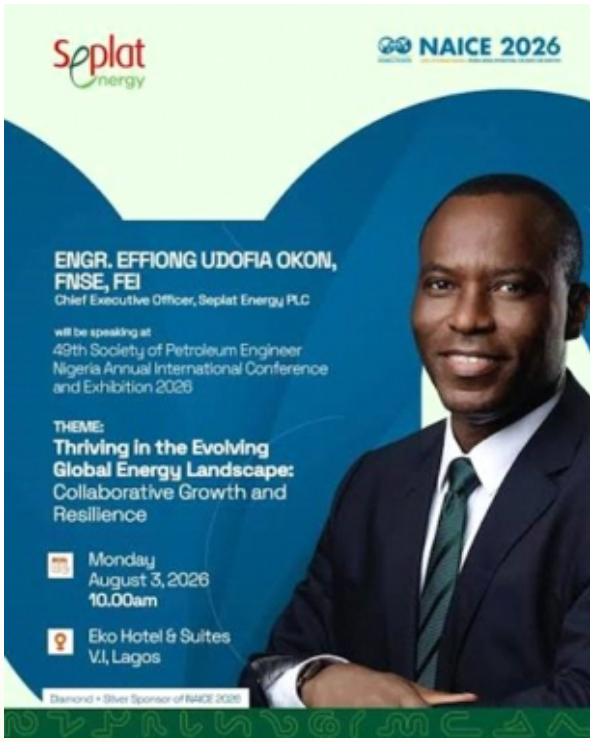
abandonment obligations.

(v). Participants stressed accelerating investments along the domestic gas value chain using initiatives like the Midstream and Downstream Gas Infrastructure Fund (MDGIF).

(vi). Resolutions highlighted balancing Domestic Crude Supply Obligations with market-based returns to secure Nigeria's position as a regional refining hub.

(vii). Companies were mandated to actively embed environmental responsibility by driving methane emissions management and carbon capture investments.

(viii). Stakeholders agreed that the sector must pivot from transactional HR to strategic workforce planning, targeted reskilling, and bridging the gap between academic institutions and industry realities.



The 25th NOG Energy Week Conference & Exhibition

The 25th NOG Energy Week Conference & Exhibition took place from 5 – 9 July 2026 at the Bola Ahmed Tinubu International Conference Centre in Abuja, Nigeria. As Africa's largest annual energy industry gathering, this milestone anniversary event focused on the theme: *"Advancing Energy Ambitions for Competitive & Resilient Economies."*

The five-day program was structured into distinct industry segments:

Nigerian Content Seminar: Dedicated to local capacity, technology adoption, and operational execution across the domestic energy value chain.

Strategic Conference: Addressed high-level policy, investment attraction, infrastructure development, and navigating Africa's sustainable energy transition.

Technical Seminar: Explored





engineering breakthroughs, cutting gas flaring, and field production efficiencies.

International Exhibition: A commercial marketplace showcasing advancements in oil, gas, LNG, power, renewables, and financial solutions.

Prominent Speakers

The 2026 event featured influential policymakers and corporate executives:

H.E. Sen. Heineken Lokpobiri: Minister of State for Petroleum Resources (Oil), Nigeria.

H.E. Rt. Hon. Ekperikpe Ekpo: Minister of State for Petroleum Resources (Gas), Nigeria.

Olu A. Verheijen: Special Adviser to the President on Energy, Nigeria.

H.E. Sen. John Owan Enoh: Minister of State for Industry, Nigeria.

Oritsemeyiwa A. Eyesan: Commission Chief Executive, NUPRC.

Rabiu A. Umar: Authority Chief Executive, Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA).

Engr. Felix Omatsola Ogbe: Executive Secretary, Nigerian Content Development & Monitoring Board (NCDMB).

H.E. Hon. July Moyo: Minister of Energy and Power Development, Republic of Zimbabwe.

H.E. Hamadou Tini: Minister of Petroleum, Republic of the Niger.

Amina Benkhadra: Director General, National Office of Hydrocarbons and Mines (ONHYM), Morocco.

Engr. Cany Jobe: Director General, Petroleum Commission, The Gambia.

