NIGERIA – ICAT PROJECT SECTORAL MRV REVIEW

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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Abbreviation

Ad	Activity data
AD	Anaerobic Digestion
AfDB	African Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
AOR	Annual Oil Report
BTR	Biennial Transparency Reports
BUR	Biennial Updates Report
BUR 1	First Biennial Update Report
CBN	Central Bank of Nigeria
CBP	Capacity Building Plan
CC	Climate Change
CCU FP	Climate Change Unit Focal Point
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH_4	Methane
Citepa	International Technical Centre on Air Pollution and Climate Change
CL	Crop Land
CLL	Concurrent Legislative List
CO_2	Carbon Dioxide
COP	Conference of Parties
CSO	Civil Society Organization
DCC	Department of Climate Change
DFID	Department for International Development
DOM	Dead Organic Matter
DPR	Department of Petroleum Resources
DRTS	Directorate of Road Traffic Service
ECN	Energy Commission of Nigeria
EF	Emission Factor
ETF	Enhanced Transparency Framework
FAAN	Federal Airports Authority of Nigeria
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FCCU	Focal Climate Change Unit
FCTA	Federal Capital Territory Administration
FL	Forest Land
FMARD	Federal Ministry of Agriculture and Rural Development
FMB & NP	Federal Ministry of Budget &National Planning
FMEnv	Federal Ministry of Environment
FMoA	Federal Ministry of Aviation
FMoFB&NP	Federal Ministry of Finance, Budget, and National Planning
FMoT	Federal Ministry of Transport
FMoW&H	Federal Ministry of Works and Housing
FNC	First National Communication
FOS	Federal Office of Statistics
FQD	Fuel Quality Directive
FRA	Forest Resources Assessment
FRSC	Federal Road Safety Corps
GACMO	Greenhouse Gas Abatement Cost Model
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHGE	Greenhouse Gas Emission
GHGI	Greenhouse Gas Inventory
GHGMI	Greenhouse Gas Management Institute
GL	Grass Land

GPG	Good Practice Guidance
GW	Global Warming
HSR	High-Speed Rail
HWP	Harvested Wood Products
IA	Institutional Arrangement
IAP	Interested and Affected Parties
ICAO	International Civil Aviation Organization
ICAT	Initiative for Climate Action Transparency
ICCC	Inter-Ministerial Committee on Climate Change
ICD/ICT	Inland Containers Depot/Terminal
IMS	Inventory Management System
INDC	Intended Nationally Determined Contribution
IOC	International oil companies
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
IRR	International Reporting Requirements
KRPC	Kaduna Refining and Petrochemical Company
LDAR	Leak Detection and Repair
LEAP	Low Emissions Analysis Platform
LGA	Local Government Areas
LNG	Liquefied Natural Gas
LULUCF	Land Use, Land Use Charge and Forestry
MDA	Ministries, Departments and Agencies
MoU	Memoranda of Understanding
MPG	Modalities, Procedures and Guidelines
MRV	Monitoring, Reporting and Verification
N_2O	Nitrous Oxide
NADDC	National Automotive Design and Development Council
NAI	Non-Annex I
NAMAs	Nationally Appropriate Mitigation Actions
NAMA	Nigerian Airspace Management Agency
NASS	National Assembly (bicameral)
NBS	National Bureau of Statistics
NC	National Communication
NCAA	Nigerian Civil Aviation Authority
NCAT	Nigerian College of Aviation Technology
NCCC	National Committee on Climate Change
NCCF	Nigerian Climate Change Fund
NCCPRS	National Climate Change Policy Response and Strategy
NCS	Nigeria Customs Service
NDC	Nationally Determined Contribution
NECAL 2050	Nigeria Energy Calculator 2050
NESREA	National Environmental Standards and Regulations Enforcement Agency
NEST	Nigerian Environmental Study Action Team
NGC	Nigeria Gas Company
NGF	Nigerian Governors Forum
NGO	Non-Governmental Organizations
NIIMP	Nigeria Integrated Infrastructure Master Plan
NIMASA	Nigerian Maritime Administration and Safety Agency
NIMET	Nigerian Meteorological Agency
NISER	Nigerian Institute of Social and Economic Research
NITT	Nigerian Institute of Transport Technology
NIWA	Nigerian Inland Waterways Authority
NNPC	Nigerian National Petroleum Corporation
NNPC-RED	Nigerian National Petroleum Corporation - Renewable Energy
NOC	National oil companies
NPA	Nigerian Ports Authority

NPDC	Nigerian Petroleum Development Company
NRC	Nigerian Railway Corporation
NSC	Nigerian Shippers Council
NURTW	National Union of Road Transport Workers
O&G	Oil and Gas
OTS	Other Transport Sector
P&M	Policies and Measures
PaM	Programs and Measure
PEF	Petroleum Equalization Fund
PHRC	Port Harcourt Refining Company
PPMC	Pipelines and Product Marketing Company
QA	Quality Assurance
QC	Quality Control
REDD	Reducing Emissions from Deforestation and Forest Degradation
RTS	Road Transport Sector
SDG	Sustainable Development Goal
SLCP	Short-Lived Climate Pollutants
SNC	Second National Communication
SON	Standard Organization of Nigeria
TNC	Third National Communication
ToR	Terms of Reference
UER	Upstream Emission Reduction
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNREDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
VRU	Vapor Recovery Unit
WAGP	West African Gas Pipeline
WRPC	Warri Refining and Petrochemical Company

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Executive Summary

The Initiative for Climate Action Transparency (ICAT) was founded in response to the need to support improved transparency and capacity building under the Paris Agreement (PA). ICAT aims to help countries assess the impacts of their climate policies and actions and fulfill their transparency commitments. ICAT's work is a country-driven process that, aims at building on the existing MRV system and knowledge in the supported countries, hence complementing their previous as well as the on-going efforts in their commitment in combating the impact of climate change.

Efforts to achieve the set objectives of the ICAT project in Nigeria is anchored by the Federal Ministry of Environment (FMEnv) (which is legally mandated with the protection of the natural environment against pollution and degradation and conserving the natural resource for sustainable development) and delivered by ICAT National and International Project Consultants working closely with identified stakeholder entities in public, private and multinational organizations.

The technical support provided by ICAT to Nigeria is expected to contribute to Nigeria's commitment to build adequate capacity to develop and apply sectoral MRV system to measure the performance of the targeted climate policies and actions defined for three sectors (Oil and Gas, Transport and AFOLU) and to integrate sector MRV systems into an overarching MRV system under the Enhanced Transparency Framework (ETF) of the Paris Agreement.

Under the United Nations Framework Convention on Climate Change (UNFCCC), all Parties are required to develop and submit national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHGs) not controlled by the Montreal Protocol. For non-Annex I (NAI) Parties, the periodicity of inventory reporting is dependent on the requirements for submission of National Communications (NCs) and Biennial Update Reports (BURs)/ Biennial Transparency Reports (BTR). In the context of an ongoing, two-year cycle of GHG inventory (GHGI) preparation and reporting, there is a need to institutionalize the related processes within a national system for measurement, reporting and verification (MRV), compliant with the reporting requirements for NAI Parties under the UNFCCC.

The current institutional arrangement has the Department of Climate Change (DCC) as the lead National Agency responsible for implementing and reporting climate action. The lead institution must work closely with key industry stakeholders for effective GHG inventories and reporting.

