Department of Climate Change
Federal Ministry of Environment

Other Transport Sector Institutional MRV System

Initiative for Climate Action Transparency (ICAT) – Consultancy Project(s) Capacity Building on application of Measure, Report and Verify (MRV) Greenhouse Gas (GHG) Emissions for Mitigating the Impact of Climate Change in Nigeria

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ICAT INITIATIVE FOR Climate Action Transparency

CITEPA

ghg management institute

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Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use.
AS	Archiving Systems.
BUR	Biennial Update Reports.
CAR	Climate Action Reserve.
CBI	Confidential Business Information.
CBN	Central Bank Of Nigeria
CDM	Clean Development Mechanism.
CEMS	Continuous Emissions Monitoring Systems.
CO_2	Carbon dioxide.
COP	Conference of Parties.
CSO	Civil Society Organization.
CSR	Corporate Social Responsibility.
DCC	Department of Climate Change.
DRM	Dispute Resolution Mechanism.
DSA	Data Supply Arrangements.
ETF	Enhanced Transparency Framework.
ETP	Emissions Trading Programme.
FAAN	Federal Airports Authority Of Nigeria.
FMEnv	Federal Ministry of Environment.
FMOA	Federal Ministry of Aviation.
FMOT	Federal Ministry of Transport.
GEF	Global Environment Facility.
GHG	Greenhouse Gas.
GHGI	Green House Gas Inventory.
HSE	Health, Safety and Environment.
IA	Institutional Arrangements.
IAR	International Assessment and Review.
ICA	International Consultation and Analysis
IMP	Inventory Management Plan
IPCC	Intergovernmental Panel on Climate Change.
IPI	Inventory Progress Indicator.
IPPU	Industrial Processes and Product Use.
ISO	International Organization for Standardization.
KCA	Key Category Analysis.
LCD	Low-Carbon Development.
LEDS	Low Emissions Development Strategy.
LULUCF	Land use, Land-Use Change, and Forestry.
MAP	Mitigation Actions Plan.
MAN	Maritime Academy of Nigeria.
MDA	Ministries, Departments, Agencies.
MDD	Methods and Data Documentation.
MOU	Memorandum of Understanding.
MRV	Monitoring, Reporting and Verification.
NAMA	Nationally Appropriate Mitigation Actions.
NAZCA	Non-State Actor Zone for Climate Actions.

NBS	National Bureau of Statistics.
NC	National Communications.
NDC	Nationally Determined Contributions.
NGO	Non-Governmental Organizations.
NRC	Nigerian Railway Corporation.
NIMASA	Nigerian Maritime Administration and Safety Agency.
NIWA	Nigerian Inland Waterways Authority.
NAMA	Nigerian Airspace Management Authority.
NITT	Nigerian Institute of Transport Technology.
NISER	National Institute of Social and Economic Research.
NCAA	Nigerian Civil Aviation Authority.
NCAT	Nigerian Civil Aviation Technology.
NIIP	National Inventory Improvement Plan.
NPA	Nigerian Ports Authority.
NSC	Nigerian Shippers Council.
OTS	Other Transport Sector (Rail, Water-borne navigation, and Aviation).
QA	Quality Assurance.
QC	Quality Control.
SD	Sustainable Development.
SNE	Single National Entity.
SWOT	Strengths, Weaknesses, Opportunities, and Threats.
TER	Technical Expert Review.
TOR	Terms of Reference.
UNFCCC	United Nations Convention on Climate Change.
US EPA	United States Environmental Protection Agency.
VCS	Verified carbon Standard.

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Executive Summary

MRV as a concept was introduced in Bali 2007 at the Conference of Parties (COP 13) and detailed out the processes and procedures that are needed for the collection and reporting of GHG emissions data, its credibility, completeness, and transparency as well as their validation and verification. This will help to determine how and when Parties to the Paris agreement meets their respective obligations in the implementation of their actions, as expressly contained in their respective Nationally Determined Contributions (NDCs).

This report focuses on the Institutional MRV framework to be emplaced, relevance and purposes of MRV and its SWOT (strengths, weaknesses, opportunities, and threats) in the *Other Transport System* (OTS) in Nigeria. It also highlighted the necessary steps to follow in setting up MRV system and the applicability of MRV as a tool for meeting UNFCCC reporting requirements.

OTS refers to *other transport systems* that covers four specific non-road transport sub-sectors, namely:

- Railways,
- Aviation,
- Inland Water Ways, and;
- International Maritime.

These sectors are critical and important for consideration because they contribute to GHG emissions. The major concern in these sectors is how to reduce both fuel consumption and GHG emissions. The emissions for the subsectors are obtained based on the following:

- Railways: Railways are a key mode of overland transport which generates emissions from the combustion of coal, heavy fuel oil, diesel, and other fossil fuels. Emissions estimations are done by multiplying emission factors by either fuel consumption or train kilometers.
- Aviation (Domestic): Aviation is one of the most rapidly growing forms of national and international transportation. It consumes Jet-A1, Kero-jet, other fossil fuels. Emissions estimates are based on the number of aircraft movements, broken down by aircraft type at each airport.
- Inland Water ways: Emissions estimate are based on population, engine size and hours of use of different types of watercrafts, together with emission factors from EMEP/ EEA Guidebook.
- International maritime: Emission estimate are derived by the difference between total fuel consumption statistics for maritime fuels and fuel consumption by domestic shipping.

The GHG Inventory and GHG mitigation measures for each of the Nigeria's OTS modes (i.e. Aviation, Maritime/shipping, Inland waterways and Railway) were expressly treated, with appropriate recommendations per mode; in conformance with International bodies' visions and global aspirational goals and the set pathways to attain Carbon Neutrality by 2050.

The regulatory international bodies being referred to here are IMO (International Maritime Organization), UIC (International Union of Railways), ICAO (International Civil Aviation Organization) and IATA (International Air Transport Association). These international bodies provide technical support, assistance (in form of projects) and capacity-building, to member-countries (like Nigeria) to make compliance with their regulations and standards in reducing GHG emissions, much easier.

In line with the Paris Agreement, the relevance and importance of Institutional Arrangements (one of the six National Inventory Systems Templates required for the development of a sustainable National Inventory Management Systems) was clearly defined. This is developed as a framework to help in facilitating the tracking,

reporting, verifying, and responding to the review of sectoral and national Greenhouse gas (GHG) emissions, leading to GHG inventory compilation process.

In line with the constituent elements of Institutional Arrangements (IA), the MRV for the OTS was presented based on:

- Organizational Mandates
- Expertise
- Data flows
- Co-ordination, systems, and tools
- Stakeholders Engagement

This report goes further to explain the roles and responsibilities (sectoral and national) of Stakeholders, expectations of stakeholders from these OTS' modal agencies (i. e. NRC, NPA, NIMASA, NCAA, FAAN, NiMET, NITT, NIWA etc); as well as Workplan and Roadmap for OTS in Nigeria.

Chapter One - Introduction

1.0 MRV Overview

The OTS subsector represents a very important component of transportation sector and by extension, a key driver of the economy. Considering the sources and volume of fuel used by the OTS subsector in the movement of passenger and goods, it is therefore critical that Nigeria develop a robust MRV system to ensure tracking and mitigation of GHG emissions in the sub sector.

The MRV system will help to set out the processes and procedures for the collection and reporting of data, its credibility, completeness, and transparency as well as its validation and verification. This is to determine how well and when parties to the Paris agreement are meeting their respective obligations in the implementation of their climate actions, as defined in their Nationally Determined Contributions (NDCs). MRV as a tool is required for meeting the United Nations Convention on Climate Change (UNFCCC) reporting requirements in terms of:

- providing useful and relevant information on the coverage and level of ambition of a nation's responses to climate issues.
- enhancing accountability and transparency of information provided and reported.
- ensuring confidence and building mutual trust in information reported and
- tracking progress made in the realization of nation's commitment and pledges towards addressing climate change as contained in its NDC's issues.

The institutional MRV framework can be categorized into two namely:

- Domestic MRV: captures domestically supported Nationally Appropriate Mitigation Actions (NAMAs) (voluntary)
    - makes report on domestics MRV in nation's Biennial Update Reports (BURs).
- International MRV: undertakes reports through national communications (NCs) (by measurement of Greenhouse Gas (GHG) emissions and sinks, i.e., GHG inventory and indicating determined actions of implementing UNFCCC directives).
    - undertakes BURs (through GHG inventory report, measurement of mitigation actions and their impacts, reports on domestic MRV system and give an account of needs and support received and utilized)

Through literature, many questions have been raised as to: **What** are "M, R, V"? **Who** should use it? **When** should it be used? and **How** should it be used?

MRV as a terminology is used to describe all measures taken by countries to collect data on GHG emissions, mitigation actions and support.

M (Measuring): means estimated calculations of GHG emissions and emissions' abatement, by organizations with strict compliance with GHG protocol and guidelines, such as Intergovernmental Panel on Climate Change (IPCC) guidelines and Clean Development Mechanism (CDM) method. The estimation may be by direct measurements, using specified devices, or simple methods or complex models.

R (Reporting): means proper documentation of the estimates, with the intent of adequately informing all interested stake holders. Information to be reported includes methodologies, data and assumptions used in estimation. Reporting starts from standardized reporting templates, protocols, guidelines, and procedures that are used to feed the national GHG inventory, NCs and BURs.

V (Verifying): refers to the specified procedures to be followed and expert reviews to verify the quality of the data and emissions estimations. Verification can be internal or external.

The other transport systems (OTS) cover four specific non-road transport sub-sectors, namely: Railways, Aviation, Inland Water Ways, and International Maritime. As of today, there is no existing, formal MRV system for Other Transport Sector (OTS) modal agencies in Nigeria. Historically, random and un-coordinated reporting of GHG inventory has been the trend, in the years past. Poor awareness of MRV as a tool, absence of technical skills in application of methodologies for emissions' estimation, poor funding, lack of institutional, legal, and regulatory arrangements, are some of the major limiting factors for establishment of sectoral and national MRV systems in Nigeria.

There is need to institutionally set up these sub-sectors purposely to ensure their capacity to implement the MRV system. Hitherto, data has been a big challenge but not only in the OTS sector. It is therefore imperative to ensure that these sectors are able to capture GHG related data and also implement mitigation activities as applicable in the various sectors.

These subsectors are very important to the nation in terms of the driver towards GHG reduction:

Railway: The railway for example, is a mass transit system capable of moving thousands of people daily. As the country continue to improve its railway network system, there is bound to be a shift from use of cars and buses to rail network system where applicable.

Maritime: The maritime transport uses primarily bunkers which is one of the most significant sources of GHG emissions due to its heavy carbon content.

Inland Water Ways: While this is yet to be fully developed in the country, the coastal parts of the Country such as Lagos, Warri, Calabar, Port Harcourt have started developing their inland water ways especially in Lagos state.

Aviation: The aviation sub-sector in Nigeria has evolved with more airports built and traffic across the country. The implication of this is that more footprint of emissions as a result of air flights used in the country

1.1 MRV: Types and Relevance

1.1.1. MRV Relevance

MRV is the main pivot upon which global responses to climate change rest. Aside from enabling parties to the Paris Agreement to meet international reporting requirements, it also helps to build new, and to augment existing, GHG inventories. MRV is the conceptual foundation that provides policy makers with credible, transparent, and reliable data required to develop LED-Low Emissions Development Strategies, Mitigation Actions Plans (MAPs), NCs, BURs, NAMAs (Nationally Appropriate Mitigation Actions) and NDCs, as well as to facilitate broader responses to climate change and sustainable development (SD) objectives.

1.1.2. Purposes of MRV

- To enable recognition and visibility of mitigation achievements.
- To ensure increased transparency, accuracy, consistency, completeness and comparability of data and information on climate change at the national and international levels.
- To aggregate and attribute quantified mitigation effects to policies.
- To promote good accounting of sectoral, national and international progress, in line with international best practices.
- To ensure ownership of MRV and securing consensus for MRV within an organization or a sector.

1.1.3. Types of MRV

There are three (3) types of MRV namely:

- *MRV of GHG emissions:* This refers to the estimation of total GHG emissions over a period, at facility, organizational or national level.
- *MRV of Mitigation actions*: This is an assessment of either ex-ante or post-ante of GHG emissions reductions and/or sustainable development (i.e., non-GHG) impacts of policies, plans, programmes and actions, as well as the act of tracking progress. In effect, it estimates the expected change in GHG emissions and other non-GHG variables that result from the mitigation actions.
- *MRV of support:* This majorly centers on type and quantum of support received (i.e., finance, capacity-building, technical knowledge, and technology) as well as assessment of the impact of such support and result produced.

1.2.4. Identifying type of MRV needed by a Modal Agency in OTS

To set up an MRV system in any of the modes in OTS, providing cogent and direct answers, to these questions, in a sequential order, will be helpful:

- *WHY, OF MRV?* This gives an indication of the objective (s) of the MRV System to be set up. It also gives credence to the ownership of the MRV to the organization.
- *HOW, OF MRV?* This clearly spells out the methodological and technical guidelines and procedures to be followed by a mode to undertake its MRV. e.g., IPCC guidelines.
- *WHEN, OF MRV?* This refers to the specific time frame, within which the MRV will be undertaken by the modal agency.
- *WHO, OF MRV*? Identification of the parties or departments within a modal agency of OTS, that will be assigned with the tasks to carry out the MRV, the resources (i.e., finance) required as well as the data sources. The resources (i.e., finance); -will it come from either and /or the national budget, Grants, or international donations?

1.2.5. The National MRV System

MRV operates, or can be developed, at sectoral, national, sub-national, and international levels. However, for a nation to have a national MRV system strong institutional arrangements, supportive legal and regulatory mechanisms, technical capacity and ability and sectoral bodies, at multi-levels of government must be present. These facilitate good and seamless interplay to check the quality of GHG emissions monitoring, the application of effective mitigation actions as well as support received and used. In addition, the system must be such that the impact of support received (be it domestic or international) on the overall GHG emission abatement, can be monitored and assessed to ascertain progress.

1.2.6. SWOT/SWOC of National MRV System in Nigeria

Strengths

- Presence of coordinating entity i.e., Federal Ministry of Environment (FMEnv) and a National Focal Point (i.e., Department of Climate Change (DCC), to play the co-coordinating role nationally and serve as a link with UNFCCC and relevant international bodies.
- Availability of facilities (at FMEnv Level) to operate the system in areas of planning, specifying indications that would produce activity Data, Emission factors etc.,
- FMEnv/DCC capability and capacity to determine the coverage areas and compilation of GHG inventories, calculation of Emission factors, application of Mitigation Actions and seeking and obtaining of support.