Aune Amutenya: Acting Petroleum Commissioner, Ministry of Industries, Mines and Energy, Namibia.

Engr. Bayo Bashir Ojulari: Group Chief Executive Officer (GCEO), NNPC Limited.

Matthieu Bouyer: Chairman, OPTS | Country Chairman & MD, TotalEnergies Nigeria.

Jim Swartz: Chairman & MD, Chevron Nigeria Mid-Africa Business Unit.

Jagir Baxi: Chairman & MD, ExxonMobil Affiliates in Nigeria.

Mario Bello: Executive VP & Chairman, Eni Sub-Saharan Africa.

Wole Ogidan: MD & Head of Country, BP Nigeria.

Dr. Ainojie 'Alex' Irune: MD, Oando Energy Resources.

Adegbite Falade: Chairman, Independent Petroleum Producers Group (IPPG) | MD & CEO, Aradel Holdings Plc.

George Onafowokan: MD & CEO, Coleman Wires & Cables.

Seun Suleiman: MD, Siemens Energy, West Africa.

Tony Attah: MD & CEO, Renaissance Africa Energy Company Limited.

Audrey Joe-Ezigbo: Co-Founder & CEO, Falcon Corporation.

Kola Karim: Chairman & CEO, Shoreline Group.

Ahonsi I. Unuigbe: Founder & CEO, Petralon Energy.

Key Takeaways and Resolutions

(i). Over $4.5 billion in deals were finalized during the week.

(ii). NNPC Limited signed six major agreements. These spanned Memoranda of Understanding (MoUs) in Gas Supply Agreements (GSAs), and transport deals.

(iii). Data showed Nigeria's share of Africa's total upstream Final Investment Decisions (FIDs) surged to nearly 40%.

(iv). Resolution to accelerate gas processing for local electricity, petrochemicals, and transport.

(vi). Directives issued to retrofit existing plants with gas recovery systems.

(vi). Captured gas will feed pipelines or virtual distribution trucks to eliminate waste.

(vii). Recommitted to collaborative distribution networks to bring affordable cooking gas to local homes.

(viii). The NUPRC and NMDPRA committed to cutting human bottlenecks.

(ix). Regulators pledged clear, market-driven "willing-buyer, willing-seller" pricing to sustain capital inflows.

(xi). Revolved around deploying advanced automated security architectures to protect onshore assets.

(xii). Tech panels prioritized deploying Industrial AI and Machine Learning to optimize well delivery.

(xiii). Adopting smart tech to anticipate gear failure and slash asset downtime.

(xiv). Increased space for solar mini-grids, off-grid solutions, and hybrid backup power storage systems.



FEDERAL UNIVERSITY OF PETROLEUM RESOURCES, EFFURUN, DELTA STATE.

Motto: Excellence and Relevance

FUPRE 2026/2027

ADMISSIONS NOW OPEN

UNDERGRADUATE, POSTGRADUATE, PRE-DEGREE & FOUNDATION (JUPEB) & ENERGY BUSINESS SCHOOL PROGRAMMES

Apply Now @ www.fupre.edu.ng

The Federal University of Petroleum Resources, Effurun (FUPRE), invites applications from suitably qualified candidates into its Undergraduate (Post-UTME), Postgraduate, Pre-Degree/Foundation (JUPEB) and Energy Business School programmes for the 2026/2027 Academic Session.

Established in 2007, FUPRE is the first of its kind in Africa and the sixth in the world. As a globally recognized, innovation-driven university, FUPRE is renowned for academic excellence, cutting-edge research, and industry-aligned education, producing highly skilled professionals and future leaders across Science, Engineering & Technology, Computing, Maritime and Offshore Studies, Energy, and Petroleum Administration & Management.

UNDERGRADUATE (POST-UTME)
Where Ambition Meets Opportunity

Available Colleges

- College of Science
- College of Engineering & Technology
- College of Maritime & Offshore Studies
- College of Computing
- College of Petroleum Administration & Management

Minimum JAMB Score: 160
Application Fee: N2000
Deadline: July 17, 2026
Apply: utme.fupre.edu.ng

POSTGRADUATE SCHOOL
Research-Driven. Industry-Ready.