This assignment reviewed the existing needs and gaps within three priority sectors, Oil and Gas (O&G), Road Transport & Other Transport, Agriculture, Forestry and Other Land Use (AFOLU). To achieve this objective, various methods were deployed to effectively engage relevant stakeholders in the priority sectors such as face to face meeting, online workshops, focus group discussion, open ended questionnaires, and review of relevant documents.

The interaction with the stakeholders at various levels during consultative meetings revealed the absence of established functional national MRV framework in the priority sectors. Although informal interaction and data collection exists between the DCC and some of the stakeholders (data providers); the informal nature does not give room for growth and development of a robust functional national MRV system.

This report therefore focuses on the review of MRV sectoral process in the three sectors highlighting the needs and gaps. There is generally a challenge on data collection in almost all the sectors in the country.

While the awareness is increasing across all the NDC sectors of the country, there is more to do in terms of building capacity on type of data to collect, how to collect the data, validation of the quality of data collected and reporting process for the data. The current organizational structure in most of the Ministries, Departments and Agencies are not set up to address the collection, monitoring and reporting of data. It is imperative to review or amend process in some sectors for it to accommodate data collection and validation while in some other sectors with a bit of MRV structure, it is important to clearly define roles to ensure that transparency and best practices on MRV is applied.

The organizational structure, data collection processes, mitigation actions, challenges and solutions were discussed in this report based on consultation with stakeholders from various sectors. The three sectors of focus are already involved in various mitigation actions projects and are highlighted in this report.

The sectoral MRV review has been implemented to support the ICAT-Nigeria MRV System. This will assist the country in addressing GHG data management challenges sustainably and systematically with a view to plugging existing gaps and enhancing public perception of the objectivity, impartiality, and independence of environmental statistics and GHGs datasets captured in the BURs, NCs, and BTRs. Subsequent follow up sessions with Stakeholders will focus on how the MRV processes can be improved in the three sectors with the support and buy-in of the top administrators of the concerned MDAs.

1.0   Introduction

As the focus on reduction of carbon emissions and the impact of Climate Change (CC) becomes topical globally, it is imperative that Nigeria, as a member nation that ratified the PA and submitted its NDCs implemented in 2015, take actions towards achieving its NDCs targets.

The NDCs are reports from all countries that present the commitment by each country in accordance with the PA outlining and communicating their post-2020 climate actions to reach their goals. The countries are expected to pursue domestic mitigation measures to achieve the objectives set in the NDC.

The Nigeria NDC highlighted key measures required to reach the United Nations Framework Convention on Climate Change (UNFCCC) goals: ending gas flaring by 2030, off-grid solar PV of 13GW, efficient gas generators, 2% per year energy efficiency (30% by 2030), transport shift from car to buses, improve electricity grid performance, climate smart agriculture and reforestation.

These measures can only be attained successfully when the mitigation measures are effectively integrated into national and sectoral legislation. It is also important to develop an accurate and reliable system of reporting climate information. The effective tool to achieve these measures transparently as required by the PA is to have a robust MRV system. Article 12 of the UNFCCC obliges all Parties, to communicate to the Conference of the Parties (COP) information relevant to the implementation of the Convention, including in relation to emissions and removals. This allows the Convention to have reliable, transparent, and comprehensive information on emissions, actions, and support, thereby forming an essential basis for understanding current emission levels, and the ambition of existing efforts, as well as progress on both the national and international scale.

MRV refers to activities that track progress and steer towards climate change related targets. The term MRV was coined in Bali (COP 13, 2007), bringing together all aspects pertaining to transparency under the climate regime. With MRV systems, there is a better understanding of the key sources and sinks of Greenhouse Gas (GHG) emissions, overall emissions trends, the effectiveness and impacts of mitigation strategies, and the necessary support for continuous improvement. MRV systems serve countries' domestic goals and priorities and are a tool to monitor the level of progress that has been achieved by hence, determine areas that need to be focused on.

A robust MRV system consists of three interconnected processes:
- *Monitoring/Measuring (Data collection and assessment)*

Parties to the PA applies efforts to address CC including the level of GHG emissions by sources and removals by sinks, emission reductions and other co-benefits. These measurements occur at the national level. Initially, this was addressed as measurement of GHG emissions by sources and removals by sinks through the national GHG inventories, which are usually reported in National Communications (NC).

Based on the decisions adopted at COP 16 and 17, non-Annex I Parties now need to measure the specific effects of national mitigation actions as well as the support needed and received, and to provide this information, including a national inventory report, as part of their Biennial Update Report (BURs). The methodologies for measurement are not defined by the Convention; therefore, in undertaking measurement, non-Annex 1 parties rely on methodologies developed externally,

including methodologies by the Intergovernmental Panel on Climate Change (IPCC) and other organizations.

Other parameters to be measured/monitored are:

- o Emissions reduced or avoided through mitigation actions.
- o Other relevant variables such as consumption of energy or materials (water), socioeconomic or environmental variables, or co-benefits of mitigation actions.

- *Reporting:*

  Non-Annex 1 Parties are required to report on their actions to address climate change in their NCs and the BURs, which include information on the GHG inventories, adaptation, mitigation actions and their effects, constraints and gaps, support needed and received, and other information considered relevant to the achievement of the objective of the Convention. National communications are to be submitted every four years and prepared following the guidance contained in the revised guidelines for the preparation of national communications for non-Annex I Parties. Also, developing countries are expected to submit their BURs every two years. The BURs will provide an update of the information presented in the NCs particularly on national GHG inventories, mitigation actions, constraints, and gaps, also including support that is needed and already received.

- *Verification:*

  Verification processes can be carried out by third party auditors however, at the national level, verification is implemented through domestic MRV mechanisms established by Parties. The importance of verification process is to increase the transparency of mitigation actions and their effects, and support needed and received.

1.1 MRV Principles

A sustainable and robust MRV system consists of five basic principles that must be critically considered. These principles form the basis of all MRV processes and must be strictly adhered to have a sustainable MRV process. These Principles include the following:

- Transparency: all assumptions and methodologies used for an inventory must be clearly explained in simple and transparent terms to allow for replication and assessment of the inventory by users of the reported information.

- Accuracy: this is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under stated, as far as can be judged, and that uncertainties are reduced as far as practicable. Appropriate methodologies should be used, in accordance with the relevant MRV system guidance, to promote accuracy.

- Consistency: an inventory should be internally consistent in all its elements when compared to other years. An inventory is consistent if the initial methodologies that are used are the same with the subsequent years and if consistent data sets are applied to estimate emissions or removals from sources or sinks.

- Comparability: estimates of emissions and removals reported should be comparable among all reporting Parties.

- Completeness: an inventory is said to be complete if it covers all relevant sources and sinks, as well as all gases. Completeness also means full geographic coverage of sources and sinks.

There are three types of mitigation related MRV:

- *MRV of GHG Emissions:* The concept of MRV of GHG emissions entails measuring and monitoring GHG emissions and removals associated with activities of entities such as countries, organizations, or facilities; reporting collected data in a GHG inventory and subjecting the process to review and verification. The process of MRV of GHG emissions on the national level involves conducting the MRV process at the sectoral level. On the sectoral level, MRV of GHG emissions involves building an organization-wide inventory of total emissions and removals from all sources within the organization's boundary.
- *MRV of Mitigation Action:* This MRV involves implementing mitigation actions (interventions and commitments which include goals, policies, and projects that are undertaken either by the government or private organizations/individuals with the goal to reduce GHG emissions). The Concept of MRV of mitigation actions focuses on the effects of GHG, effects of sustainable development and implementation progress**.**
- *MRV of Support:* The concept of MRV of support is to track provision and receipts of climate support (finance), monitor results achieved from the actual implementation of projects and assess the impact of the implemented projects. For instance, countries track financial support provided for mitigation efforts and building capacity. (e.g., climate finance, technology transfer, and capacity-building) to track provision and receipt of climate support, monitor results achieved, and assess impact.