- Availability of technical skills in FMEnv/DCC, research centers and tertiary institutions, to undertake the development of country specific parameters.
- Willingness of the Federal Government to provide necessary support for MRV development in OTS.

Weaknesses

- No cohesive institutional arrangements at OTS modal agencies.
- Lack of solid procedural arrangements (for GHGs Emissions' Estimations, GHG inventory).
- Lack of regulatory and legal framework at OTS modal agencies.
- Lack of Archiving system.
- No sectoral and country- specific Emissions' factors.
- Absence of experience in the design and operationalization of MRV of GHG Emissions, GHG inventories, Mitigation Actions and Support at OTS level.
- Lack of necessary facilities (e.g., software, computers, spreadsheet etc.,) at OTS level.
- Non-existence of well-manned MRV units/Divisions/Departments at OTS modal Agencies.

Opportunities

- Ample room exists, for the development, institutionalization, and implementation of an efficient and effective system in OTS modal agencies.
- Chances to introduce, as well as improve on GHG emissions data collection and calculations and GHG inventory compilation, exist.
- Presence of good international clime that supports the institutionalization of MRV system at both national and sectoral levels.
- Accessibility to NAMA Registry.

Threats /Constraints

- Lack of finance to enable the implementation of sectoral GHGI and GHG Emissions.
- Challenges, in processing and securing climate finance from international bodies (e.g., Green Climate Fund).
- Abandonment of project based MRV Initiatives that are not mainstreamed into the National Development Plans and National Budgets.
- Technical staff mobility in the form of transfer at short notices and within short tenure of office by any OTS modal Agency.

1.3. Setting Up Other Transport Sector (OTS) MRV System in Nigeria

MRV encapsulates the concept of Transparency. "It is defined as a process to increase the transparency of mitigation efforts made by developing countries as well as to build mutual confidence amongst all countries." (UNFCCC 2010). It is a major support to the country and serves to ensuring quality and facilitating common understanding within UNFCCC. Transparency is a key element in the Paris Agreement and very central to implementation of NDCs in developing countries.

Other Transport Sector (OTS) is one of the most significant and fastest growing sources of GHG emissions contributors in Nigeria, due to its increasing role in the nation's anthropogenic GHG activities. So, the need for Nigeria to meet its international reporting requirements under the UNFCCC and address the growing GHG emissions in the OTS, justifies the need to set up a sectoral MRV system specifically targeting the OTS. The objectives of setting up a sectoral MRV System for OTS are:

- To design and develop institutional arrangements (i.e., roles, responsibilities, reporting channels) and capacities (i.e., human, technical, procedural) required to implement MRV GHG Emissions, MRV GHG Inventory and MRV Mitigation Actions.
- To identify and proffer appropriate tools, methodologies and guidance that are necessary for MRV GHG Emissions, MRV GHG Inventories, MRV Mitigation Actions and MRV Support.

To set up a sectoral MRV System for OTS, there are three specified phases, broken down to nine steps, to be followed:

PHASE ONE: Define Scope and Boundaries

Step 1: Identify main effects of mitigation actions.

Step 2: Assess data availability/gaps.

Step 3: Define boundaries for analysis.

PHASE TWO: Scenarios and Modelling

Step 4: Develop baseline scenario (and ex-ante mitigation scenario)

Step 5: Set-up Model to calculate emissions

Step 6: Develop data collection plan (and methods such as surveys)

PHASE THREE: Scenarios and Modelling

Step 7: Collect Data (Measures)

Step 8: Calculate emissions reductions

Step 9: Report and verify

Chapter Two – Organizational Mandates

2.1. GHG Inventory

An organizational mandate simply refers to an authority or an enabler that permits an organization to conduct its GHG inventory activities, using standardized method and templates.

GHG inventory is a "list of emission source and the associated emissions quantified, using standardized methods." (US. EPA, JULY 2021). Compilation of a GHG inventory by an organization is undertaken for these reasons:

- Management of GHG risk identification of emissions- reduction change.
- Participation in mandatory or voluntary programmers.
- Participation in GHG carbon market.
- Enablement of recognition of voluntary actions.

Preparation of GHG inventory can be carried out under the guidance of GHG protocol Corporate Standard-(a Corporate Accounting and Reporting Standard). This Protocol provides specific guidance for GHG Emission sources, GHG calculations, methodologies, emission factors, defining inventory boundaries, and defining/adjusting inventory base years etc. Organizations are therefore mandated to consult this GHG protocol which provides the foundation guidance on GHG inventory compilation.

GHG Inventory In other Transport Sector (OTS)

The Other Transport Sector (OTS) in Nigeria, is comprised of Rail, water-borne Navigation (Inland waterways and Maritime) and Aviation/ Air Transport Modes.

National GHG Inventory is the accounting of greenhouse gases (GHGs) emitted into or removed from, the atmosphere, showing by source, the quantum of pollution released into the atmosphere during a given time frame, with the use of standardized methods. It is one of the major reports required by Nigeria, to develop and track policies and measures on GHG Emissions and removals (i.e., the National Total GHG Emissions and removals due to anthropogenic causes). It is used by UNFCCC to manage GHG Emissions and to monitor progress made towards emission reduction targets; and to help Nigeria access international Climate Finance. Again, policymakers can use it to establish a baseline to track emission trends, develop mitigation strategies and monitor progress.

In preparing a National GHG inventory for OTS in Nigeria, the UNFCCC Data quality principles must be adhered to strictly. These principles are:

- **Transparency**: (of assumptions and methodologies, that must be clearly stated and documented),
- **Accuracy:** (of the exactness of emission/sinks' estimates, uncertainties reduced, appropriateness of methodology used):
- **Consistency:** (Data sets for estimation of emissions and sinks from sources, use of same methodologies for base year and subsequent years, elements used for inventory for a given year must be consistent with previous years);
- **Comparability:** (estimates to be comparable amongst Parties; methodologies used to be in conformity with Conference of Parties; allocation of source categories);
- **Completeness**: (all sources/sinks and gases in the IPCC guidelines must be reported; full geographic coverage of sources/sinks of a party to be included).

In compiling a National GHG inventory, attention must be given to relevant Guidelines and Protocols, Workbooks, Software and Literature resources; methodologies/tiers (from simple to complex ones). The use of IPCC Guidelines 1996,2000and 2006 readily comes to mind when GHG inventory compilation is to be done. Whilst 1996 IPCC Guidelines use the same calculation method for all gases across all tiers, the 2006 IPCC guidelines only provide fuel-based estimates for CO_2 with Tier 2 for CO_2 using country-specific values instead of international default values which are used in Tier 1. Data development for national GHG Inventory is achievable through either/or a combination of 'Top-Down' or 'Bottom-up' Approach and can be used to foster better Stakeholder's engagement across board. The 1996 IPCC Guidelines differentiate between these two approaches thus: when calculations are based on fuel/energy consumption they are known as "Top-Down": whereas calculations based on distance travelled, are known as "Bottom-up" approach. Both IPCC guidelines (i.e., 1996, 2006) state that there is no tier 3 as "it is not possible to produce significantly better results for CO_2 than by using existing Tier 2 " (IPCC 2006). The 2006 IPCC guidelines recognized operating conditions as explicit factors in tier 3 calculations, whereas in 1996 IPCC guidelines, it is stated implicitly. (MarionViewmeg,2017).

Bottom-up approach is majorly kilometres–based; with the following inputs (i.e., Activity Data):

- Distance travelled (i.e., VKT, Pass-km, Ton-km).
- Emission factor (i.e., Kg CO_2eq/km) based on emissions per distance travelled.

The inputs (i.e., activity data) for 'Top-Down' approach that is energy-based are:

- Fuel consumption Data.
- Emission factor (i.e., Kg Co_2 /TJ) based on energy content of fuels. Any calculation made based on fuel/energy consumption is regarded as; "Top-Down" Approach.

To undertake GHG Inventory in OTS, following factors will decide its Data requirements:

- Type of measure (i.e., of MRV GHG Emissions, MRV Mitigation Actions, MRV of Support.
- Purpose of Analysis:
    - Ex-ante assessment, which relies more on assumptions, default values, averages, and actual data to be used as a basis for calculations.
    - Ex-post evaluation and monitoring which demands actual data, particularly the exact activity data.
- Expected level of accuracy.

There are three different levels of estimation method for GHG inventories as provided in the IPCC Guidelines for National Greenhouse gas inventories. These levels are called "TIERS" in the Guidelines and their categories are determined by levels of methodological complexities as shown below:

Table 1: TIERS" in the Guidelines and their categories

Category	Level	Explanations
Tier 1	Basic	Has readily available estimation methods and default emission factors provided by the IPCC Guidelines.
Tier 2	Intermediate	Use readily available estimation methods provided by the IPCC guidelines and country-specific emissions factors.
Tier 3	Most Complex	Use country-specific estimation methods, such as complex modeling approaches and country-specific emission factors.

Source; GIZ (April 2014): MRV Guidebook for Policymakers. International Partnership on Mitigation and MRV

Basically, there is a general method for estimating national level GHG and that is:

Multiply activity data by emissions factor
The equation goes thus;

E = AD × EF;
where:
E = GHG Emission,
AD = Activity Data,
EF = emission Factors.

It must be stated that the higher the Tier, the more complex the equation or algorithm becomes. However, Decision Tree comes handy in selecting which of the three Tiers to choose and use. Of all the three Tiers, Data requirements for Tier 3 GHG inventories are high, requiring much more detailed and consistent information.

Furthermore, boundary setting in OTS is an important factor in GHG inventory compilation as expressly stated in IPCC guidelines. To determine boundary setting, these dimensions must be considered:

- Geographic scope of analysis (i.e., national territory);
- Upstream/downstream emissions (i.e., mobile fuel consumption, direct GHG emissions from fuel combustion);
- Gases covered (i.e., CO_2, CH_4, N_2O);
- Time frame for Analysis (i.e., every 2years as part of BURs).

At this juncture, one is tempted to ask: what is national GHG Inventory used for? A National GHG inventory, is prepared to achieve a lot of different purposes, for different Stakeholders viz;

- A scientific tool, to be used by scientists, to develop models from natural and anthropogenic GHG emissions.
- A tool or framework to be used by Policymakers to develop policies for actualization of GHG emissions' abatements and tracking of progress for applying such policies.
- A tool to be used by businesses, public pressure groups (e.g., NGOs) to appreciate the sources and trends in GHG emissions (and carbon sinks);
- A tool by regulatory bodies to monitor and ensure compliance with regulations and rules. E.g. "Allowable Emissions Rules".

These GHG inventory Data are to be compiled and submitted, through National Communications (NCS) and Biennial Update Reports (BURS) by Nigeria (a Non-Annex 1 Party); in conformance with Articles 4 and 12 of UNFCCC, that required countries, who are signatories to the Convention, to submit their National GHG Inventories to the UNFCCC Secretariat, in line with the Convention reporting requirements, such as "Guidelines for the Preparation of National Communications for Non-Annex 1 Parties", as contained in Decision 17/CP.8.

GHG Inventory Development Process

There are four major steps for GHG inventory development process that are applicable in Nigeria's O.T.S; in a sequential order.

Step 1

- Review of accounting standards and methods.
- Determine organizational and operational boundaries.
- Determine a base year and consider 3rd party verification ignition.

Step 2

- Identify data requirement and preferred methods for data collection.
- Develop data collection procedures, tools, and guidance materials.
- Compile and review Organization's data (e.g. activity Data, fuel, consumption data)
- Estimate missing data to fill gaps.
- Select Emissions factors.
- Calculate emissions.

Step 3

- Develop a GHG Inventory Management Plan (IMP) to formalize procedures for collection of data and also document the process.

Step 4

- Establishment of a GHG emission abatement Target.
- Formalize data, track it and report progress.
- Undertake 3rd Party Verification.

GHG Inventory process does not start with compilation and end with verification alone. GHG Inventory, when compiled, must be reported, to complete the chain. Under normal circumstance, all OTS modal agencies in Nigeria, are expected to report their GHG emissions data annually to an independent, 3rd Party verifier, for sake of data transparency and integrity. But alas! This scenario does not exist in the OTS Modal Agencies.

To effectuate Organizational mandates for GHG Inventory, a practical framework is required by OTS modal Agencies to conceptualize, design, and develop a good management system and plan or GHG Inventory Management plan (IMP), that is open to future improvements. The IMP centres on the following institutional, technical, and managerial elements of a GHG Inventory.

These elements are:

- *Methods:* Refer to the technical parts of GHG inventory compilation. An organization is expected to choose or develop methods for estimating emissions accurately in line with their source categories.
- *Data:* Data such as Activity Data, emission factors, process and operations are very vital to GHG inventory compilation. Collection of high-quality data, maintenance and improvement of high collection procedures are essential.
- *Inventory Processes and Systems:* Preparation of GHG Inventories demands the articulation of institutional, technical, and managerial procedures. This entails the inclusion of technical expert team (s) and processes tasked with producing an inventory of high quality.
- *Documentation and Archiving:* This stage entails record-keeping of data, methods, processes, systems, assumptions, and estimates used for GHG inventory compilation by Organizations. There is no doubt that both GHG Emissions estimations and GHG inventory compilation are highly technical in nature (involving science, mathematics, and engineering). Documentation and Archiving are both necessary in GHG inventory compilation.

Table 2: Inventory Management Plan (IMP) Fundamentals

Inventory Component	Details
Methods- the technical aspects of Inventory preparation.	• Define Inventory boundaries..... and identify sources etc., • Identify methods for estimating emissions, the GHG protocol website(http://www.ghgprotocol.org) providing any default methods and protocols to help organizations within effort. • Establish procedures for applying and updating Inventory methods in response to new organization activities, new technical information, or new reporting requirements.
Data- the basic information on activity levels, emissions factors and operations.	• Develop the approach and assign roles and responsibilities to facilitate collection of high-quality data. • Create a process for the maintenance and improvements of data collection procedures.
Inventory processes and systems- the institutional, managerial, and technical procedures for preparing GHG Inventories.	• Define all institutional, managerial, and formal procedural aspects required to develop and maintain a GHG Inventory that meets the public sector protocol accounting and reporting standards. • Whenever reasonable, integrate these processes with other organization processes.
Documentation (and Archiving).	• Identify internal and external audiences and develop procedures to document information intended for their use. • Establish documentation sufficient for an inventory development team to accurately and efficiently continue preparing and improving all four fundamentals in the organization's inventory. • Ensure documentation provides sufficient transparency to facilitate potential internal or external verification. • Ensure good storage of documents (hard and soft) (print or electronics) for easy access and reference and protection against damage or theft.