Available Programmes

- PGD
- M.Sc.
- M.Eng.
- M.Phil.
- Ph.D.

Available in

- College of Science
- College of Computing
- College of Engineering & Technology

Application Fee: N25,000
Deadline: Sept. 28, 2026
Apply: pg.fupre.edu.ng

PRE-DEGREE & (JUPEB)
Your Gateway to University Success

Available Pathways

- Pre-Degree (Admission into 100 Level)
- JUPEB Foundation (Admission into 200 Level)

Pre-Degree Fee: N10,000
JUPEG Fee: -15,000
Deadline: August 31, 2026
Apply: subdegree.fupre.edu.ng

FUPRE ENERGY BUSINESS SCHOOL (EBS)
Developing Leaders for the Future of Energy

Available Programmes

- PGD in Petroleum & Energy Studies
- Master's Degrees in Energy & Petroleum Mgt.
- Professional Doctorates in Energy, Sustainability & Petroleum Economics

Deadline: July 31, 2026
Apply: fupreebschool.org/applicant

THE FUPRE ADVANTAGE

- Africa's Premier Energy University
- Fully Accredited Academics Programmes
- Experienced and Distinguished Facility
- Modern Laboratories and Smart Learning Facilities
- Industry-Relevant Curriculum
- Innovation & Enterprenuership Development
- Strong Industry & International Partnerships
- Safe, Conducive and Technology-Driven Campus

FOR FURTHER ENQUIRIES

08034805996 | 07017324801
admissions@fupre.edu.ng
www.fupre.edu.ng

QUICK ACCESS – APPLY ONLINE

UNDERGRADUATE	POSTGRADUATE	PRE-DEGREE/JUPEB	ENERGY BUSINESS SCHOOL (EBS)
utme.fupre.edu.ng	pg.fupre.edu.ng	subdegree.fupre.edu.ng	fupreebschool.org/applicant

@FUPREofficial | @fuprenigeria | @FUPREofficial | @FUPRENigeria | @fupreofficial

Dr. (Mrs.) E. Jane Omoyine-Registrar

RC 1229221

VOLTSON

Engineering & Consulting Ltd.

Redefining Perfection...

- ENGINEERING
- PROCUREMENT
- CONSTRUCTION
- COMMISSIONING
- MAINTENANCE
- TRAINING

VISION

Our vision is to be a leading organisation in our chosen industries by constantly seeking opportunities for which our capabilities create superior value.

OUR MISSION

Our mission is to have every employee contribute to the long term health of the company by living out our value daily, adhering to safe and technically sound practice and delivering what we promise in a prompt, reliable and cost-effective manner.

VOLTSON ENGINEERING AND CONSULTING LIMITED is a quality management service provider plus human capital (manpower) solution provider - local and expatriate.

Contact us:

Warri Address: KM 4, off Refinery Road, Ekpan -Warri Delta State, Nigeria
Lagos Address: B1/B24 Mayfair Gardens Estate Km 36, Awoyaya Lagos-Epe Expressway, Lagos State, Nigeria.

+234(0) 8158849 993, +234(0) 703 6956 107, +234(0) 816 9520 929

info@voltsonengineering.com
www.voltsonengineering.com
facebook.com/voltsonengineering
Voltson_2013
Voltson_eng
Voltson Engineering & Consulting Ltd

About Us

VOLTSON ENGINEERING AND CONSULTING LIMITED is an indigenous limited liability company, with registration No. R 1229221 incorporated in Nigeria; it has its head office at Kilometer 4 Refinery Road Ekpan-Warri, Delta State Nigeria. It has vast experience in the area of Engineering, Procurement & Construction (EPC); design, installation, commissioning & maintenance.

Voltson was incorporated to consolidate all our business activities with a focus on building a long-term value creation and competitive advantage for the services we provide. Our employees bring a disciplined, strategic approach to these services and for continuous improvement in compliance and performance. Underlying the management philosophy and its day-to-day execution is the expectation that each of our employee will be an entrepreneur and responsible citizen.

GUIDING PRINCIPLES

The success achieved in the past and any future success, is a direct result of our commitment to live by a set of guiding principles that include:

- Performance
- Integrity
- Teamwork
- Excellence
- Dedication and commitment to the creation if real values.