Therefore, as part of working towards achieving the Nigeria NDC target, there have been continuous efforts in setting up MRV system for all the key sectors identified in the Nigeria NDC report. The priority sector focused on under this Initiative for Climate Action Transparency (ICAT) –Consultancy Project(s) on application of MRV GHGE for mitigating the impacts of Climate Change in Nigeria.

As mentioned earlier, the MRV under this consultancy assignment focuses on three of the priority sectors and these three sectors are reported under five categories as follows:
- O&G
- Road Transport
- Other Transport
- Agriculture – Crop and Livestock
- Land Use, Land Use Change and Forestry (LULUCF)

As part of establishing the MRV system, it is imperative to review the current process in place in each sector to avoid 're-inventing the wheel' particularly in situation where there is a process that can be improved upon. MRV system has overtime been adopted by both governments and other entities in the form of monitoring and evaluation to assess and track the implementation of planned mitigation actions. When applied at the national level, it assists with clearly assessing the status of implementation and progress achieved on national climate change goals.

1.2   Scope and Objective

The review of the sectors in terms of GHG inventory and mitigation action focuses on the formal assessment of the existing MRV practices within three priority sectors. The review is aimed at instituting changes through improving, enhancing capacities, and implementing the adoption of robust MRV system across the various NDC sectors in Nigeria.

The specific objectives of this report, aligns with overall objectives of this project which primarily are to:
- Carry out a review of the sectors in terms of GHG inventory and mitigation actions.
- Provide inputs to an internal Nigerian Reporting Scheme towards developing the national institutional setup.
- Develop an overarching Institutional Arrangement (IA) with recommendation for national reporting system and design; and
- Assess Policies and Measures (P&M) to develop NDC indicators/tools. ICAT methodologies available for Transport, Agriculture and Forestry will be applied if corresponding to national P&M.

The above objectives are expected to improve Nigeria's ambition towards ensuring transparency and effective reporting as it relates to the National GHG Inventory especially as the country moves closer towards NDC implementation.

The scope of this report is focused on the MRV sectoral review of the selected NDC priority sectors, and this involves the review of the existing IA and stakeholder's perception, review of the existing MRV frameworks, alongside GHGE reporting and Mitigation actions and the existing Methodological tools for MRV. The challenges and gaps of these parameters are explored towards improving upon the existing MRV practices in these sectors.

1.3   Structure of the Report

This report is divided into three (3) sections:

Section 1:
This section focuses on the general introduction, scope and objectives and the structure of the report.

Sections 2 - 6:
These sections **present a review of the** existing IA and Stakeholder Identification for the three-priority sectors, with an overview of the Description, Challenges and Gaps**. It also focuses on** Mitigation Actions in the sectors and Existing Methodological Tools for MRV

Section 7:
This section **focusses on the conclusion stressing the next steps for subsequent reports.**

2.0   Agriculture Sectoral MRV

2.1   Introduction

The MRV is the mechanism through which progress towards achieving climate change related targets and commitments is tracked at the national and subnational levels (NDC Sectoral Action Plan, 2017). This creates the baseline for understanding a country's emission sectors and mitigation actions, policies for tracking the implementation of measures necessary to achieve the commitments, mitigation targets and the key achievements or progress within the set timeline. Other support received during the process is also reported. These all provide a clear line of sight towards achieving GHG emission reductions or strengthening adaptation action towards adapting to the impacts of climate change.

The PA and the IPCC guidelines under the enhanced transparency framework specify at a very general level what information should be reported regularly (at least biennially), and the detailed reporting requirements.

At the national level, there are no specific definitions for either what constitutes 'MRV' or what specific provisions or parameters should be included within an MRV system or framework rather systems should be designed and tailored such that they will be sustainable under the respective national circumstances.

With the objective of communicating reliable, transparent, and comprehensive information on GHG emissions, actions and support, the transparency of climate action and support forms an essential basis for understanding current GHGE levels, the ambition of existing efforts, as well as understanding progress on both the national and international scale.

2.2   Existing Institutional Arrangements and Stakeholder Identification

An integral component of an MRV system is identifying the organization(s) responsible for compiling and management of the needed data. This role will involve agreeing on provision of data from network of stakeholders and data providers. Data management, analysis and reporting are also key tasks in developing a sustainable MRV system. Strong Institutional arrangements (IA) are vital to enabling countries to provide reliable, comprehensive, and regularly updated information that meets the enhanced reporting requirements and serves national decision makers and action-implementing stakeholders.

Stakeholder Identification and Consultations

The stakeholder mapping activity identified the key emission sources and potential data sources in the Crop and Livestock sector. The overview of IA of MRV and GHGI stakeholders the sector is presented in Figure 1. Consultation with the contributors to the GHGI process will permit the sector to account for the varying responsibilities, capacities and commitment during the planning, implementation and assessment of the process and the selection of the national entity host for the GHG inventory technical team within the Crop and Livestock sector. Furthermore, consultation with users of the GHGI results provides feedback as the country defines the characteristics of the GHGI such as level of detail required and tiers to apply and possibilities of improving on the Tier 1 method. It may also help to define appropriate interagency collaboration, technology transfer, national and international funding sources. Typical users of these results are ministries, research institutions, industrial associations, and non-

governmental organizations (NGOs).

The current IA has the Department of Climate Change (DCC) as the lead National Agency responsible for implementing and reporting climate action. The DCC comprises of four divisions comprising GHG and Flexible Mechanism Division, Vulnerability and Adaptation Division, Mitigation Division, as well as Education, Training, Public Awareness, and other information Division coordinating activities within various components. The DCC also convenes and chairs the Inter-Ministerial Committee on Climate Change (ICCC). Figure 1 blow depicts the current institutional arrangement.