Source: (Adapted): USA/EPA: (March 2007): Programme Guide for Climate Leaders http://www.epa.gov

2.2. Mitigation

One of the ways of responding to climate change is mitigation i.e. ways and means of reducing greenhouse gas emissions and stabilizing the levels of heat- trapping greenhouse gases in the atmosphere" (NASA, 2021). Climate neutrality can be described as all efforts aimed at reducing, eliminating or offsetting the GHG emissions associated with the operations in the OTS. Reducing the impacts of GHG emissions, through mitigation, is one of the most critical responses, which requires total commitments, in using carbon offsets or technological improvements, or operational improvements or behavioral changes or other measures to achieve.

In GHG Mitigation, the focus is primarily on:

- Reduction or avoidance of GHG emissions through energy efficiency (i.e., a cost-saving efforts);
- Elimination of GHG emissions through switching from one source of energy to another better option e.g. from fossils-based fuel to renewable (i.e., zero carbon) sources of energy e.g., CNG, LPG, Bio-fuels, wind-powered, photovoltaic solar energy etc.)
- Sequestration or offsetting any remaining emissions.

There are many available mitigation options in each of the OTS modes, but certain criteria have to be employed in evaluating them and selecting the appropriate option(s) that is/are applicable to each mode. These criteria include but not limited to:

- Potential to reduce or avoid GHG emission.
- Flexibility of a mitigation option to wards GHG emission's GHG abatement.

- Potential of a mitigation option, when taken, to cause environmental and social side effects positively or negatively.
- Tandem relationship with other potential mitigation measures to produce the desired results.
- Potential of a mitigation option when successful, to be scaled up (in the nearest future);
- Potential to involve stakeholders from the start to the end.

Applying these criteria enable propel evaluation, prioritization, and selection of appropriate mitigation measures, in sequence, for the implementation and easy tracking of progress. The aim of evaluation of mitigation option (projects, programmes, initiatives) is one or a combination of these:

- Identify and know the initial capital out lay;
- Monetary savings;
- Identify Payback period/time, Return on Investment (ROI), Net Present Value (NPV), or Internal Rate of Return (IRR).
- Identify GHG emission reduction (Rate)
- Identify emission reduction efficiency (in $/mtco$_2$).

GHG emissions mitigation in other transport sector (OTS)

Climate change is one of the multi—faceted and complex issues, that are of grave concerns to the entire world, as at today.

It is a multi-dimensional issue that cuts across science, politics, economics, environment, and moral fabrics of the society; with heat-trapping greenhouse gases, especially CO_2 increasing the global warming levels – thus calling for concerted responses to global warming.

Such responses will be dependent on how anthropogenic activities emitting greenhouse gases can be monitored and controlled. Responses to climate change can be classified into two dimensions:

- By Mitigation i.e., ways and means of "reducing GHG emissions and stabilizing the level of heat – trapping greenhouse gases in the atmosphere" (NASA, 2021).
- By Adaptation, "as the process of adjustment to actual or expected climate and its effects" (IPCC – Inter Governmental Panel on Climate change, 2014).

Mitigation involves reducing the flow of heat – trapping greenhouse gas emissions into the atmosphere, either by reducing sources of these gases (e.g., the burning of fossil fuels by transport) or enhancing the "sinks" that accumulate and store these gases (in the seas, soils, forests).

In understanding mitigation actions in Other Transport Sector (OTS), the boundary setting must be specified. The boundary dimensions for the mitigation actions that must be considered are:

- Geographical Scope of Analysis (i.e., corridor, ride, national/regional/state territory);
- Upstream/Downstream GHG emissions (i.e., fuel, infrastructure, construction, mobile fuel combustion, construction);
- Gases covered (CO2, CH4, N2O);
- Time frame for Analysis (depends on type of measure).

Mitigation Measures in Aviation

Reduction on Carbon Emissions, toward attaining carbon neutrality, has been on in Federal Airports Authority of Nigerian, (FAAN) since 2018. through an Initiative of Airport Council International (ACI) – a body of all accredited Airport in the world with a Pro-active vision of taking steps to reduce GHG Emissions in Airport. This Programme under the Initiative is called Airport Carbon Accreditation Programme (ACAP) – a voluntary programme for Airports to contribute towards carbon – reduction. Not too long ago, the Murtala Mohammed International Airport (MMIA) Lagos, got this license for compliance, from Airport Council International (ACI), through its consultant Administrator (i.e., WSP), based in United Kingdom.

FAAN still has plan to extend this programme, to other Airports in Nigeria, through data collection on ACI's standardized templates.

Nigerian Civil Aviation Authority (NCAA), a regulatory body in Nigeria's Aviation sector, has been adopting CORSIA (Carbon Offsetting Reduction Scheme in International Aviation) to mitigate GHG emissions reduction, as demanded by ICAO – although there is still much more to do.

There are seven categories of Mitigation measures in Aviation industry namely:

- Aircraft – related technology development,
- Sustainable Energy fuel,
- Improved Air traffic management and related infrastructure use,
- More efficient operations,
- Economic/market-based measures/mechanisms,
- Regulatory measures,
- Airport improvements.

But based on ICAO 37th Assembly Resolution A39–2, in 2010, all these measures to reduce GHG emissions in Air Transport, were further re – grouped into four new categories and are referred to as "ICAO Basket of Measures", to achieve its Global Aspirational Goals and promote sustainable growths in International Aviation. The Global Aspirational Goals are:

- Attainment of 2% Fuel Efficiency improvement through 2050,
- Carbon neutral growth from 2020 onward. (ICAO 2010).

The ICAO "Basket of Measures" is comprised of:

- **Air Technology Improvements and Standards:** These take the shape of: Aircraft minimum efficiency standards; retrofitting and upgrades of existing aircrafts; adoption of revolutionary new designs in aircraft engines; purchase of new aircraft engines; avionics; re – jigging of the structure, aerodynamics and propulsive of aircraft. (For lower fuel consumption); reduction in aircraft's weight; introduction of drag – reduction technologies and wing – tip devices to improve Aircraft's aerodynamics.

- **Sustainable Aviation Fuels (SAFs):** Introduction and use of Bio – fuels and other fuel sources with lower CO_2 emissions that meet set technical standards, for use as alternative fuels. It is a strategy aimed at reducing fuel consumption drastically. The current challenge to its use in the Aviation industry is that it is more expensive than the conventional Jet – A fuel. The technology to produce SAF already exists but its other challenges are how to accelerate its development, how to reduce its cost of production and how to ensure its environmental integrity and its wider acceptability in the Aviation world.

- **Operational Improvements:** These include,
  - Improved Air Traffic Management and related Infrastructure use. This requires substantial investments taking into consideration, performance indicators such as safety, reliability of service, cost as well as aircraft and airport capabilities.
  - More efficient operations through:
    - Adoption of best practices in operations,
    - Navigational improvements.
    - Optimization of maintenance in Aircrafts.
    - Better use of Airspace and Routes streamlining to cut down flight travel times.
    - Choosing appropriate Aircraft, well – suited for a given flight.
    - Encouraging Green taxing.
    - Optimization of Airport layout to improve throughput and minimize unwarranted holding.

Although Operational Improvements may necessitate additional investments, considerable savings in GHG emissions, are assured.

  - Airport Improvements. e.g. use of photovoltaic panels as a source of power generation in Airport; improvement in Ground Support Equipment (GSE) management; Airfield improvements; conversion of GSE to cleaner fuels.

Market – based Measures or Investments: These include:

- Participation in multi – lateral emissions Trading Schemes in Aviation industry.
- Introduction of payment of GHG Emissions charge or modulation of landing/ taking – off (LTO) charges.
- Membership of Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This enables Airlines to offset their GHG emissions, with reductions in other sectors. It requires giving financial support to the project, for it to be successful and achieve carbon – neutrality in Nigeria Aviation sector. CORSIA, a global market – based mechanism to stabilize net CO_2 emissions from international Aviation, with effect from 2021, to ensure carbon – neutral growth, was adopted in 2016 at the ICOA's 39th Assembly. CORSIA helps in filling any remaining GHG emission gaps in the Aviation industry.

Recommendations

For Nigeria to address the climate impact in its Aviation Sector:

- Nigeria has to key in, into the three climate goals, as set out by IATA (International Air Transport Association) and show strong commitment in implementing these three goals namely:
  - Improvement in Fuel Efficiency of "1.5% per year from 2009 – 2020" (IATA July 2021);
  - Attaining Carbon – Neutrality, using CORSIA, to offset GHG emissions till when other low – carbon emissions technology such as Sustainable Aviation Fuels (SAFs) fully comes on board and Infrastructure measures witness convincing improvements.
  - Reduction in Aviation's net CO_2 emission to half of 2005 levels by 2050 (IATA July 2021). This is an ambitious goal that requires strong Federal Government's commitment and political support for the adoption of SAFs and, continued investments in new technologies, for it to succeed.

These three climate goals set by IATA, are achievable through a 4 – pronged approach, called Pillars. Interestingly, these 4 Pillars are the same thing with the four elements of ICAO's basket of measures of mitigation, set out to achieve its (ICAO's) two Global Aspiration goals, as earlier discussed.

Further, to achieve Climate Neutrality in Nigeria's Aviation sub – sector, a target of net reduction in GHG emission of say,30% by 2030, must be set, through a programme course of actions, with necessary legislative support, at both sectoral/modal and national levels.

- Nigeria must have a State Action Plan (SAP) on Emissions' Reductions, in accordance with ICAO's Directive, on its Drive or stance to contribute significantly towards reducing the impacts of climate change; albeit financial, technical, and human resources have continued to be the drawbacks.

However, ICAO, in order to enable member states (of which Nigeria is one) overcome these challenges, introduced and
launched the State Action Plan (SAP) Initiative in 2010, so as to provide member states with capacity, quantification tools and guidance documents to develop and implement their SAPs .
The State Action Plan Initiative will enable Nigeria to set up a long-term strategy on climate change for the international aviation sub-sector, with all the interested parties at modal and national levels, involved. These parties are expected to work as a team and come up with:

- Well-defined quantified baseline scenario.
- Select appropriate mitigation measures from ICAO's basket of measures.

- Calculate the expected results of implementing the mitigation measures so selected. All these constitute SAP to be submitted to ICAO. This must be updated every three years, in order to make it easier for ICAO to continually compile the quantified information, so provided and also to track progress.

The responsible entities in Nigeria are: Federal Ministry of Aviation (supervisory Ministry), Nigeria Civil Aviation Authority (NCAA), Federal Airports Authority of Nigeria (FAAN), Nigerian Meteorological Authority (NiMET), Nigerian Civil Aviation Authority (NCAA) and Nigerian Airspace Management Authority (NAMA).

Mitigation Measures in Maritime Transport
In Maritime Transport, the major concern is how to reduce both fuel consumption and GHG emissions.

The International Maritime Organization (IMO),based on its adoption of its Initial Strategy (2018) on the GHG Emissions Reduction from both Ships and Ports; and as a sign of its commitment to emissions' reduction in International Shipping, came up with a Vision, thus: "*IMO remains committed to reducing GHG emissions from the International Shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century."(IMO, April 2018).* IMO has since been doing so, through global technical assistance to country members (of which Nigeria is one), by giving support for implementation of energy efficiency and other related mitigation measures in International Shipping sub-sector.

The IMO targets at GHG Emissions' Reduction from Shipping……" By 50% in 2050 and to reduce average Carbon intensity by 40% in 2030 and 70% in 2050 compared to 2008" (IMO 2018). To attain the level of the overall Ambition of the IMO's Initial Strategy by the end of this century, it has to be noted that technological innovations, adoption of alternative fuels, efficient source of energy, Research & Development, Investment Drive and improving Operational measures, are the basis upon which to build the anticipated zero carbon regime. The notable mitigation measures in Maritime Transport are:

- Improve turnaround times at Ports for ships, arising from improved stevedoring operations, berths availability and efficiency of loading and un-loading equipment.
- Improvements in ships designs (e.g., on energy efficiency design, optimization of super structure, Hull shape, propulsion machinery, peripheral system, and auxiliary machinery).
- Introduction of specific initiatives, policies, and programmes to address GHG Emissions at ports/berths, as it is estimated that GHG Emissions from ships are far greater than those of operational activities at ports.
- Lowering of ships speed on high seas, to reduce fuel consumption.
- Operations- related measures are dependent on both ports and ship operations. Ship's fuel consumption is dependent on ship's speed, albeit ships are built to operate at a given design speed.
- Optimization of logistics supply chains at ports.
- Ports to incentivize ship owners and operatives, to operate their vessels, to produce lower GHG emissions, through speed reduction programme or reduced port charges /fees.

- Pro-active drive to turn conventional ports to "Green Ports". e.g., by linking ships at berths, to On-shore power supply system, sourced from hydro-power generation or wind turbines.
- Streamline Hull and propeller designs. The ship builders are doing this so that ships can move faster, with less fuel consumption and less GHG emissions. Streamlining of ships and drag reduction are ensured through Hull's optimization.
- Support R&D and Investments drive in the design and manufacture of Zero- carbon ships; innovative Sustainable Technologies (ST); development of infrastructure to support Zero-carbon fuels; provision of power supply on ships or On-shore or at shore, from renewable energy sources.
- Switch from fossils-based fuel (oil, gas, coal) to alternative sources such as LNG, Methanol, to provide low carbon fuel.

Recommendations

- Nigeria as a member-State of IMO should endeavor to adopt and implement the IMO's Strategy (2018) on Reduction of GHG Emissions from Ships and map out Plans to phase such ships out, as soon as possible, before the end of this century. The Strategy sets out a "Pathway of carbon dioxide emissions' reduction, consistent with the Paris Agreement temperature goals". The relevant Agencies here are: Federal Ministry of Transport, NIMASA, NPA, MAN and NSC.
- To improve Energy efficiency of international shipping, Nigeria (through its agencies, NIMASA, NPA, MAN and NSC) should adopt these regulatory tools:
    - EEDI: (Energy Efficiency Design Index): This is a mandatory requirement for new ships, to ensure strict compliance with carbon neutrality standards.
    - SEEMP (Ship Energy Efficiency Management Plan): This is the mandatory operational requirement to be met by operators to improve the energy efficiency of all ships.
    - IMO'S Data Collection System: This is mandatory for all ships of 5,000 gross tonnage and above, to collect fuel oil consumption data for annual reporting to IMO by a member—flag state, effective from January 01 2019.
- Nigeria, (through the relevant agencies (NIMASA, NPA) must strive to implement these measures, as Action Plans, to mitigate GHG emissions reduction in maritime, on a consistent basis by:
    - Undertaking Policy and Institutional Reforms.
    - Establishing a Public ---Private Partnership (PPP) Arrangement that will support and promote low carbon shipping.
    - Creating public awareness and stepping up capacity -building activities.
    - The responsible **entities to take charge are: Federal Ministry of Transport, Nigerian Maritime Safety and Administration (NIMASA)**, Nigerian Ports Authority (NPA), Nigerian Shippers Council (NSC) and Maritime Academy of Nigeria (MAN).