LEE ENGINEERING

Lee Engineering & Construction Company Ltd.

Engineering - Procurement - Construction - Operations - Maintenance



Head Office
39, Norman Williams ST.
Ikoyi, Lagos, Nigeria

Operations Base
KM 7, NPA Express Ekpan
P.O Box 3101,
Warri, Delta, Nigeria

Project Base
40B Gen Diryai Street GRA Phase1,
Port Harcourt, Rivers, Nigeria

LIASON OFFICES
Houston, USA: 10375 Richmond Avenue. Suite 1600, Houston TX 77042, USA
Italy: Lee International Services S.r.l – Via Lazzaretto 19 20124 Milano

Trifex

A Boutique Consulting And Advisory Firm Focused On Finance And Risk Solutions For Businesses In Nigeria



OUR SERVICES:

- Revenue Life-cycle Consulting
- Advisory & Risk Consulting
- Treasury Operations Consulting
- Business Development



Contact Us:

Lagos Office: 27, Ibikunle Street off Herbert Macaulay Way, Yaba, Lagos.
Abuja Office: Suite 37, Alphacell Plaza Ebitu-ukiwe Street, Jabi Abuja

+2347034033795 +2348022903936
www.tifexlimited.com


shiloh beach
RESORTS & APARTMENTS
Our Facilities
Beach
Fully Furnished Apartments
Gated Access
24/7 Security Services
All Rooms En Suite
Bar/Lounge
Restaurant
Mini Swimming Pool
Steady Power Supply
Fully AC Rooms
24 HOURS
BOOK NOW
@Shiloh Beach Resort and Apartments,
River Road, Eku, Delta State, Nigeria
Tel: +234 803 356 4409, +234 802 722 2274
Come have your share of Paradise


FLEX/
BANNER
SAV/
STICKER
GRAPHICS
DIRECT
PRINT
PLOTTING
BRANDING
AWARDS MAKING
PROGRAM
PUBLISHING
DTF(SHIRTS & CAP)
Call Us For
Your High Quality
PRINTING
SO-DAVE
CLASSIC
08033090117, 08052929714
#58 NSUKKA STREET MILE 1 DIOBU,
PORT HARCOURT

Sustainability Times Magazine

Redefining Sustainability

The challenges we face today trigger by unsustainable practices and the urgency of climate resilience to the complexities of the circular economy require more than just headlines, they require a roadmap

Sustainability Times Magazine is an innovative multi-media platform dedicated to be the definitive resource for businesses, proffessionals and individuals navigating the transition to a rapidly evolving sustainability landscape. Our platform is a hub where innovation meets investment, and wheregrassroots activists connect with global policymakers to bridge the gap between vision and reality.

What you will find here:

- Breaking News & Vital Context
- Interview of Sustainability Leaders
- Key Features on
  - Circular Economy
  - Climate Action
  - Clean Technology
  - Nanotechnology
  - Sustainable Business
  - Green Skills Mobility
  - Material Flow Analysis
- Global Sustainability Trend & Data
- Sustainability Advertisement
- Sustainability Photos

Advertisement Rates

OUTER BACK COVER	N300, 000	FULL PAGE	N150, 000
INNER BACK PAGE	N200,000	HALF PAGE	N80,000
INNER FRONT PAGE	N200,000	QUARTER PAGE	N50,000

Sustainbility is no longer a choice, it is our shared responsibility, Join us as we Documentsthe emergence of a new, resilent modernity that will result to a greener lifestyle.

thesustainabilitytimes.net

akpofure@thesustainabilitytimes.net

+234-(0)80-2328-9899, +234-(0)80-3683-1995

ADANO
ENGINEERING CO. (NIG. LTD)

Old Infrastructure. New Standards. Sustainable Future.



Revitalizing Nigeria's Energy Infrastructure

The most sustainable structure is the one you don't have to build from scratch. Adano specializes in the complex rehabilitation of depots and tank farms. We extend the life of energy assets, improving their efficiency and sealing them against emissions, helping Nigeria's energy sector transition to cleaner, tighter standards.

Revitalizing Nigeria's Energy Infrastructure.