Figure 1: Existing Institutional Arrangement
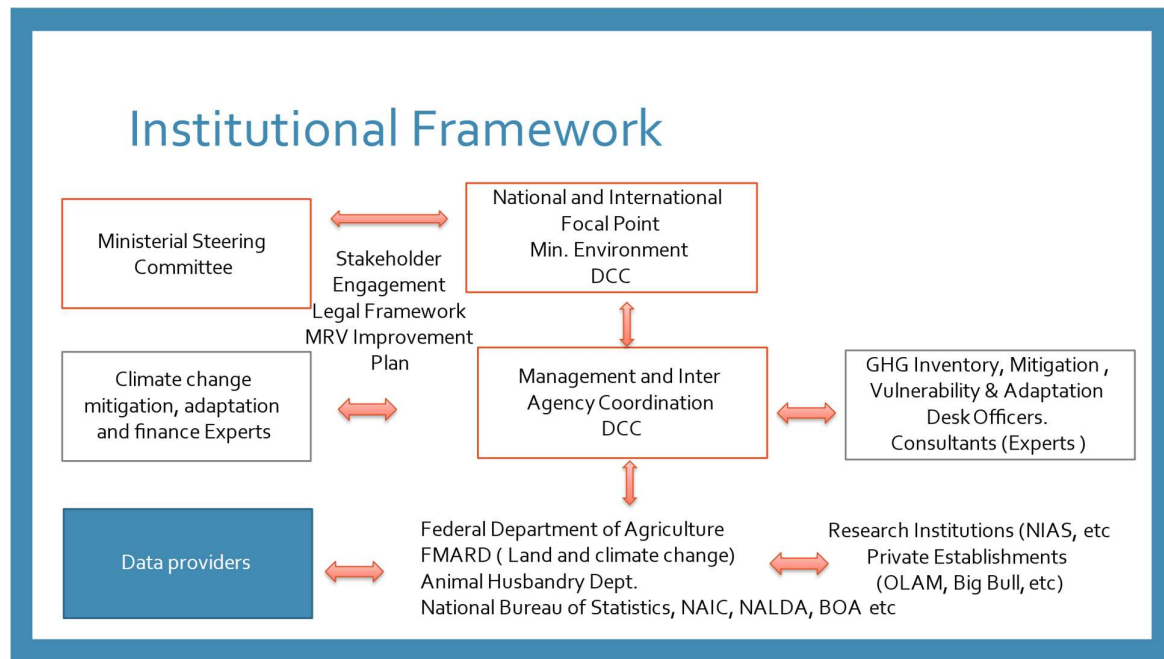
The following MDAs, NGOs and other key sector experts were engaged during the review process as listed in the table below.

Table 1: List of Consulted Stakeholders in Crop and Livestock Sector

S/N	Name of Organization	Address
1	African Development Bank Group	1521 Cadastral Zone A0 Off Memorial Close Mabushi Central Business District Abuja
2	Agricultural Research Council of Nigeria	Agricultural Research House, Plot 223D, Cadastral Zone B6 Mabushi, Abuja
3	National Institute of Animal Science (NIAS)	Plot 1882 C13, Kabusa, Off Sunny Vill Junction Okanje District Abuja
4	Nigerian Environmental study Action Team (NEST)	1 Oluokun Street, Off Awolowo Avenue Bodija Ibadan.
5	International Institute of Tropical Agriculture (IITA)	Oyo Road Ibadan
6	Institute of Agricultural Research & Training (IAR&T)	Obafemi Awolowo University Moor Plantation Ibadan

S/N	Name of Organization	Address
7	National Horticultural Research Institute (NIHORT)	P.M.B. 5432, Jericho Reservation Area, Idi-Ishin, Ibadan
8	Forestry Research Institute of Nigeria (FRIN)	Idi-Ishin Jericho Road Ibadan.
9	National Animal Production Research Institute (NAPRI)	Shika, Zaria, Kaduna
10	National Agricultural Extension and Research Liaison Services (NAERLS)	Ahmadu Bello University Zaria, Kaduna
11	Cocoa Research Institute of Nigeria (CRIN)	Km 14 Ibadan-Ijebu Ode Rd, Idi-Ayunre, Oyo.
12	Institute of Agricultural Research (IAR)	Samaru, Ahmadu Bello University Zaria, Kaduna
13	National Veterinary Research Institute (NVRI)	Vom, plateau State
14	National Root Crop Research Institute (NRCRI)	Km 8 Umuahia-Ikot Ekpene Rd, Abia
16	Economic Community of West African States (ECOWAS), Department of Agriculture and Environment & climate change	Abogo Largema Street CBD, Airport Road Abuja
17	Food and Agricultural Organization (FAO)	Old CBN Building, No 4 Zaria Street Ladoke Akintola Boulevard Garki II, Abuja.
18	Federal Ministry of Agriculture and Rural Development (FMARD)	Area 11, Garki, Abuja
19	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	No 4 Julius Nyerere Crescent Asokoro, FCT, Abuja
20	European Union Delegation to Nigeria and ECOWAS	No 21 Crescent off Constitution Avenue CBD, Airport Rd, Abuja
21	International Fund for Agricultural Development (IFAD)	AFDB Building 1521 Cadastral Zone A0 Off Memorial Close CBD, Abuja
22	Rice Farmers Association of Nigeria (RIFAN)	24 Ekoro-Oruro Street, Off Osun Cres, Maitama, Abuja
23	Idorama Fertilizers	149, Adetokunbo Ademola Crescent Wuse, Abuja
24	Nigerian Agricultural Insurance Cooperation (NAIC)	Plot 590, zone AO, Cadastral zone, Abuja, Federal Capital Territory, Nigeria.
25	National Agricultural Land Development Authority (NALDA)	3A, Third Floor, Phase 1, Federal Secretariat Complex, Abuja
26	Nigeria Erosion and Watershed Management Project (NEWMAP)	56 Honourable Justice Mamman Nasir Crescent Asokoro, Abuja.
27	Nigerian Institute for Oil-Palm Research (NIFOR)	KM 7, Benin Akure Road, Edo State. City. Benin City
28	National Cereal Research Institute (NCRI)	Badeggi, P. M. B 8, Bida, Niger State.
29	Nigerian Meteorological Agency (NIMET)	National Weather Forecasting and Climate Research Center Nnamdi Azikwe International Airport Abuja
30	Poultry Association of Nigeria (PAN)	2nd Floor, Katsina House, Ralph Shodeinde Street, Abuja, FCT – Nigeria
31	REDD+ Nigeria	Mabushi, FCT, Abuja
32	Rubber Research Institute of Nigeria (RRIN)	Off Km 19 Sapele Rd, Iyanomo Benin, Edo.
33	World Bank	102 Yakubu Gowon Crescent Asokoro, Abuja.
34	United Nations Development Programme	UN House, Plot 617/618 Diplomatic Drive Central Business Area Abuja
35	UNDP	Plot 1075 Diplomatic Drive Central District Area, Abuja
36	Veterinary Council of Nigeria	No. 8 Zambezi Crescent Off Aguiyi Ironsi Way, Maitama, Abuja, FCT.
37	Nigerian Institute of Soil Science (NISS)	8 Abdullahi Ibrahim St, Mabushi, Abuja
38	Oxfam Nigeria	11 Ganges St, Maitama 900271, Abuja
39	Olam Nigerian Ltd	1 Sheraton Abuja Hotel, ladi Kwali St, Maitama, Abuja

2.3 Description, Challenges and Gaps

The sustainability of the MRV system is frequently confronted with several challenges, which particularly depend on political support and correspondingly, allocation of financial resources. High-level internal political support is an important factor to ensure the continuous and sustainable operation of a national MRV system, especially when it comes to budget allocation and delivery of GHG-relevant data and information from data providers and stakeholders. Sustainability of the MRV system can be supported by legal instruments such as memoranda of understanding (MoU) or legal agreements to ensure incorporation of MRV activities in the normal routine of relevant stakeholders. Lack of such support can decisively affect the sustainability of the budget for inventory preparation as well as the processes of data provision and compilation and the overall quality of the inventory, reporting and tracking mitigation actions.

Some of the critical issues listed during the stakeholder consultations include:
- No clear roles and responsibilities of relevant MDAs in activity data collection, archiving and processing for developing a robust sustainable MRV system in the sector.
- No clear definition of institutional arrangements, data collection methodology and reporting structure, data transfer and sharing.
- Small teams with limited resources and multiple responsibilities.
- difficulty in retaining expertise (transfers within the civil service system);
- Incomplete or non-existent activity data, and lack of experimental data for developing country-specific emission and stock change factors.
- Insufficient documentation and absence of an archiving system from previous inventories.
- No quality assurance and quality control (QA/QC) plan within the relevant MDAs identified as key stakeholders; and no defined path/working document to improve future national GHG inventory in the Crop and Livestock sector.
- Lack of support, capacity building and technology transfer to facilitate data collection, reporting, archiving and transfer.