Mitigation Measures in Inland Waterways Transport

GHG emissions from vessels on Inland waterways in Nigeria, are not currently and properly captured (i.e., measured, reported and verified), due largely to the fact that national fuel consumption data directly used by this sector are subsumed (as a segment in Transport) under Energy sector. It should be noted that Inland water ways (Inland Navigation) relatively contribute lower GHG emissions when compared to road and air and the intent of its mitigating measures is to prevent further rise in global warming and reduce the negative climate change impacts. Some of the mitigation measures in Inland waterways transport include:

- Operational Measures e.g. optimizing speeds of vessels and improving operating conditions.
- Switch to Alternative propulsion system to ensure efficiency.

- Adopt alternative sources of Energy, that are of low carbon intensity or carbon free; and its future is guaranteed. e.g., Liquid Biofuels; Liquefied Natural Gas (LNG); on-board electricity supply from renewable energy; and synthetic methane. However, these Alternative fuels are still subject to further R & D as well as laws, regulations and standards governing Inland waterways in Nigeria.
- Adopt and be guided by, supporting measures e.g., compliance with relevant portions of IMO's Initial Strategy (2018) that are not at variance to Nigerian Laws.
- Seek improvements in the design of vessel's Eco Hull. This is a way of improving efficiency in fuel consumption, as underwater "Drag" and '' wash creation "are highly minimized. Use of glass fibre as against traditional use of steel for moulding and casting of Hull, is gradually gaining momentum. Albeit, with Hull improvements, vessels travel faster, with increase in fuel consumption and no corresponding decrease in GHG emissions. But where behavioural changes are adopted, there is tendency to experience a modicum of fuel consumption and GHG emissions reduction.
- Behavioral measures to reduce use of engines, will ultimately alter fuel consumption by engines e.g. the hydro-dynamic interactions of a vessel restricts the speed of a vessel, when moved in a confined area or channel. Speed restrictions (officially-imposed or personally imposed by the pilot) save fuel and thus lead to emissions reduction.
- Introduce alternative engine systems which include electric boats and Hook-up pillars. The hook-up pillars serve as hanging units for vessels and thus lead to lower emissions. This can be promoted by offering a significant reduction in licensing fees. However, the high capital outlay and maintenance of electric boats (e.g., regular replacement of batteries) is a discouragement to investors. Other notable alternative engine systems are wind-assisted vessels; Hydrogen-fuel cells powered vessels – all these should be explored further as they are equally good mitigation measures.
- Improvement in navigation-related infrastructure e.g., Terminals (Ports or nodes), Locks, Rivers, Channels, Bridges, Pillars (along or in the channels), On-shores power supply from hydro-power generation etc).

Recommendation

Federal Ministry of Transport (FMOT) and Nigerian Inland Waterways Authority (NIWA) should strive to implement these mitigating measures.

Mitigation Measures in Railway Transport

Railway is one of the most efficient and environmentally friendly modes for mass movements of people and goods (freight) and has tremendous potentials to reduce GHG emissions and improve quality of life. It generates the lowest CO_2 emissions, when compared with Air, Road and Maritime.

Specifically, GHG mitigation Actions in Rail Transport that are necessary to decrease emissions and increase rail outputs and sustainability are:

- Fuel efficiency with the aid of technology e.g.
  - Introduction of fuel management systems 'software which enables locomotive Driver to drive his train at most fuel-efficient manner. This software enables power setting on locomotives, to be adjusted in a way that fuel wastage is reduced, train movement is fuel-efficient and train operation is optimized.
  - Introduction of 'Stop-start' Idling system on locomotives to reduce fuel wastage and to improve environment, e.g., on-board computer on locomotives that determines power needs and when to start or stop a locomotive engine.
- Modal shift from air and road, especially for freight movements.
- Improvements in Rail operations to decrease GHG emissions and its adverse impacts on the environment and society.

- Afforestation programme by planting trees at strategic locations in railway stations and along the track, to reduce carbon footprint.
- New Technology and innovations e.g., improvement in aerodynamics of motive power and rolling stock, reduces fuel consumptions and GHG emissions; as well as reduction in frictions between wheels and rail surface - all to ensure fuel efficiency.
- Strict enforcement of compliance with technical and operational rules, regulations and standards, so as to ensure better traffic management and train control system that improve traffic flows.
- Adoption of diesel-hybrid rail vehicles (locomotives), as E- mobility is still at the infancy stage in Nigeria. This type of diesel- hybrid rail vehicles will use a diesel-powered engine and regenerative brakes to charge the electric batteries.
- Introduction of high-speed rail (HSR) which has a very strong potential for savings in fuel consumption and GHG emissions.
- Increased access to nation's rail network for freight traffic movements, over considerable long distances, as part of intermodal logistics' chain. This could be facilitated by creating legal instruments that will make it mandatory for stakeholders (i.e., freighters's) compliance.

Recommendations:

- Nigeria, through its Agency –Nigerian Railway Corporation (NRC), is not a member of UIC (International Union of Railways), but it must still strive to get much more involved in the global concerted efforts to mitigate GHG emissions, by signing the UIC Pledge to implement the Railway Climate Declaration on Climate Emergency, through these voluntary targets:
  - To improve Rail's Fuel Efficiency.
  - To decarbonize fuel (diesel) supply (i.e. cut carbon emissions);
  - To achieve a more sustainable balance of transport mode.
  - To make rail travel "greener" and make it an integral part of the global carbon – neutral network by 2050
- Nigeria, through Nigerian Railway Corporation (NRC) must have an Initiative that is committed to a steady transition of diesel trains currently in stock, to use of either electric-powered or battery and hydrogen fuel cells, for powering its trains.

The responsible Entities are: Federal Ministry of transport (FMOT)and Nigerian Railway Corporation (NRC).

Chapter Three–Expertise

3.0 Preamble

Skilled Expertise, in terms of appreciation of, as well as good knowledge and application of Methodologies, Tools and Guidelines in GHG Inventory, GHG Emissions, Data collection and Analysis, Mitigation actions, Emissions' estimation etc. are a sine qua non for good, quality, GHG Inventory process. The team of experts (or technical team) at both sectoral and national levels, must be well-trained, educationally qualified, professionally competent, and knowledgeable in climate change-related issues. In the immediate, training materials, computers, software, tools, and support needed by the experts to perform, must be provided for them; whilst succession plan must be emplaced through recruitment, training, and retention to ensure seamless availability of technical teams (sectoral and national). As such, Expertise needs to be built, strengthened, and sustained in any Organizational setup.

A good expert (sectoral and national) must have these qualities:

- Have good, cordial, and regular relationship with Data providers.
- Have good competence and skills, in Data analysis and calculations, use of methodologies, tools, guidelines and associated science.
- Have good understanding of the benefits and constraints of data sets and data supply arrangements (DSA).

3.1. GHG Inventory

In setting up Expertise/Technical Teams (sectoral/organizational and national) for GHG Inventories, there are six basic steps to follow:

Step 1: Stock-taking of existing structure and conditions for GHG inventories

A stock-taking of an existing system (if any) for GHG inventory compilation and reporting, will serve as a basis upon which a new team will be set. Some useful questions to serve as guide for this step are:

- Is there an entity already in place that is responsible for GHG Inventory?
- Are there existing qualified and competent GHG inventory experts in the organization or sector?
- Is funding arrangement in place, to ensure a sustainable functioning of the system?
- Is Nigeria making use of Global Environment Facility (GEF) inventory experts at sectoral or national level?
- Are institutional arrangements, laws, regulations, national policies in place to facilitate the GHG inventory compilation?

The results of the stock-taking will allow the institution tasked with the responsibility of setting up or enhancing the technical team to undertake a Gap Analysis of the existing structures, conditions, and specific reporting requirements for GHG inventory.

Step 2: Define necessary structures and conditions for the continuous preparation of GHG inventories

Defining necessary actions that will enable the sector or nation prepare an accurate, comparable, complete, reliable and timely GHG inventory is crucial at this stage. The reporting requirements, underlying methodologies and assumptions, available resources (human, financial, institutional, legal) and stakeholders' consultation, all put together, will determine the GHG inventory characteristics that it seeks to produce. With these, the sector or nation can define the necessary structures and conditions to achieve the GHG inventory with these characteristics:

Legal Arrangements:

The legal basis to support GHG inventory compilation must be established first. This may be any of these: National Law on Climate, Byelaw, Regulations, Decree, Directive (i.e. Presidential or Ministerial) or legal instrument that establishes a permanent National entity tasked with the responsibility for the GHG inventory and setting up the inventory team. It also covers the legal instrument required to formally assign roles and responsibilities to relevant government institutions.

Institutional Set-up:

This works in tandem with the legal arrangements. This determines the required characteristics of the institutions responsible for GHG inventory, their roles and responsibilities. There are two approaches to institutional set-up:

- The Centralized Approach: This has one Lead Agency (or Department or Technical team) which has a controlling hand in GHG inventory compilation. For it to be effective, an enabling law that sets it up, strong and active technical expertise, the managerial capacity and strong legal capacity to enter into a DSA with data providers, will be required.
- The Decentralized Approach: This is comprised of a strong technical team and/or institutions, that will use their discretions to compile GHG inventory and adopt appropriate methodologies, guidelines and tools as they may technically and professionally deem it fit.
- Human Resource: This refers to the human element in the GHG inventory compilation system. The composition of the technical team of experts shall be informed by Nigeria's specific situation i.e. Budget (for financing), availability of qualified and competent technical experts and availability of data required for GHG inventory preparation. The composition of the GHG inventory team shall be: Inventory Coordinator (who can as well serve as NCs & BURs coordinator), Inventory Compiler, Sector Expertise and QA/QC coordinator.
- Financial Resource: Funding of the costs of GHG inventory preparation must be considered abnitio. Funds (through National Budget, International Donors) must be seen to be readily available to cover costs of hiring experts, purchase of computers, software, tools, central server etc.
- Stakeholder Consultation: There are two main types of stakeholders that are essential to GHG inventory:
    - Those that will be involved in inventory preparation such as data providers, possible national institutions that could host the technical team (sectoral, national).
    - The potential users of the GHG inventory outcomes.

Contributions from these stakeholders will enable Nigeria to account for all the different responsibilities, capacities and commitment during planning stage and selection of the national entity-host for the inventory technical team.

Step 3: Establish Roles and Responsibilities for the preparation of GHG Inventories.

The roles and responsibilities to be assigned, should cover different tasks such as: inventory planning & management, supply of high-quality Activity Data, selection of emissions factors, inventory calculations, QA/QC plan and report preparation. In Nigeria, the Lead Institution should be located within the FMEnv/DCC. The National GHG Inventory Team, should be ideally located within the Lead Institution located within FMEnv/DCC and their roles and responsibilities clearly assigned and delineated as shown in Table 3 below:

Table 3: Roles, Responsibilities and Capacities for GHG Inventories

Role	General Responsibilities	Necessary Staff Capacities
Lead Institution	• Responsible for inventory management, planning, and improvement. • Overall supervision of GHG inventory development. • Management of contracts and delivery of GHG inventory. • Co-ordination with stakeholders. • Identification of necessary resources to improve the inventory.	• Technical and administrative expertise, as well as formal government authority. • Technical knowledge of the UNFCC reporting requirements and IPCC methodologies. • Capacity to co-ordinate and lead the process.
National Focal Point for BUR/NC.	• Submission of the GHG inventory. • Communication with UNFCCC.	• Knowledge about UNFCCC procedures and reporting guidelines/requirements.
Data Providers.	• Timely Delivery of Data in Appropriate Format. • Management of Internal Data Acquisition and Processing QA/QC Requirements. • Communication with Lead Institution.	• Technical skills, legal authority to improve and enhance data collection.
Independent Entity.	• Conduct QA activities.	• Technical skills to review the GHG inventory.
GHG Inventory Team.	• Co-ordination with Lead Entity to prepare the GHG inventory. • Scheduling of Tools and Responsibilities. • Data acquisition, processing and reporting. • Review of source data and identification of developments required to improve GHG inventory data quality. • Documentation and Archiving. • Management of QA/QC plans. • Delivery of GHG inventory products.	• Technical skills to carry out estimation and draft inventory report. • Technical knowledge of the UNFCC reporting requirements and IPCC methodologies.

Source: Mitsubishi UFJ Research and Consulting, 2014

Step 4: Assemble the Technical team to implement the preparation of GHG Inventories.

A good understanding (and appreciation) of the roles and functions of the six stages in the GHG inventory cycle, will enable the inventory team to properly do the management, co-ordination, data compilation, calculation and carry out expertise activities regarding GHG emissions. The six stages of GHG inventory cycle are:

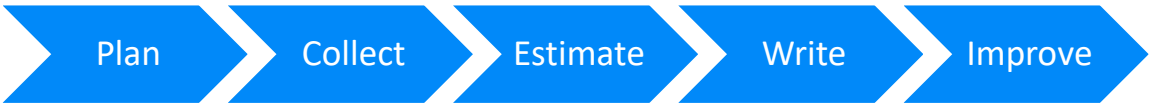


Table 4: Roles and Capacities in a GHG Inventory Team

Role	General Responsibilities	Necessary Staff Capacities
Inventory Coordinator.	• Overall planning, co-ordination, management, and technical oversight of the inventory.	• Technical and administrative expertise as well as formal government authority.
Inventory Compiler.	• Overall data and document management. • Combine sector experts' work into a cohesive inventory product. • identify and propose ways to resolve cross-cutting issues.	• Technical knowledge of the UNFCC reporting requirements on NCs and BURs and IPCC guidelines 1996 and/or 2006. • Technical skills to carry out estimation and draft report.
Sector Experts.	• Undertake research, data collection, calculations, drafting, QC, archiving and documentation. • Co-ordinate with other sector experts to identify and resolve cross-sectoral issues.	• Knowledge of the sector (Energy, Industrial Production, Agriculture, Agriculture, Forestry, and Other Land Use (AFOLU), Land Use, Land-Use Change, and Forestry (LULUCF), Waste) and (Transport) at the country level including Activity Data (e.g. Energy generated, amounts produced, livestock numbers) and main statistics relevant to the sector and ability to make expert judgments and use assumptions in cases where data may not be accurate or sufficient.
QA/QC Coordinator.	• Overall QA/QC co-ordination and/or overall data and document management.	• Administrative and technical expertise. • Technical knowledge of QA/QC techniques for large flows of technical information and reporting. • Good understanding of UNFCCC requirements for NCs and BURs and IPCC guidelines. Understanding of uncertainty calculation.

Source: Mitsubishi UFJ Research and Consulting, 2014

Step 5: Build a Quality Assurance/Quality Control System for GHG Inventories.