The reasons for lack of support within the MDAs and Private sector players were attributed to low visibility of the outputs produced by the GHGI, which generally are of technical and complex nature, and lack of awareness of the benefits that a robust and high-quality inventory can provide for the country. The challenge to increase the visibility of outputs could be addressed through a targeted communication strategy demonstrating the benefits of the inventory data, as well as related underlying information and data, for various purposes, stakeholders, and audiences. For example, priority could be given to the dissemination of results of the GHGI with information and key messages tailored to the respective stakeholders, such as policy makers at different governmental levels and sectors as well as the public. To this end, GHG inventory information needs be summarized and turned into tailor-made outputs using a less technical language as emphasized by the stakeholders.

Furthermore, the information contained in BURs/BTRs, NCs and related reports can have numerous uses in addition to complying with UNFCCC reporting requirements. The information can, for example, help in tracking progress of national goals, such as the NDCs, in assessing the potential of planned or implemented measures (e.g. potential use of carbon taxes in products and services), in identifying sectors that could expand with low carbon footprint, or in considering technological options in specific sectors. Finally, they can also assist in obtaining information on adaptation needs.

There is currently no specific finalized legal instrument in form of MoU or data sharing agreements between stakeholders in the Crop and Livestock Sector. There is therefore no definite legal obligation by any of the key emission sectors or MDAs to collect, process, and share GHG data with the Department of Climate Change. The coherence within some of these institutions is lacking in terms of harmonization of already existing datasets which are held by individual officers instead of institutions. This hinders sustainability of the data management processes.

The DCC in FMEnv can initiate the process of formalizing the relationship between the department and sector partners. CC Department can draft MoUs (using a template) with organizations that collect relevant data; and share with the sector hubs like FMARD. The data harmonization process can strengthen all institutions via forward and backward inter agency linkage and collaborations, knowledge sharing and capacity building.

2.4   Review of Existing MRV Framework – Crops

The existing MRV Framework is structured in a similar manner as in the Figure 1 presented above where the major stakeholders are within or report to the Federal Ministry of Agriculture which coordinates other agencies and supported projects within the sector.

This current arrangement has been reported to be weak in data collection, archiving, monitoring, and reporting.

The interaction with the stakeholders during consultative meetings revealed the absence of established functional national MRV framework for the sector. Although informal interaction and data collections exists between the DCC and some of the stakeholders (data providers); the informal nature does not give room for growth and development of a robust functional national MRV system.

There is currently no specific finalized legal instrument in form of MoU or data sharing agreements between stakeholders in the Crop and Livestock Sector. There is therefore no definite legal obligation by any of the key emission sectors or MDAs to collect, process, and share GHG data with the DCC. The coherence within some of these institutions is lacking in terms of harmonization of already existing datasets which are held by individual officers instead of institutions. This inters sustainability of the data management processes.

The DCC in FMEnv can initiate the process of formalizing the relationship between the department and sector partners. CC Department can draft MoUs (using a template) with organizations that collect relevant data; and share with the sector hubs like FMARD. The data harmonization process can strengthen all institutions via forward and backward inter agency linkage and collaborations, knowledge sharing and capacity building.

2.4.1   GHGE Reporting and Mitigation Actions

GHGE in the Crop Sector

Crop sub-sector deals with anthropogenic GHG emissions and removals, defined as all emissions and removals occurring on 'managed land' and that are associated with the use of land, including agriculture and husbandry. Managed land is land where human interventions and practices have been applied to perform production, ecological or social functions (IPCC, 2006).

The estimates of GHG emissions and removals deriving from AFOLU include:
- CO_2 from cultivated organic soils.
- non-CO_2 emissions from fire on all managed land.
- CH_4 emissions from rice cultivation.
- N_2O emissions from all managed soils.
- CO_2 emissions associated with liming and urea application to managed soils.

Biomass Burning: Nigeria is one of the 13 low-latitude countries that have significant biomass burning activities. Biomass burning occurs in moist savanna, dry forests, and forest plantations. Fires in the forest zone are associated with slash and burn agriculture; the areal extent of burning is estimated to be 80% of the natural savanna while over 90% of litter from forest plantations are burned.

Managed soils: This category includes all agricultural soils. This category includes direct and indirect nitrous oxide emissions that are usually estimated from data on nitrogen supplied to soils, including nitrogen fertilizer usage or sales, crops residue management, organic amendments, cultivation of organic soils (i.e. drainage of peatlands in agricultural land) and land-use conversions that enhance mineralization of nitrogen in soil organic matter.

Liming: is used to reduce soil acidity and improve plant growth in managed systems, particularly agricultural lands, and managed forests. Adding carbonates to soils in the form of lime (e.g., calcic limestone ($CaCO_3$), or dolomite ($CaMg (CO_3)_2$) leads to CO_2 emissions as the carbonate limes dissolve and release bicarbonate ($2HCO_3$), which evolves into CO_2 and water (H_2O). These are methods for soil fertilization. Adding urea to soils during fertilization leads to a loss of the CO2 that was fixed in the industrial production process.

Urea ($CO(NH_2)_2$): is converted into ammonium (NH_{4+}), a hydroxyl ion (OH-), and bicarbonate (HCO_3-), in the presence of water and urease enzymes. Similar to the soil reaction following addition of lime, the bicarbonate that is formed evolves into CO_2 and water. This source category is included because the CO_2 removal from the atmosphere during urea manufacturing is estimated in the Industrial Processes and Product Use Sector.

Rice cultivation: This category refers to the anaerobic decomposition of organic material in flooded rice fields that produces methane, which escapes to the atmosphere primarily through air-bubbles and by being transported through the rice plants. The amount emitted is a function of the rice species, the number and duration of harvests, the soil type and temperature, the irrigation method, and fertilizer use.

Reporting in the Crop Sub-Sector

The Tier 1 approach has been used to estimate emission in the previous communications such as the BUR1 & 2, First, Second and Third National Communication. Lack of country-specific emission factors and lack of relevant activity data needed for application of tier 2 methodology as required in the IPCC guidelines limited the inventory compilers to the use of Tier 1 method. All the source categories occurring in the country from the crop sector were not covered in the above-mentioned reports due to paucity of

data. In some cases, estimates relied almost entirely on international databases, where the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) data were used.

There were no alternative sources to verify activity data used for GHGE estimates in these reports for crop sector subcategories. Therefore, the validity, authenticity and otherwise the correctness of the only source of the FAOSTAT dataset used could not be determined.

Mitigations Actions in the Crop Sub-Sector

The country mitigation actions provide information on options and actions taken by the country aimed at reducing current and future GHGE stemming from socio-economic activities, without compromising opportunities for sustainable development. A robust mitigation strategy demands a good understanding of the historical and base period GHG emissions in each of the sectors of the economy, as the starting point for gathering information about actions already taken and planned in the country.

The mitigation actions enable the country to track activities and their impact to achieve NDC commitment. The following are some of the mitigation policy documents reviewed and key commitments extracted. National Development Plans and Policies on CC.

Mitigation is guided by the National Climate Change Policy Response and Strategy (NCCPRS) which was adopted in 2012 to better frame and implement the GHG reduction options (TNC, 2020). The goal of the NCCPRS is to foster low-carbon high economic growth and build a climate resilient society, through the following main objectives:

- Implement mitigation to promote low carbon sustainable high economic growth.
- Enhance national capacity to adapt to climate change.
- Increase public awareness.
- Involve the private sector to address CC challenges.
- Strengthen national institutions and mechanisms for a suitable and functional CC governance.
- Framework.

Within the framework of this strategy, several policies have been developed and the main ones are given below.

National Action Plan to Reduce Short-Lived Climate Pollutants

Agriculture and Livestock Sector Mitigation Measures Four (4) Short-Lived Climate Pollutants (SLCP) abatement measures have been selected for implementation under the Agriculture and Livestock sector, and these include:

- Increased adoption of intermittent aeration of continuously flooded rice paddy fields (AWD).
- Reduction of Open field Burning of crop residues. This deals with the replacement of open-burning of agriculture waste with clean-air alternatives
- Promotion of Anaerobic Digestion (AD) of manure from livestock and poultry
- Reduction of methane emissions from Enteric Fermentation. This will entail the implementation of actions, such as improved feed to reduce methane emissions from enteric fermentation.

Nigeria's Intended Nationally Determined Contribution (INDC)

- Climate smart agriculture and reforestation: The objectives of climate-smart agriculture are to sustainably increase agricultural productivity and incomes; adapt and build resilience to climate change; and reduce or remove greenhouse gases, where possible – reflect the greater goals of the NDC mitigation objective. Mitigation may be considered a secondary goal of climate-smart agriculture, after adaptation strategies. However, mitigation remains an important goal, particularly as climate change acts as a negative feedback loop that exacerbates climate risks for those who are already most vulnerable (IPCC, 2007). For example, poorer crop farmers without irrigation infrastructure are more likely to suffer the impacts of low yield due to more frequent drought events.

Nigeria Long-Term Vision to 2050: Policy Review Analysis (2050 Pathways Platform)

Agricultural Promotion Policy (2016-2020): Introduction of Climate Smart Agriculture to also help in GHG emission reduction through improved land and nutrient management, improved livestock management and through agroforestry practices.

Challenges and Gaps

A recent IPCC Special Report on Global Warming (GW) of 1.5ºC confirms there is an important role for land use sectors stabilizing global temperatures (IPCC Special Report, 2018). Four broad options could be implemented in the agriculture sector to mitigate GHG emissions. The first two encompass supply-side measures and the latter two cover demand-side measures:

- Introduce farm practices that reduce agricultural non-carbon dioxide (non-CO_2) emissions, including methane (CH_4) and nitrous oxide (N_2O).
- Introduce practices to remove CO_2 from the atmosphere and accumulate as carbon in vegetation and soils, or that reduce emissions from the degradation and removal of these carbon stocks.
- Introduce measures that encourage consumers to shift to healthier, lower emission diets.
- Introduce measures that reduce product losses along food supply chains and food waste by consumers.

To mitigate GHGE from agriculture as cost effectively as possible, several barriers need to be addressed to enable widespread implementation of effective mitigation policies in the agricultural sector, and thereby unlock its large mitigation potential. These barriers include political constraints related to sensitivities about food security, distributional impacts on producers, and emissions leakages, as well as challenges related to institutional capacity and the MRV of emission reductions. The existing policy assembly of voluntary measures based on the funding and financing of abatement measures, and modest target setting are, in some ways, a testament to these challenges. Critical roadmap must be created to adequately track, monitor, and report progress made while providing the needed support to various components of the sector.

2.4.2 Existing Methodological Tools for MRV

Estimates of GHGE have been compiled using the IPCC 2006 Guidelines for National GHG Inventories (IPCC 2007) and the IPCC Good Practice guidance and Uncertainty Management (IPCC 2000) for NC1,2,3, and the BUR1. The reports selected tier one level for all analysis within the crop sector based on availability of relevant activity data. The reports used default emission factors and over 95% of the data harvested from FAOSTAT. The IPCC 2006 software template was used for the inventory calculations.

Based on the TNC inventory report, activities in the AFOLU sector are among the highest contributors to emissions of greenhouse gases in Nigeria, which makes it a key category.

General Principle of GHG Calculation in Crop Sector

The fundamental formula for estimating the quantity of GHG emissions can always be expressed as the multiplication of the activity data (AD) by the emission factor (EF), as follows:
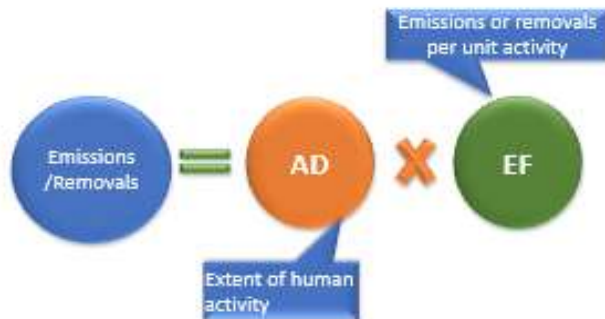
Where:

- **EF = Emission Factor**

Emission factors are coefficients that quantify the emissions or removals of a gas per unit activity data. Emission factors are based on samples of measurements, averaged at various levels of detail depending upon the Tier methodology used, to develop a representative rate of emission for a given activity level under a given set of operating conditions.

- **AD = Activity Data**

Activity data describe the magnitude of a human activity resulting in emissions or removals of greenhouse gases, taking place during a given period and over a specified area. Data on livestock type and numbers, the area extent of managed agriculture, pastures, and associated changes or the amount of synthetic or organic fertilizer applied, are all examples of AD relevant to the computation of emissions for the crop and livestock sector. In addition to the AD and the EF, this basic equation can also incorporate other estimation parameters to reflect actual emissions or removals.

The quantification of GHG emissions in an inventory is a multi-step process for each category and a detailed step by step approach is provided in the IPCC guideline.

Estimation Process
The IPCC 2006 Guidelines provide comprehensive documentation on how to proceed for estimating the emission and removals, and below are the initial steps of the process.

- **The identification of Key Categories**
A key category is one that is prioritized within the national inventory system, because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level,

the trend, or the uncertainty in emissions and removals. Whenever the term "key category" is used, it includes both source and sinks categories. Key categories should be the priority for country when allocating inventory resources for data collection, compilation, quality assurance/ quality control and reporting.

- **Selection of methods and measurement**

The IPCC-2006 Guidelines report three tiered approaches related to methods used in the AFOLU Sector:
- o Tier 1 is the basic method.
- o Tier 2 is the intermediate method; and
- o Tier 3 is the most demanding, in terms of complexity and data requirements.

Generally, moving to higher tiers improves the inventory's accuracy and reduces uncertainty, but the complexity and resources required for conducting inventories also increase; Nigeria has adopted the tier 1 in most of the reports. Tiers 2 and 3 are sometimes referred to as higher tier methods and are generally considered to be more accurate. If necessary, a combination of tiers can be used, e.g. Tier 2 can be used for biomass and Tier 1 for soil carbon. The methods will be generally applicable to Tier 2 inventories, but the default data presented for Tier 1 will be partly or wholly replaced with national data as part of the Tier 2 estimation.