QA/QC system is incorporated in the scope of GHG inventory team, to address the uncertainties arising from multiple sources of data of large volumes and also to ensure quality standard in the inventory preparation and emissions calculations. Once QA/QC is done and the inventory report is submitted, via BUR to UNFCCC, it is still subject to the ICA process, for a technical analysis by international team of technical experts, coordinated by UNFCCC. These are the constituent elements of a QA/QC plan:

- Personnel responsible for coordinating QA/QC activities.
- General QC procedures.
- Source specific QC procedures.
- QA review procedures.
- Schedule for conducting QA/QC activities.
- Reporting, documentation and archiving procedures.
- Review changes in literature, methods and assumptions used for the current inventory.
- Review previous years' estimates and methodologies.
- Cross-check the tools, methods and information used for the current inventory with new developments.
- Review reliability of applied methodology (Tier) i.e., check estimations and statistical procedures; review the quality of the outputs using sensitivity analysis.

- Revise the workflow and methodologies of the data suppliers.
- Undertake internal review of procedures, work flows and performance in time and quality.
- Revise Memorandum of understanding (MOUs), if necessary.

Step 6: Define and Implement a Continuous Improvement Plan for GHG Inventories.

To complement the QA/QC plan, a continuous improvement plan has to be defined, emplaced and as such, implemented, by the GHG Inventory team. In this regard, following actions have to be undertaken:

- Establish a GHG Inventory Improvement Plan that considers updating of inventory Time series in each GHG inventory cycle.
- Include both QC (internal checks) and QA (external verification) into the GHG Inventory Improvement Plan.
- Prioritize activities in the GHG compilation process and establish timelines for the activities.
- Carry out activities that will aid implementation of identified priorities. e.g., development of emissions factors or key source categories analysis.
- Include improvements in the next inventory preparation cycle as deemed necessary.

3.2. Mitigation

For National Greenhouse Gas Inventory Experts in OTS, these are the required Experts' Profiles and Attributes for mitigation:

- Have a good understanding of the transport sector, particularly shipping (inland waterways/maritime), aviation and rail.
- Have good knowledge and understanding of the historical data and be competent in providing projected data, applicable to the GHG inventory to be compiled; as well as the time-series for the estimated GHG inventory (emission & sinks).
- Be good with numerical data, data processing, analysis, tools, methodologies, and models.
- Be skillful in making appropriate assumptions.
- Have a deep understanding of IPCC Guidelines, International reporting requirements and review processes (i.e. validation and verifications) as demanded by UNFCCC and Paris agreement.
- Be constantly abreast of national policies and economic development and any sectoral economic impact models.
- Have ability to identify and fill gaps and address resource constraints that may likely be encountered in data collection process.
- Understand sectoral and national mitigation goals, mitigation strategies, mitigation projects, their respective status and their investments/supply needed/provided.

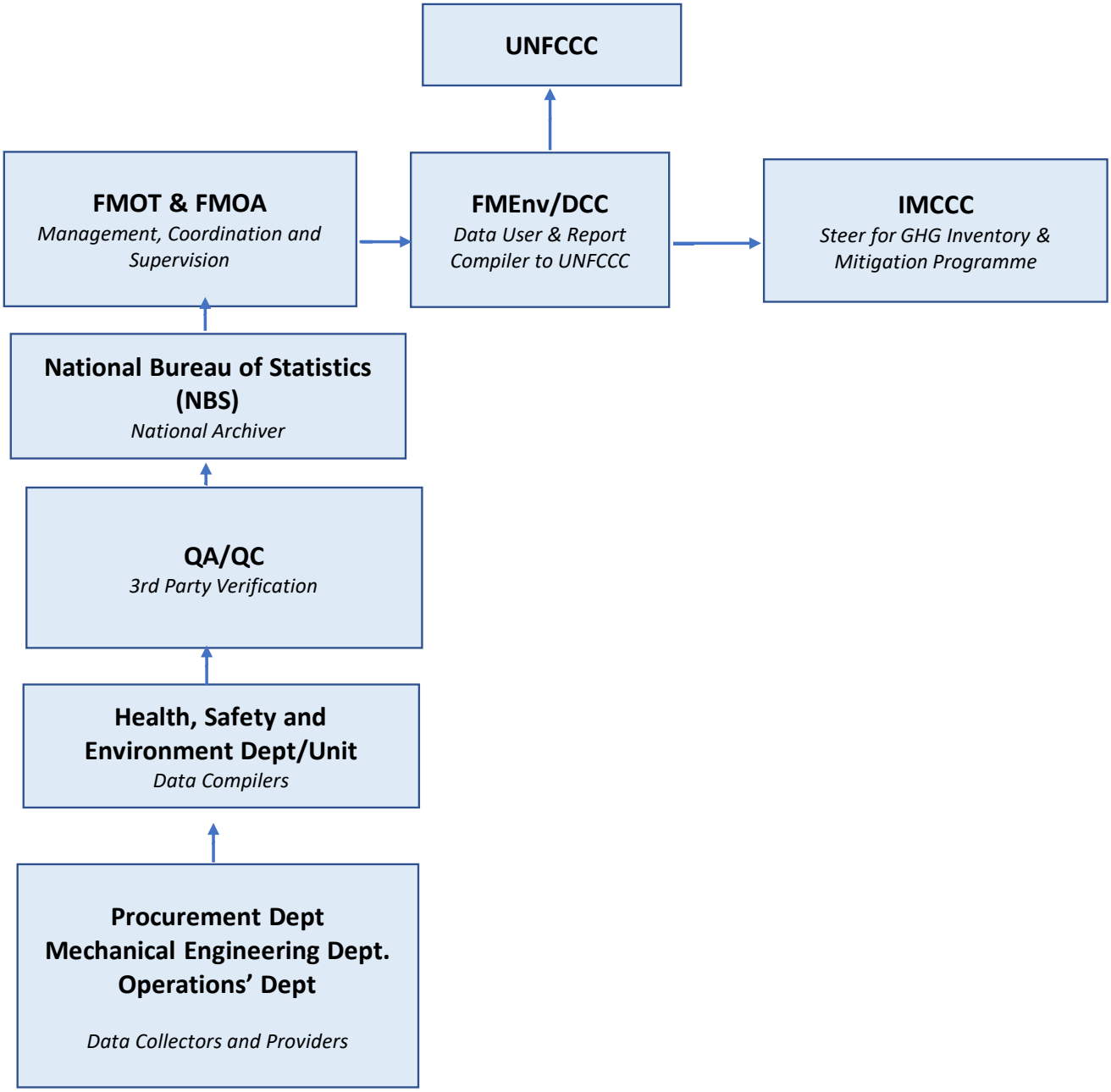
To further mitigate technical deficiencies in Expertise, the use of tools that are necessary for monitoring and updating Nationally Determined Contributions (NDCs) and undertaking mitigation assessments, is recommended. The Tool Known as the Mitigation Modeling Tool Selection Guide "is an Excel workbook, that provides a platform which enables adequate comparison of three modeling tools, quantitively and qualitatively. The three software tools being referred to are: GAMCO, LEAP and PROSPECTS. The relevant details about each of these three Tools are adequately contained in the "Mitigation Modeling Tool Selection Guide"; which is simple, well-structured document which creates room for Users' interface and promotes flexibility in conducting a simple, detailed mitigation analysis.

Chapter Four - Data flows

4.1 GHG Inventory

Data flow, when graphically represented, gives an overview of GHG Inventory process, from input to output, without necessarily going into details; but can later be elaborated upon.

Figure 1: Diagram showing a proposed typical GHG flow in an OTS Modal Agency



To undertake data flows for GHG Inventory, a lot of investments into resources (such as staff time (for data collection and analysis), training, purchase of appropriate software and/or membership with GHG Inventory – specialized body, are necessary. In developing Data flow process for OTS modal Agencies and/or national GHG Inventory process, three fundamental factors that are critical to it must be considered.

These are:

- Building Internal Support: Making other Departments within an Organization to know and key into GHG Inventory process, is highly essential. To let them understand their relative importance, support and participation in data collection (directly / indirectly) is critical to GHG Inventory programmes 'collective success. The support may be in form of co-operation, staff time, energy/ effort, timely processing and releasing of approved funds, making useful contributions etc.
- Comprehensive Data collection: Tenacity of purpose and consistency are necessary, because data and information to be collected are from multiple sources. GHG Inventory Software (e.g., IPCC Inventory Software) or detailed spreadsheets are a key component for undertaking Inventory calculations. Specific GHG protocol must be approved when using IPCC inventory software or spreadsheet templates.
- Excellent Record – keeping: The data collection process (showing details of data sources), the data providers and users of the data on either software or spreadsheets must be meticulously guarded. All assumptions made must also be noted in the record – keeping, particularly when data are unavailable. Proper documentation, in an organized manner from the Start to the End of the Inventory process, given validity to it and serves as a basis for future reference.

4.1.1. Steps for GHG Emissions Inventory Programme Design Process Flow.

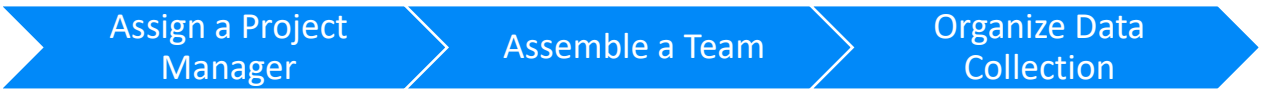
In designing the GHG Emissions Inventory Programme Process flow, there are two categories of Action sub divided into six steps viz:

Table 5: Categories of Action

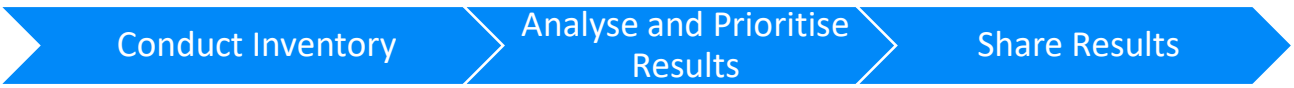
Programme Implementation (1)	GHG Inventory (2)
Step 1: Assign a Project Manager	Step 4: Conduct Inventory
Step 2: Assemble a Team	Step 5: Analyse and Prioritize Results
Step 3: Organize Data collection	Step 6: Share Results

***Figure 2*: GHG Emissions Inventory Programme Design Process Flow Diagram**

Programme Implementation



GHG Inventory



Step 1 - *Assign a Project manager*: This will manage the inventory process due to its complexity, multiple data sources and multiple communication channels, for success to be achieved.

Step 2 - *Assemble a Team*: A Team of enthusiastic, dedicated and committed Staff that will fully be in support of the process needs to be assembled. Their roles, objectives of the assignment, the timelines and key deliverables must be clearly spelt out to the Team, from the onset. The Team must be a mix of staff representing various departments that would provide data.

Step 3 - *Organize Data collection*: Before the start of the Inventory process, it is very important to identify and organize these three critical elements, with the support of specific GHG Protocol Tool:

- *Boundary of Analysis:* Noting the multiple potential sources of GHG Emissions of each of the OTS Modal Agencies, following questions must be addressed, to get the metrics required to define the Scope which helps in Knowing what is included and those yet to be included:
    - What emissions sources to measure?
    - What emissions to Include? and
    - What emissions to disregard?

- *Baseline Year:* To measure future successes in GHG emissions reductions, it is necessary to establish a baseline year of GHG Emissions. The guiding factor here is the completeness of Data and it is better to choose a more recent base year with complete information, rather than spending (weeks or months) and money to track down data that may neither exist nor complete.

Step 4 - *Conduct Inventory*: Once all the 3 steps under Programme Implementation are completed, the next step entails gathering, organizing and entering the relevant data into the Inventory Software or Spread sheets It must be stressed here that many of these Inventory spreadsheets come with data sheets to assist in data collection. In summary, the units of measurement of fuel in use, meticulous record-keeping , appropriate emission factors to use and validation / verification of the exercise (to give it credence of transparency, completeness, consistency, comparability and accuracy) must be taken into account throughout the process.

Step 5 - *Analyse and Prioritize Results (i.e., evaluation)*: Once the data collection is fully completed, the next thing is to interpret the Inventory results, with a view to identifying the GHG sources, Mitigation of Sources and Trends. This is the right time to examine existing emissions reports closely which thus give idea on how to organize and present results

Step 6: *Share Results*: Sorting out multiple data is not a teacup affair and more so, sorting out quantitative results into forms that can easily be understood by Stakeholders. Using tables or graphical illustrations can help in presenting information to Stakeholders, by using any of these Sorting Modes:

- Sectoral Mode (Rail, water-borne navigation, aviation);
- Fuel (Diesel, Gasoline, Jet fuel),
- Operations (passenger, freight, mixed, inter-urban, intra-urban services);
- Time trends (chart sector growth);
- Visualizing results.

4.1.2. Data Needs

To enhance Data flows, process for GHG Inventory, the Data Needs (i.e., Activity Data) to the GHG Inventory compiler, must be of high Quality and subject to continuous Quality Improvements. The quality of emission estimates should be a reflection, to a greater extent, of the quality of the Institutional Arrangements for GHG inventories preparation. The 2006 IPCC guidelines specifically provides Guidance on the Approaches to Data collection, evaluation of existing data sources and planning new measurements and surveys. Establishment of data collection system should be formalized, in conformance with Nigeria national circumstances and be reviewed periodically.

4.1.3 Data Required for GHG Inventory production in OTS

- Railways: Emissions' estimation are done by multiplying emission factors by either fuel consumption or train kilometres (Tier1 and Tier 2 are recommended).

- Aviation (Domestic): Emissions estimates are based on the number of aircraft movements, broken down by aircraft type at each airport. (Tier 3 is recommended).

- Inland Water ways: Emissions estimate are based on population, engine size and hours of use of different types of watercrafts, together with emission factors from EMEP/ EEA Guidebook (Tier 1 is recommended).

- International maritime: Emission estimate are derived by the difference between total fuel consumption statistics for maritime fuels and fuel consumption by domestic shipping This is however reported as Memo Item.

4.1.4 Data Flow Mapping

A Data flow map helps in identifying all the available data and how it moves from one point to another during inventory preparation. To develop data flow mapping, the following key factors must be considered.

- Data items (i.e., Activity data and relevant information).
- Formats (e g hard copy forms, on-line data entry, database).
- Transfer methods (e.g. by telephone post, e-mail, internal/external message).
- Locations (e g offices, third parties, cloud).

Although Data flow mapping is characterized by some challenges e.g. technical and organizational issues, the organization still has to find ways of addressing such challenges to the minimum level for it to achieve results.