- **The selection and collection of activity data**

Data collection is an integral part of developing and updating a GHG inventory. Formalized data collection activities should be established, adapted to the countries' national circumstances, and reviewed periodically as a part of implementing IPCC good practice guidelines.
Data sources:
- o National and International Literature: The IPCC Guidelines recommend collecting data from bodies such as National Statistical Agencies, and national regulatory authorities responsible for permitting of industrial and other processes subject to pollution emission legislation. Other sources of specialized literature that provide activity data, include UN statistics (including the FAOSTAT database: http://faostat3.fao.org/faostat-gateway/go/to/home/E), the US Geological Survey (USGS) and others.
- o Surveys & Census information: Survey and census information provide the best agricultural, production statistics (e.g 1992 Livestock census) that can be used for greenhouse gas inventories and are generally compiled by relevant MDAs.

- **The selection of emission factors or carbon stock change factors**

The IPCC Guidelines define the emission factor as the average emission rate of a given GHG for a given source, relative to units of activity. The 2006 IPCC Guidelines, adopting the Tier 1 methods for all categories, enable the use of readily available national or international statistics, in combination with provided default emission factors and additional parameters provided, thus making it feasible to prepare estimates. The recent communications submitted relied on the default emission factors for the GHGE inventory preparation. Developing country specific emission factors will help Nigeria submit GHGE estimates that are more accurate and reliable.

Tools for GHGE Reporting in the Crop Sector

A wide array of tools has been developed by various organization to guide the preparation of GHGE inventories. Some of the identified tools will be summarized below.

- IPCC Guideline: The IPCC guideline provides guidance on methods to estimate emissions from the crop sector from various land management practices like fertilizer application, crop residue management, bush burning and other subcategories.
- IPCC Inventory Software: The IPCC Inventory Software implements the simplest Tier 1 methods for all sectors and Tier 2 methods for agriculture categories under AFOLU Sector in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
- MRV Toolbox: The MRV Toolbox provides links and resources for tools specifically for measuring, verifying and reporting (MRV) GHGs with a focus on rice. Tools include guidance and calculators for GHG inventories, mitigation projects, product-specific assessments, and evaluation of GHG field experiments.
- Source-selective and Emission-adjusted greenhouse gas Calculator for cropland (SECTOR) tool: SECTOR is a Greenhouse Gas Calculator for cropland based on the IPCC Tier 2 approach for rice and other crops. SECTOR was developed in response to increasing interest in mitigation research on cropland, particularly rice production. The tool is currently available as an EXCEL file and requires inputs on crop area, yield, and management.
- Emissions Overview Tool (FAO): The Emissions Overview tool report gives emissions and trends in the AFOLU sector, subdivided by source categories, for one or more user-specified countries. It also contextualizes emissions within the regions, continents and globally. It is based on the FAOSTAT emissions database. It aims to support countries in the preparation of NAMAs and NDCs.
- Quality Assurance/ Quality Control (QA/QC) and Verification: The tool allows users to compare national GHG inventory data for the AFOLU sector reported to the UNFCCC with data from the FAOSTAT Emissions database. The tool helps countries improve their capacity to report the AFOLU sector in their National GHG Inventory.
- Mitigation Options Tool for agriculture (CCAFS-MOT): The CCAFS-MOT tool integrates published empirical models to emissions for different land use systems according to management types. Allows the user to rank mitigation potential of over 34 crop and livestock management practices, including geographic distinctions.
- Clean Development Mechanism (CDM) methodologies for agriculture: CDM provides methodologies for rice cultivation, manure management, fertilizer management, and mulching. These methodologies are intended for monitoring of CDM projects.
- MRV Tool on how to set up national MRV systems: (GIZ) MRV Tool provides developers and implementers of NAMAs with brief step-by-step instructions on how to develop an MRV system. The tool navigates users to the relevant information, knowledge, instruments, and publications available.
- The GHG Mitigation in Rice Information Kiosk is a communication tool for information on greenhouse gas emissions and mitigation options in rice production systems and is part of the Climate and Clean Air Coalition's (CCAC) Agriculture Initiative. It covers best practices for minimizing emissions of climate pollutants from agriculture while increasing productivity and improving food security and livelihoods.
- UNFCCC Small-Scale Methodology: Methane emission reduction by adjusted water management practice in rice cultivation: This methodology comprises technology/measures that reduce anaerobic decomposition of organic matter in rice cropping soils, which reduce the generation of methane. The methodology includes projects such as: farms that change the water regime during the cultivation period from continuously to intermittent flooded

conditions and/or a shortened period of flooded conditions; alternate wetting and drying method along with aerobic rice cultivation methods (see IRRI Water Management); farms that change rice cultivation practice from transplanted to direct seeded rice.

- UNFCCC Small-Scale Methodology: Reduction of N2O emissions from use of Nitrogen Use Efficient (NUE) seeds that require less fertilizer application: This methodology enables project proponents to calculate reductions in greenhouse gas (GHG) emissions from the use of the NUE seed. By reducing the amount of fertilizer required to sustain yields of regular seed, N_2O emissions are reduced.

Table 2: Existing Data and Data Sources

Category	Sub-category	Data Type	Data Source	Principal Data Provider
Aggregated and non-CO₂ emission on land	Biomass burning	Actual mass of savanna and crop residues burnt	FAOSTAT	FAO
	Direct N2O emission from managed soil	Synthetic fertilizer consumption	FAOSTAT	FAO
	Indirect N2O emission from managed soil	Crop Land Area	FAOSTAT	FAO
	Rice cultivation	Area of land under rice	FAOSTAT	FAO

Source: Third National Communication 2020

2.4.2.1   Description, Challenges and Gaps

The lack of country specific EF has limited the scope of activity data subcategories and tier one level also being used. Default data set from Food and Agriculture Organization (FAO) database was the major source of data used in previous reports (BUR1, NC 1,2, &3) giving room for bias, deviations from the actual national circumstance and lower accuracy of inventory. IA for activity data collection, archiving, monitoring, and reporting are weak in the sector.

Stakeholders reported lack of standardized methods and tools for data collection, calculations, and reporting structure, reporting cycle and lead institution for coordination and monitoring.

2.5   Review of Existing MRV Framework – Livestock

The livestock sector component of the MRV is structured in a similar manner as in the

Figure 2 presented below where the major stakeholders are within or report to the Federal Ministry of Agriculture which coordinates other agencies and supported projects within the sector. 14The current IA has been reported to be weak in data collection, archiving, monitoring, and reporting.

The Tier 1 approach has been used to estimate emission in the previous communications such as the BUR1 & 2, First, Second and TNC. Lack of country-specific emission factors limited the inventory compilers to the use of Tier 1 method. All the source categories occurring in the country from the livestock sector were not covered in the above-mentioned reports due to paucity of data. In some cases, estimates relied almost entirely on international databases, where the FAOSTAT data were used.

There were no alternative sources to verify activity data used for GHG emission estimates in these reports for crop sector subcategories. Therefore, the validity, authenticity and otherwise the correctness of the only source of the FAOSTAT dataset used could not be determined.