4.1.5. Data Supply Agreements (DSAs)

A key element to sustaining and updating data flows is the Data Supply Agreements (DSAs) which needs to be formalized between the designated GHG's Single National Entity (SNE) and Data Supplier(s). DSAs is a document demanding for information such as what data are required, from who (source), to whom (users), and when (timelines) that will be supplied for GHG inventory compilation. DSA ensures data security against future reference. DSA can either be formal (i. e. if there is any existing, supporting national climate law, or MOU or Agreement); or Informal (i.e., where no such law exists, but an understanding enables it).

4.2. Mitigation

This is necessary to checkmate the extents of Data flow breaches or distortions so as not to affect the quality of the data and credibility of data sources. Literature has however, revealed a collection of best practices to data breaches in the flow process:

- Prioritize protection of vital data in order to increase effectiveness of the flow process and drastically minimize compromise.
- Document the response process and meticulously ensure compliance to logical end. A checklist to serve as a guide to prevent or minimize derailments from set path is necessary.
- Involve user (s) in the process from start to end, in order to avoid disruption of the process of the process or tampering unnecessarily with data.
- Understand the business context properly to know what and where confidential data are stored or when passing through the system and also the impact of the data on the flow process.

- Be thorough in the process of data gathering, analysis, calculations, methodologies used and conscious of assumptions to make, - all to ensure transparency and credibility.
- Be pro-active in collecting data to readily make them available for use whenever the need arises.
- Go with or tag along with the flow process, to avoid distraction and compromise.
- Train and Drill staff in the art of data flow mitigation so that they can effectively respond to breaches or distortions in the flow process.
- Seek and obtain external help (I. e external experts) to assist the internal inventory team in the event of data breaches or lapses in the flow process.
- Go on the offensive when defense mechanism breaks down. This is a strategy to address data breaches.

Chapter Five - Coordination, Systems and Tools

5.1 GHG Inventory

To effectively manage GHG Emissions, a GHG Inventory has to be developed and emplaced. A complete GHG inventory is regarded as an important tool that enables good understanding of GHG emissions, trends and making projections or future emissions and identifying sectoral or national cost-effective emission abatements chances. One of the ways of meeting UNFCCC reporting requirements is the National GHG Inventory. To build a National GHG Inventory System in line with Nigeria's National Circumstances, an appropriate Toolkit named "The United States Environmental Protection Agency (U.S. EPA) Toolkit for Building National GHG Inventory Systems is apt and recommended. This Toolkit is comprised of pre-defined National System Templates that can be compiled into a Manual, containing comprehensive documented information that are suitable for managing GHG Inventory process in Nigeria.

This knowledge product (i.e., Toolkit) is comprised of both instructional Templates for developing a National GHG Inventory System (showing how a National GHG Inventory system can be built and consistently improved upon) and supporting templates. These templates to be used by GHG Inventory Co-Ordinator as well as other inventory team members, include the following:

- Instructional Template: How to Use the Template (HUT): This template gives an overview of how to use the templates in the toolkit.
    - Supporting Template: The National GHG Inventory Inception Memorandum Template gives guidelines to the inventory team on how to prepare a National Inventory Inception Memorandum, detailing procedures for GHG Inventory compilation and specifics of GHG Inventory Plan. This can be adapted to suit Nigeria's peculiar circumstances or in OTS Modal Agencies.
- Instructional Template: Institutional Arrangements for National Inventory Systems. This template helps the National Inventory Team to identify, assess and document the strengths and weaknesses of institutional arrangements, knowing full well that a functional and institutional arrangements promote GHG Inventory's integrity, transparency, and continuity.
    - Supporting Template: National GHG Inventory Coordinator: Responsibilities and Qualifications Template, indicating possible roles and responsibilities for each sector lead in managing and coordinating national GHG inventory development.
- Supporting Template: Memorandum of Co-operation Template focuses on how to draft an Agreement between two entities working on a National GHG Inventory e.g., between FMEnv and a data provider.
    - Supporting Template: Scope of Work Template is used to develop a request for proposal for services that are related to National GHG Inventory compilation.
- Instructional Template: Methods and Data Documentation (MDD) Template: It is used by a GHG Inventory Team in documenting activity data set, methodologies, assumptions, and emission factors used for GHG emissions' estimations and / or removals.
    - Supporting Template: Confidentiality Agreement and Amendment Template is meant for drafting an Agreement between FMEnv and a data provider, where provision of confidential business information (CBI) required for the development of GHG emission estimation is involved.
- Instructional Template: Quality Assurance and Quality Control Procedures (QA/QC) Template: This serves as a guideline to GHG Inventory Team on how to establish and undertake a QA/QC procedure so as to ensure transparency, accuracy, comparability, consistency, completeness and comparability in a National Inventory System.
    - Supporting Template: Nil

- Instructional Template: Key Category Analysis (KCA) Template: This is useful to GHG Inventory Team in identifying the sources and removals that contribute heavily to National GHG emissions and sinks.
    - Supporting Template/Tool: The key category tool can be used by the inventory team to determine the key categories of GHG emissions and sinks.
- Instructional Template: Archiving Systems (AS) Template: This helps in the reproduction and updating of GHG emission estimations, as it stores information that are related to National GHG Inventory compilation process, reporting and institutional arrangements.
    - Supporting Template: Nil
- Instructional Template: National Inventory Improvement Plan (NIIP) Template: This template contains potential information on GHG Inventory improvements and specific priorities for future capacity-building projects.
    - Supporting Template (Tool): Inventory Progress Indicator (IPI) Tool helps the inventory team to evaluate progress in improving a National GHG Inventory.

5.1.1. GHG Inventory System Co-ordination

A good GHG Inventory system's co-ordination can take the shape of any of these three institutions:

- A Government Ministry e.g., Federal Ministry of Environment (of Nigeria) can play the management and co-ordination roles, as a Single National Entity (SNE), considering its technical and managerial capacity and its broad-based experience.
- A Private Company, University or Non-Governmental Organizations (NGOs): where a national agency outside of Government is specifically set up to manage and co-ordinate a national GHG Inventory System. It can help to ensure national retention of institutional knowledge and capability. Such an Agency may be chosen, on contractual basis, for its technical capability and competence, to co-ordinate activities and expertise for inventory compilation and reporting.
- A National Institution /Agency: A technically competent Agency (e.g., statistical, environment, meteorological) may have management and coordination delegated to it. It will have expertise and also, have access to datasets that are needed for GHG Inventory compilation and outsource data collection to external bodies.

5.1.2. GHG Inventory Management Tools

GHG Inventory Management Tools are meant to ensure transparency and efficiency in the GHG inventory compilation process. These tools are workplans, data management systems (QA/QC), improvement plans, training and capacity-building and documentation procedures.

- Workplans: A well specified workplan that contains activities (in sequence),time frames and lead actors/ stakeholders' responsibilities, is essential for the compilation of GHG Inventory. It needs to be reviewed regularly, particularly, before the start of another inventory process. For workplan to be effective, prior information to and discussion with inventory contributors, must be ensured through communications, meetings, and seminars (see chapter 7 for more).

- Data Management System: This entails the use of multiple data sets from many different sources, references, documents as well as application of expert judgements, data conversion factors, documentation, and archiving. Data Management system may be by one of these:
    - Sophisticated Database tools, that are well-connected to the Internet and publicly made available for accessibility; for data uploading and downloading.
    - Use of Spreadsheets, software systems and database for calculation of GHG emissions' estimates.

- GHG Inventory training activities: Availability of well-trained, suitably qualified, and experienced experts on GHG Inventory, goes a long way in the preparation of a high-quality GHG Inventory report. To ensure this, focus must be on:
    - Training of Staff on the use of IPCC Guidelines that are appropriate to Nigeria's specific circumstances. International courses on this are available.
    - Training in the Methods, as prescribed in relevant IPCC Guidelines and at approved UNFCCC or IPCC online training centres.
    - Participation in international review processes (e.g., UNFCCC organized reviews) – thus exposing technical experts to acquiring more knowledge and experience on GHG Inventories done by other countries. This promotes comparability, trust, building of national capacity, understanding of international reporting requirements and enhancement of National GHG Inventory System.

- Education and Public awareness: A National GHG Inventory must be informative and educative to the public (i.e., it must be capable of informing the public or stakeholders on emission trends and contributions by sectors or modes) so as to enable them take appropriate decisions. FMEnv can organize following types of activity that aimed at promoting virile GHG Inventory process and its outcomes. These include:
    - Workshop for Stakeholders (NGOs, private businesses etc.) on GHG Inventory -oriented activities (e.g., technical workshops, in simplified forms, with attention on specific sectors, general inventory outputs or awareness-raising for mass media).
    - Publication of GHG Inventory Data, in a very simplified, user-friendly form, with the aid of visual tools (e.g., infographics) to relay information to stakeholders-students, policymakers, businessmen, pressmen, commuters, freighters etc.,
    - Production of factsheets detailing overview and sector-specific and national-specific indicators on the trends and progress to targets' attainment.

Chapter Six - Stakeholders Engagement

6.1 GHG Inventory

The decision to include Shareholders' Engagement in Climate Change issues, stemmed from UNFCCC decision of 1992, with the objective of … "stabilizing Greenhouse Gas emissions to prevent dangerous human stimulated effects on the climate system." (Savitri Jetoo, 2019). The inclusion of Stakeholders' Engagement could be further traced to the preamble of UNFCCC that calls "for their participation in an effective and appropriate international response, in accordance with their common and their social and economic conditions." (UNFCCC). Coming closer, the inclusiveness of actors other than Government into the climate change clime, was further accentuated with the Conference of Parties (COP. 20) decision in December 2014, in Lima Peru, with the launch of online Non-State Actor Zone for Climate Actions (NAZCA). The Climate Action Portal (as the NAZCA online platform is called) tracks and summarizes individuals and joint actions by non-state and sub-state actors" (Savitri Jetoo, Aug. 2019).

Stakeholders Engagement is also referred to as Participatory Governance; simply meaning, shifting from state control to non-state control actors in the decision-making process. This amounts to decentralization of policy-making processes. Participatory Governance may be time wasting, cost-involving and energy-demanding, yet in the long-run it pays off; being a tool for decision-making, as local knowledge is incorporated into decision-making process. There are eight practices that support and fathom Stakeholders Engagement:

- "Shareholder's participation needs to be underpinned by a philosophy that emphasizes empowerment, equity, trust and learning.
- Where relevant, shareholder participation should be considered as early as possible and throughout the process.
- Relevant Stakeholders need to be analyzed and represented systematically.
- Clear objectives for the participatory process need to be agreed among stakeholders at the outset.
- Methods should be selected and tailored to the decision-making context, considering the objectives, type of participants and appropriate level of engagement.
- Highly skilled facilitation is essential.
- Local and scientific knowledge should be integrated.
- Participation needs to be institutionalized.

This philosophy centres mainly on the quality of the participation process and not on the perception of the participation process." (Savitri Jetoo, Aug 2019)

6.1.1. Aim of Stakeholder Engagement

Stakeholders' Consultation can be undertaken through:

- Direct Outreach.
- On-line Approach.
- In-Person or One-on-One Visit/discussions.
- Questionnaire/Survey.

The aims of Stakeholders engagement are:

- To give information to stakeholders on Organization's/Sectoral GHG Inventory and Mitigation Plan.
- To obtain feedback from stakeholders on GHG emissions' abatement actions.

6.1.2. Methods for Stakeholders Identification

Following methods are suitable for identifying stakeholders: A combination of two or more of these methods will improve the quality and enlarge the stakeholders' base.

- Experts' opinions or recommendations.
- Self -nominations.
- Other Stakeholders' recommendations.
- Written records (past or current).
- Population Data.
- Oral or written accounts of major events.

6.1.3. Criteria for Stakeholders' Identification

- Level of impact (minor or major) of a policy, through design and implementation, may have on a stakeholder or group of stakeholders.
- Level of stakeholders' interest in a policy.
- Marginalization of a group of stakeholders, consequent upon application of Nigeria's Law(s), policies, regulations, etc.

6.1.4. Reasons for Stakeholders' Identification

- To learn and appreciate the powers and influence of stakeholders and how often or how impactful they can influence policies.
- To create awareness amongst stakeholders of their divergent opinions, views, interests, engender collaboration and above all, promote principle of inclusiveness to facilitate seamless interactions.
- To know and understand the capacity and capability of individual stakeholders as well as benefits and disbenefits their participations may bring.
- To learn of the interests each stakeholder represents or wants to pursue.

6.1.5. Shareholders Expectations

The respective departments, sections or units and individuals in each of the OTS Modal Agencies should pay more attention to the expectations of shareholders by continuously assessing issues that are relevant to the sustenance of good relationship between each organization and society. Complaints and enquiries from external stakeholders to be treated with prompt dispatch, whilst constructive dialogue should be seriously encouraged. Continuous assessment of implementation of improvements in operational services and projects, should be promoted.

In the process leading to GHG Inventory compilation, many stakeholders are involved, with their varied expectations.

Table 6: Stakeholders Expectations

Stakeholder's Group.	Expectations from Organization.	Areas of Dialogue.	Organizational Measures.
Customers	• Compliance with safety rules and regulations. • Security for freight (goods) and parcels and safety of passengers. • Predictability of services (punctuality, regularity). • Ethical Standards (Ethical services, good customers relations, anti-corruption.) • Development of new and improved services and routes. • Introduction of new modern vehicles and operating facilities. • Upgrade of existing operating infrastructure. • Market position and reputation.	• Customer meetings. • Documentation. • Day-to-Day operations. • Audits. • Organization's website and marketing. • Communications.	• Compliance with rules and regulations. • Certification of Operating facilities and equipment. • Customer satisfaction survey. • Pro-active communication. • Innovation efforts. • Competence-driven organization. • Purchasing policies. • Safety consciousness.
Authorities (e.g., Federal Ministry of Environment), FMOT, FMOA.	• Compliance with laws and regulations. • Preparation of Reports (BURS, NCS, GHG Inventory etc.) • Involvement in Climate Actions' programmes and projects. • Appreciation and Application of Methodologies, Tools to climate change.	• Dialogue meetings, conferences, workshops, seminars. • Supervision, audits, inspection and controls. • Public consultation submissions. • Environmental and climate reporting.	• Transparency and availability. • Pro-active dialogue with authorities and politicians • Compliance with Intent of Law. • Compliance with international reporting requirements. • Clear goals on climate mitigation. • Periodic reporting on progress.
Employees	• Safe workplaces. • Good reputation.	• Employee Interviews.	• Zero harm programmes.

Stakeholder's Group.	Expectations from Organization.	Areas of Dialogue.	Organizational Measures.
	• Responsible and attractive workplaces. • Good Health, Safety and Environment (HSE) policies and guidelines. • Management and Employee participation. • Compliance with employee rights. • Good working terms and conditions. • Timely and quality training programmes.	• General meetings, Departmental/Operational Meetings. • Good co-operation/relation with Internal Trade Unions. • Whistling blowing procedure. • Employee surveys • Intranet. • Competence Programmes and on-the-job training activities. • Company decision-making paths.	• Reputation building/ employer branding. • Management development • Internal and External communication measures. • Competitive conditions. • Competence mapping and evaluation.
Funders e.g. (Donor Agencies) Governments (FMBNP).	• Sustainability Reporting. • Good Governance/Practice. • Transparent and available credible information. • Clear and consistent reporting on important and relevant factors. • Quantitative goals.	• Meetings with funders and seminar/workshops. • Quarterly/Periodic presentation. • Annual sustainability Report. • Third party analysis and audits. • Organization's website. • BUR, NC; GHG Inventory Reports.	• Sustainability and mitigation reports in line with UNFCCC standards. • Availability of information. • Establish relevant and quantifiable goals. • Prepare and highlight policies. • Communicate responsibilities. • Survey risks and opportunities.
Non-Governmental Organisations (NGOs), Civil Society Organisations (CSOs)	• GHG emissions' reductions. • Job Opportunities. • Transparency on matters that impact on the society (smell, noise, pollution, vibration, accident etc.,). • Availability and ability to respond to questions rightly. • Participation in local support and sponsorship	• 24hours availability. • Communications Unit. • Represented in local foras. • Local media. • Guided tours/visits. • Close contacts with opinion leaders, schools and colleges/universities, research centres.	• Sponsorship and Partnerships. • Proactive and Reactive information. • Pupil and Student programmes (e.g., workshops). • Being a responsible player.

Stakeholder's Group.	Expectations from Organization.	Areas of Dialogue.	Organizational Measures.
	measures (i.e., corporate social responsibility, CSR).		• Apprentice programme. • Recreational and Tourism services.
Business Partners/Group/Investors	• Clear communication. • Compliance with Agreements. • Integrity.	• Board and Owner's meetings. • Co-ordination and operational co-operation. • Development projects.	• Balanced and long-term agreements. • Integrity. • Predictable and Recognizable stance. • Communication and Transparency.
Suppliers	• Defined quality requirements. security of supply/service level. • Predictability/Long-term perspective. • Willingness to pay, ability and punctuality. • Reference. • Integrity.	• Supplier meetings. • Enquiries. • Negotiation meetings. • Day-to-day operations. • Audits.	• Enquiries with a description of requirements and scope. • Description of selection criteria. • Act on the basis of a long-term perspective and predictability in the market. • Quality suppliers based on criteria regarding HSE, quality and code of conduct.

Source: Adapted from Borregaard Sustainability Framework, Stakeholder Engagement Identification of Material topics and our Management Approach. GRI Attachment to Borregaard Sustainability Report 2020.

6.2. Mitigation

The GHG emissions reduction actions (i.e., mitigation) have their attendant benefits, opportunities, barriers, and priorities, as summarily explained below:

- Benefits:
  - Increased stakeholders' awareness about climate change mitigation.
  - Reduction of GHG emissions; and financial savings, through both vehicle and fuel efficiency.

- Opportunities:
  - Increased awareness on the possibility of using electric trains.
  - Increased awareness on modal shift from road to rail and water.

- Barriers:
  - Lack of dedicated and well-trained staff or designated department to focus on GHG emissions' estimations and GHG Inventory compilation.
  - High capital cost of energy efficiency and renewable energy projects.

- Priorities:
  - Encourage green economy opportunities that will engender sustainable development and also create job opportunities.
  - Design future assets and infrastructure that will facilitate GHG emissions' mitigation.
  - Prioritize energy management and energy efficiency in existing sectoral/organizational assets and operations and new facilities.
  - Review strategies and policies that support GHG emissions mitigation.

Going forward, a thorough understanding of an organization's stakeholders – their influence and triggers (i.e., complaints, rejections) will help in developing a mitigation plan that will capture:

- Risks (i.e., those to accept and deal with it; those to share with another party and deal with it and those to avoid outrightly).
- Measures to reduce the impacts of the risks (on organization and affected stakeholder(s)).
- Issues that are negotiable and non-negotiable, to be explained or discussed and sorted out abnitio (e.g., preferred emissions reduction measures).

Furthermore, to engender stakeholders' engagement mitigation, these steps should be considered:

- Identify and prioritize key stakeholders considering the wide stakeholder base. The level of interest shown, the influence they exert, and level of understanding displayed, will collectively help in prioritizing them (i.e., stakeholders) in order of importance.
- Understand and align shareholders expectations in order to bring a greater proportion of them (if not all) on board or be on same page. This could be necessitated through exploratory conversations with influential stakeholders in a transparent manner on "the how, the whys, the whats, and the whens" of any of the organization's actions or policies. Frequent communication will be a great asset here.
- Pro-actively resolves disputes. Hiccups or misunderstandings in stakeholders' engagements may occur at any time, irrespective of stakeholders mapping already done. However, dispute resolution mechanism should be handy to mitigate any problem(s) that may arise. The Dispute Resolution Mechanism (DRM) to be provided must be such that will allow stakeholder(s) to express their grievances freely and discuss mutually, on agreeable solutions.
- Speak plainly. In any organizational setting, use of technical and regulatory terminologies that are not easily understood by some stakeholders, is rife. Since the level of knowledge and understanding amongst stakeholders vary, the use of technical jargons, should be de-emphasized whilst communicating with stakeholders. Rather, transparency and clarity should be elevated in meetings and discussions with and reports to stakeholders.

Chapter Seven - Institutional Arrangements

7.1 Organizational structure of Institutional Arrangements.

Institutional Arrangements (IA) is a framework put in place by any Country to help in facilitating the tracking, reporting, verifying and responding to the review of its GHG Emissions' estimates on a continuous basis; by linking together Organizations that are involved with the GHG inventory process – from data collection and compilation to output.

Institution Arrangement is one of the six (6) National Inventory System templates required for the development of sustainable National Inventory Management System. Others include: Methods and Data Documentation, Description of Quality Assurance and Quality Control procedures (OA/QC), Description of Archiving System (AS), Key Category Analysis (KCA), National Inventory Improvement Plan (NIIP).

The National Circumstances, Stakeholders' needs and National priorities for actions, complementarily influence the type of Institutional Arrangements a country can emplace as there is no “one – size – fits All” Institutional Arrangements. There are five (5) main constituent elements of Institutional Arrangements namely:

- Organizational mandates.
- Expertise.
- Data flows.
- Co- ordination, systems and tools.
- Stakeholders’ engagement.

Organizational Mandates:

This give an assurance that human, financial, legal and data resources that would facilitate good decision-making process by organization, in conformance with UNFCCC and international bodies requirements, are present. These mandates must have provision for a functional collaborative process between experts and specialized organizations’ (e.g., National Bureau of Statistics, NBS), that would facilitate regular flow of quality data in a transparent way. For organizational mandates to be strong and effective, enabling National climate law, ordnances, agreements (e.g., Memorandum of Understanding- MOU, Data Supply Agreement (DSA), must all be readily present.

The design and development of Institutional Arrangements is largely informed by the scope, type and quality of information required for reporting under the current MRV arrangement and Enhanced Transparency Framework (ETF); as well as the need for continuity in improved data collection, processing, documenting and archiving. For the sake of clarity and further illumination, there is an existing standard thematic scope, (as revealed by Literature) showing the reporting and data requirements to support a viable and robust Institutional Arrangements in an OTS Organization’s GHG Inventory and Mitigation drive.

Table 7: Thematic Scope of Reporting and Data Requirements

S/N	Theme	Sub- Theme and Data Requirements
1	National GHG Inventory (CO_2)	• National Circumstances and Institutional Arrangements; • National Inventory Report of emissions by sources and removable by sinks of GHG; • Information on methods and cross- cutting elements (e.g., information on the category and gas, and the methodologies, emission factors, and activity data used at the most disaggregated level; description of key categories, recalculations, uncertainty assessments; assessment of completeness and QA\QC plan); • Estimation of emissions and removals for all category gases and carbon pools considered in the GHG Inventory. • Consistent annual time series.
2	Mitigation	• National Circumstances and Institutional Arrangements. • Description of the NDCs. • Information necessary to track progress made in implementing and achieving its NDCs. • Mitigation policies and measures, actions and plans, including those with mitigation co- benefits resulting from adaptation actions and economic diversification plans. • Projection of GHG emissions and removals as applicable; and • Other information relevant to tracking progress.

Source: UNFCCC. (June 2020): Handbook on Institutional Arrangements to support MRV / Transparency of Climate Actions and Support. Consultative Group Experts.

Constituent Elements of Organizational Mandates

The constituent elements of Organizational Mandates are:

- Terms of Reference indicating availability of human presence, financial capacity and data resource required by an organization that will clearly enable a good decision- making process;
- Institute a process that will facilitate active collaboration between experts and professional bodies that are required to provide necessary information such as quality data sets, accessibility to data and confidentiality of data;
- Establish a new Institutional Arrangements that promote good data collection, analysis, emission calculation, Reporting and archiving and also providing expertise (e.g., on key areas in environmental, economic and statistical data collection, analysis and calculations);
- Presence of any or a combination of these mechanisms, help in the establishment of a strong and functional institutional Arrangement- these are:
    - Legal framework (i.e., National climate law, ordnances, decrees).
    - Presidential or ministerial directive.
    - Organizational Agreement or enabling contracts (specifically on climate action (mitigation) and related issues).
    - Individual contracts.
    - Data Supply Agreements (DSAs).

Organizational Mandates, ideally, give an assurance of the presence of qualified experts, established data, flow process, efficient systems and tools, strong legal and regulatory mechanisms, and strong stakeholder engagement, that will work in tandem and seamlessly, to provide information to decision makers and also help to fulfill reporting requirements to UNFCCC. Sadly, as at today, none of these mechanisms is present in any of the OTS modal Agencies. what exists is mere semblance or a caricature, ineffective, Institutional Arrangements that do not suit international best practices.

Characteristics of Effective Institutional Arrangements

- Must have an established channel of communication and a mechanism for good co-ordination amongst stakeholders, so as to ensure efficiency;
- Existence of a clear-cut division of roles and responsibilities and a mutually beneficial co-operation amongst all the stakeholders so as to avoid conflict, misunderstanding, overlaps or duplication of job or grave omission of an important part of a job;
- An MOU or Agreement or a Law clearly stating the term of relationship and co- operation including step to be taken to address any changes in the course of work delivery;
- Must be flexible to address minimal and sudden changes;
- Must have a Single National Entity (SNE) to play the leading and Co-coordinating role amongst stakeholders and also serve as a National Registry, for all GHG- related data for the country;
- Must be able to meet the differing needs of the stakeholders;
- Must promote regular contact and consultations with all stakeholders;
- Must be able to promote communication between staff of different entities, so as to engender good understanding and collaboration.

Gains of strong and effective Institutional Arrangements in OTS

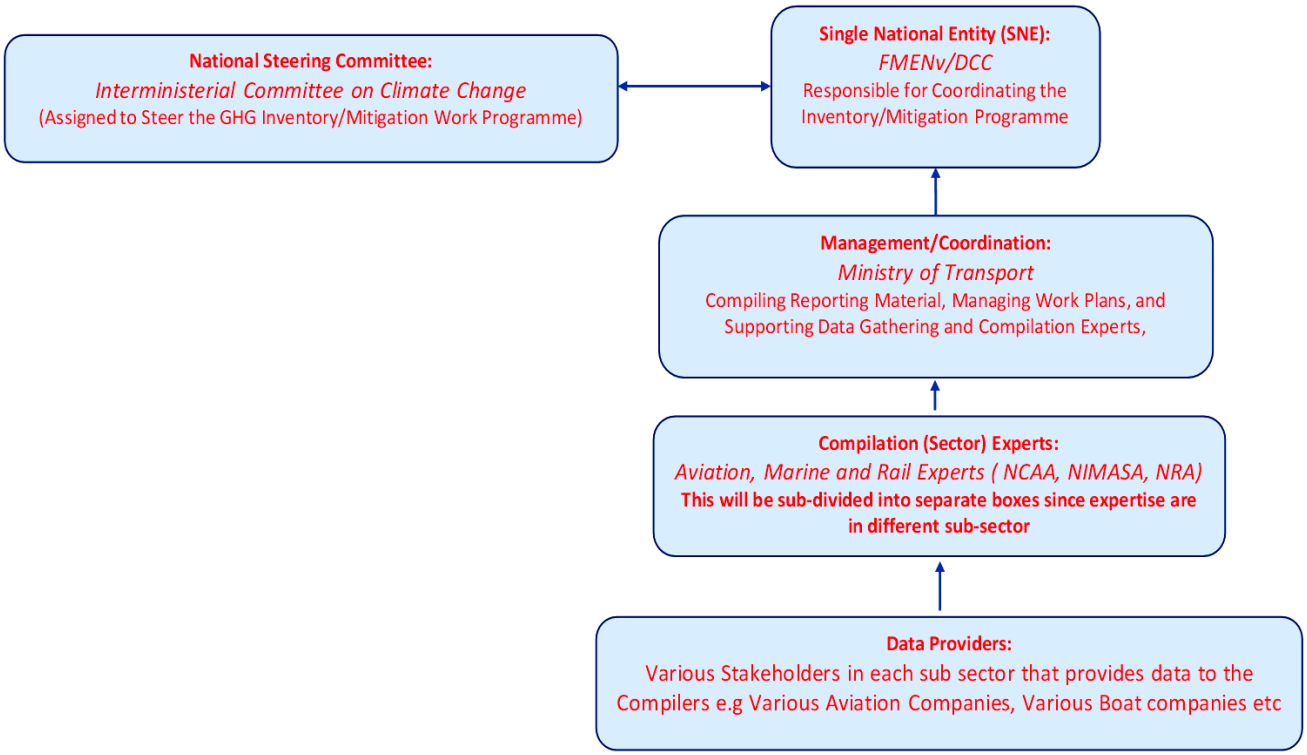
- Facilitates provision of information on climate actions and level of climate ambitions for decision-makers at sectoral and national levels;
- Provides decision makers with concrete information, on a continuous basis, to aid decision making – an action that will promote harmony between sustainable development goals and national development strategies.
- Enables compliance with international reporting requirements in a sustained and timely manner;
- Provides regular and detailed information to UNFCCC and international bodies on:

National achievements, through implementation of ambitious climate actions (e.g., mitigation); practical efforts made toward building of mutual trust and understanding between OTS modal Agencies and national authorities (i.e., FMEnv, Federal Ministry of Transport (FMOT), Federal Ministry of Aviation (FMOA), FMB & NP) on one hand and amongst themselves, on the other.

Structuring of Institution Arrangements for OTS Modal Agencies

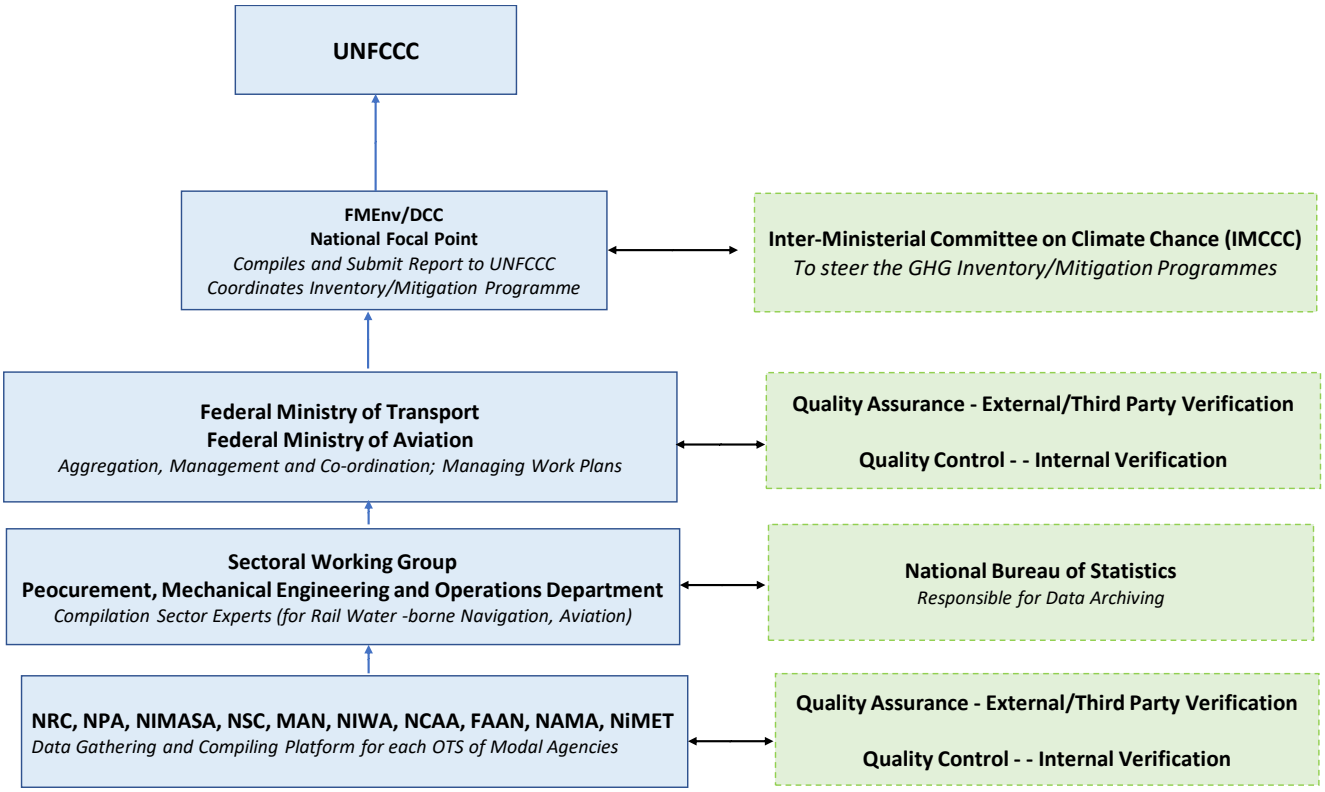
To formalize and communicate key functional roles of national institutions and experts in the compilation of a sectoral / national GHG inventory process, a well-designed Institutional Arrangements have to be in place first to show data and information flow process and the linkage. A typical example of such is shown below:

Figure 3: Model of Institutional Arrangement for the Other Transport Sector



Source: (Extracts from) 2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas inventories. Introduction to National Greenhouse inventories, chapter 1

Figure 3: Diagram of Proposed Institutional Arrangement for a typical OTS Modal Agency in Nigeria



Sectoral Roles and Responsibilities.

Considering the fact that there are many stakeholders involved in the GHG inventory compilation processes, (in the input – output chain), there is need to assign roles and responsibilities to them so as to avoid unnecessary conflict or clash of interest that can hinder the processes. As such, a good understanding of their respective interests, contributions and capacities must be noted and factored in, right from the start. For these stakeholders to perform their roles very well, two important provisions are needed.

- Terms of Reference (TOR) needs to be issued to them, stating their functional roles, responsibilities, and expectations (e.g., inventory compilation, expert inputs, tools development and use, data collection and archiving).
- Clear- cut schedules for undertaking the assignment.

Sectoral roles and responsibilities are aimed at improving efficiency, identifying the lead expert and other technical team experts involved in GHG inventory compilation, checking work done and reporting for each of OTS modal Agency. Following germane questions, need answers, to determine their sectoral roles and responsibilities:

- Is it an informal arrangement (written or verbal communication with staff)?
- Is funding available for the work?
- How will request for data be made?
- At what level of management will the request be made?
- Will there be a meeting with experts, data providers and other key contributors explaining the background and purpose of GHG Inventory?
- How will the Organization be motivated to share its data and information with the Inventory Agency?

The answer to the questions above, are needed to fill the Table 8 below:

Table 8: OTS sectoral Roles and Responsibilities

Roles	Name	Organization	Contact(s) Name(s).	Contact information (E- mails, Phone etc).	Participated in meeting on GHG inventory development Yes\No.	Comments related to role
Technical Coordinator (sector head)						
Consultant compiling estimates						
Expert Reviewer(s)						
Institutions providing data.						
Reporting manager(s)						
QA\QC manager(s)						
Uncertainty Assurance Manager(s)						
Others (e.g., policy specialist who tracks capacity building efforts and IPCC processes.						

Source: US/EPA(March2016): Templates for creating a National GHG Inventory System Manual

Table 9: National Roles and Responsibilities (National Inventory Lead Coordinator's Team)

Roles and Responsibilities.	Name	Organization	Contact information	Comment related to role(s)
National Inventory Coordinator.				
Road Transport sector Lead.				
Other Transport sector Lead.				
Oil and gas sector Lead.				
IPPU sector Lead.				
Agriculture sector Lead.				
Forestry and other land use sector Lead.				
Waste sector Lead.				
Archive (Data and Document) Manager/Coordinator.				
Uncertainty Analysis Coordinator.				
QA/QC Coordinator.				
Other: e.g GHG Emission Policy Specialist who tracks capacity building efforts and IPCC processes may use inventory information for mitigation.				

Source: US/EPA (March 2016): Templates for Creating a National GHG Inventory System Manual

Organizational Mandates for Data Flows

Preparation of GHG inventory demands a lot of data sets, from multiple data sources/ providers, such as statistical agencies (e.g., National Bureau of Statistics), Government Ministries, MDAs (Ministries, Departments, Agencies), Universities, Research centres etc. Data flows may at times be mapped out, in form of diagram(s) showing the start of data collection to final reporting point, with supporting documents to authenticate them and to show the importance of data providers and data users in the GHG inventory compilation process. Data flow process is to ensure proper documentation, build Institutional memory and promote consistency and transparency.

Good data flows are central to the functionality of Institutional Arrangements in an Organization. Data flow connotes identification of exact data required, its uses, management of data collection, documentation, archiving processes and continuous improvements in data management so as to reduce uncertainties of GHG inventory. Such data sets include Organization's/ Government data, National statistics, Organization's Annual Reports, Trade Associations' Reports etc.

Co-ordination, System and Tools

Co-ordination is a process that combines an Organization's goals and specialization (i.e Division of labor) and formation of chains of command. It refers to the establishment of communication channels, between people who are executing different roles. It is intended to correct the executors' actions, which do not comply with the chosen course of plan. Programmes are drawn up for actions during Organization's plan, determine the Co-ordination methods and tools to use. Manager's co-ordinate the whole activity, sub-divided into smaller activities, by work instructions, schedules, procedures, specifications, or order documents to produce work result.

System is a set of principles, rules, or procedures through which, something is done to achieve a common goal. An institutional system allows good accomplishment of tasks or jobs laid out, good flow of work, good interactions, and linkages amongst staff from different department backgrounds and integration of work, with a view to achieving the desired results. System enables and facilitates easy flow of quality data from Start to End in the processes of GHG emissions and GHG inventory compilation.

Tools are used by Organizations and countries to track progress towards climate goals' attainment. For institutional Arrangements to be effective, Tools, Data bases, Data Analysis, Reports and system must be developed and embraced. Critical areas such as Data Management (Collection, compilation, documentation, analysis, archiving), system, methodological Tools, QA/QC that ensure timely outputs, must be available to Teams of Technical Experts, at sectoral and national levels, to ease their work delivery.

Stakeholders' Engagement

Stakeholders' Engagement or Participatory Governance is part of modern decision-making process that entails a shift from a state-controlled governance to inclusion of other Actors in the realm of decision-making process despite the costs, energy and time demand. It also hastens decision- making process through the incorporation of local knowledge, as inputs to it.

Participatory Governance is defined as …." all the processes and structures of public decision- making actors from the private sector, civil society and/or public at large, with varying degrees of communication, collaboration and delegation of decision-making power to participants. "(Kochskamper- et al). Stakeholders' Engagement through constant communication, speaks volumes about an organization's efforts in minimizing risks, exploiting opportunities, and developing solutions, all aimed at addressing climate change and its related issues. So, the greater the stakeholders' engagement (in terms of continuity/ regularity, quality, scope, and content), the greater is the level of transparency of GHG inventory system. Stakeholder engagement is very important because stakeholders are vital in data generation, collection and archiving and at the same time, play a greater role in the adoption and use of outputs (e.g., Reports) that can enhance the decision-making process. With stakeholders' engagement, data collection process can be broadened and thus enable data to be collected from most reliable and credible sources in a transparent and organized manner.

Chapter Eight - Work Plan and Roadmap

8.1 Workplan

A good and well-crafted workplan is necessary to facilitate the compilation of a sectoral/national gag inventory, as it contains schedule of steps to take. It must be noted that no matter how good any workplan for GHG inventory is, it has to be reviewed prior to the start of another inventory cycle. Below is an illustrative example (in tabular form) of a workplan for GHG Inventory preparation as recommended in 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Table 10: Illustrative Workplan for Preparation of GHG Inventory Including an Indicative Timeline

Example Activity	Illustrative Milestones	Illustrative Lead Actor/Stake holder
Agreement on the scope of work (including stakeholder consultation and identified improvements and update to the time series) and timeframes with stakeholders/steering committee.	Week 1.	Illustrative Lead Actor/stakeholder.
Appointing/engaging the team of experts to deliver the scope of work needed (data collection, QA/AC, documentation, and reporting) establishing/revising Terms of Reference: • Roles and responsibilities. • Timelines. • Deliverables. • Time (Budgets) allocation.	Week 2-6.	SNE/Inventory Manager/Co-Ordinator.
Sectoral Estimation (e.g., Energy, Industrial Processes and Product Use (IPPU), Agriculture, AFOLU, (LULUCF), (Transport) and (waste), including: • Collecting Data (engaging with data suppliers) and checking data supplied. • Agreeing (on) any new methodologies and/or continuation of existing methodologies. • Calculation of estimates. • QC (checking of all estimates) • QA (peer review of new estimates). • Documentation. • Finalization of reporting formats.	Week 3-30	Compilation Experts.
Collation of sectoral estimates into draft final datasets and national totals and trends (master summary files or database); compilation of uncertainty aid key category analysis.	Week 30-34	Inventory Manager/co-ordinator, Compilation Experts where needed for follow up.
QC of draft final estimates and documentation of changes and trends.	Week 32-36	
Drafting (collation of the sectoral documentation on methods, data sources and assumptions, key category and uncertainty analysis) into the National Inventory Report.	Week 34-40	
Consultation with stakeholders on draft final estimates and National Inventory Report and documented changes and trend features.	Week 40-46	(SNE and Steering Committee engaged for stakeholder review/consultation on outputs).
Finalization of estimates and the National Inventory Report and archiving of the GHG Inventory material	Week 46-50	

Reporting and other deliverables to stakeholders and national decision-making processes.	Week 50-52	

Source: IPCC 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Chapter 1 Introduction to National GHG Inventories.

Note: *This Table is a Guide. It may be adjusted to meet sectoral/national circumstances, particularly the time frames and the time period of GHG Inventory cycle.*

8.2. Roadmap

Roadmap is a strategy adopted by an organization or a nation to navigate through laid out programmes, following pathways, to credible and long-lasting GHG emissions reduction's attainment. It represents action-oriented, ambitious, planning process for GHG emissions reduction and clean energy transition.

Development of a Road Map is an open, transparent process involving collection of multiple inputs from multiple stakeholders of varied backgrounds, including the mostly affected by the impacts of GHG emissions. Climate Target Setting, with a specified timeframe, is central to a Road Map in OTS. Nigeria, therefore, needs, for a start, to set 2030 as its modest Climate Target and subsequently, up-scale it. However, there are seven major steps to follow in the bid to achieving 2030 target as shown in Table 11 below:

Table 11: Proposed Road Map for OTS in Nigeria

Steps	Timelines
Step 1: Understanding the existing situation of GHG Emissions.	Jan-June 2022
Step 2: Analyze the future emissions trends.	July-Dec 2022
Step 3: Set low-carbon development (LCD) targets.	Jan-June 2023
Step 4: Develop actionable plans for OTS Modal Agencies.	July-Dec 2023
Step 5: Assess mitigation potential of low-carbon technologies/projects.	Jan-June 2024
Step 6: Propose measures for implementation (and obtain approval).	July-Dec 2024
Step 7: Implementation begins.	Jan 2025-2030

Note: Seven steps taken (and modified) from Guiyang Zhuong and Zhen'ge Zhou (2021): Formulation of low-carbon city Development Roadmap: Technical Elements and Recommendations.

8.3 Conclusion

To implement the Proposed Roadmap in Nigeria's OTS, a lot of strong political will and commitment on the part of the Federal Government of Nigeria is required.

Both supervisory Federal ministries (i.e., Transport and Aviation) will have to work in collaboration, with Federal Ministry of Environment/ Department of Climate change to jump start the process by initiating Executive Memorandum (jointly or separately) to the Federal Executive Council (FEC) for consideration and approval. This facilitates the process of the mainstreaming of Climate actions into National Development Plans, and Budgetary Appropriations.

Furthermore, the two supervisory ministries should institute a process to facilitate:

- The establishment of Institutional Arrangement (IA) of MRV in each of the OTS modal Agencies, containing all the key ingredients as well as characteristics of effective IA.
- **The implementation of all the Recommendations on Mitigation Measures as specified for each of the OTS modal Agencies.**

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