Figure 2: Institutional Framework Livestock Sector
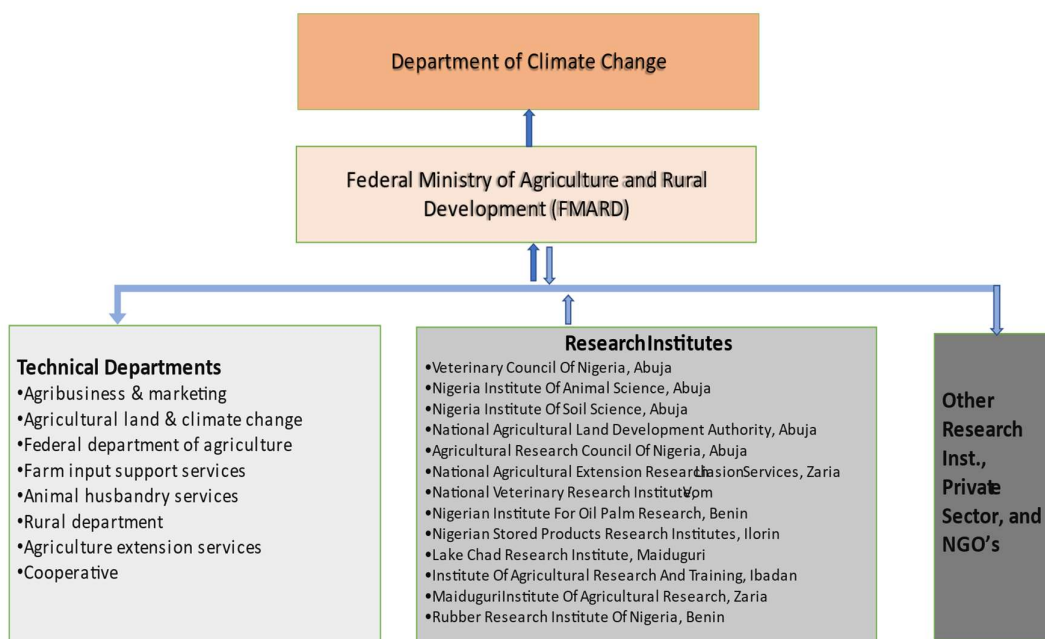
2.5.1   GHGE Reporting and Mitigation Actions

The country mitigation actions provide information on options and actions taken by the country and aimed at reducing current and future GHG emissions stemming from socio-economic activities, without compromising opportunities for sustainable development. A good knowledge and understanding of the history and the base period in GHGE inventory is very key in designing and delivering a robust mitigation strategy and implementation report.

The mitigation actions enable the country to track activities and their impact to achieve NDC commitment. The following are some of the mitigation policy documents reviewed and key commitments extracted. National Development Plans and Policies on Climate Change

Mitigation is guided by the NCCPRS which was adopted in 2012 to better frame and implement the GHG reduction options (TNC, 2020). The goal of the NCCPRS is to foster low-carbon high economic growth and build a climate resilient society, through the following main objectives:

- Implement mitigation to promote low carbon sustainable high economic growth.
- Enhance national capacity to adapt to climate change.
- Increase public awareness.
- Involve the private sector to address CC challenges.
- Strengthen national institutions and mechanisms for a suitable and functional CC governance.
- Framework.

Within the framework of this strategy, several policies have been developed and the main ones are given below.

National Action Plan to Reduce Short-Lived Climate Pollutants

Agriculture and Livestock Sector Mitigation Measures Four (4) SLCP abatement measures have been selected for implementation under the Agriculture and Livestock sector, and these include:

- Increased adoption of intermittent aeration of continuously flooded rice paddy fields (AWD).
- Reduction of Open field Burning of crop residues. This deals with the replacement of open-burning of agriculture waste with clean-air alternatives
- Promotion of Anaerobic Digestion (AD) of manure from livestock and poultry
- Reduction of methane emissions from Enteric Fermentation. This will entail the implementation of actions, such as improved feed to reduce methane emissions from enteric fermentation.

Nigeria's Intended Nationally Determined Contribution (INDC)

- Climate smart agriculture and reforestation: The objectives of climate-smart agriculture are to sustainably increase agricultural productivity and incomes; adapt and build resilience to climate change; and reduce or remove greenhouse gases, where possible – reflect the greater goals of the NDC mitigation objective. Mitigation may be considered a secondary goal of climate-smart agriculture, after adaptation strategies. However, mitigation remains an important goal, particularly as climate change acts as a negative feedback loop that exacerbates climate risks for those who are already most vulnerable (IPCC 2007). For example, poorer crop farmers without irrigation infrastructure are more likely to suffer the impacts of low yield due to more frequent drought events.

Nigeria Long-Term Vision to 2050: Policy Review Analysis (2050 Pathways Platform)

Agricultural Promotion Policy (2016-2020): Introduction of Climate Smart Agriculture to also help in GHG emission reduction through improved land and nutrient management, improved livestock management and through agroforestry practices.

2.5.1.1   Description, Challenges and Gaps

A recent IPCC Special Report on GW of 1.5ºC confirms there is an important role for land use sectors stabilizing global temperatures (IPCC Special Report, 2018). Four broad options could be implemented in the agriculture sector to mitigate GHG emissions. The first two encompass supply-side measures and the latter two cover demand-side measures:

- Introduce farm practices that reduce agricultural non-CO_2 emissions, including CH_4 and N_2O.
- Introduce practices to remove CO_2 from the atmosphere and accumulate as carbon in vegetation and soils, or that reduce emissions from the degradation and removal of these carbon stocks.
- Introduce measures that encourage consumers to shift to healthier, lower emission diets.
- Introduce measures that reduce product losses along food supply chains and food waste by consumers.

To mitigate GHGE from agriculture as cost effectively as possible, several barriers need to be addressed to enable widespread implementation of effective mitigation policies in the agricultural sector, and thereby unlock its large mitigation potential. These barriers include political constraints related to sensitivities about food security, distributional impacts on producers, and emissions leakages, as well as challenges related to institutional capacity and the MRV of emission reductions. The existing policy assembly of voluntary measures based on the funding and financing of abatement measures, and modest

target setting are, in some ways, a testament to these challenges. Critical roadmap must be created to adequately track, monitor, and report progress made while providing the needed support to various components of the sector.

2.5.2 Existing Methodological Tools for MRV

Estimates of GHGE have been compiled using the IPCC 2006 Guidelines for National GHG Inventories (IPCC 2007) and the IPCC Good Practice guidance and Uncertainty Management (IPCC 2000) for NC1,2,3, and the BUR1. The reports selected tier one level for all analysis within the crop sector based on availability of relevant activity data and national emission factors. The reports had default emission factors used and most data from FAOSTAT. The IPCC 2006 software template was used for the inventory calculations.

Based on the TNC inventory report, activities in the AFOLU sector are among the highest contributors to emissions of greenhouse gases in Nigeria, which makes it a key category.

The methods for estimating CH_4 and N_2O emissions from livestock-related source categories all require information such as the definitions of livestock sub-categories, annual populations, and feed intake estimates (IPPC Guideline, 2019). To ensure that these definitions and data are used consistently across the source categories a single 'characterization' should be developed for each species. A coordinated livestock characterization ensures consistency across the following source categories:

- CH_4 emissions from enteric fermentation in domestic livestock.
- CH_4 emissions from manure management.
- N_2O emissions from manure management.
- Direct N_2O emissions from agricultural soils.
- INDIRECT N_2O EMISSIONS FROM NITROGEN USED IN AGRICULTURE.

Good practice is to identify the appropriate method for estimating emissions for each source category, and then base the characterization on the most detailed requirements identified for each livestock species. The livestock characterization ultimately developed will likely undergo multiple iterations as the needs of each source category are assessed during the emissions estimation process.

AD refers to the intensity, level or quantity of activity that led to emissions and/or removals of GHGs while EF represents the rate at which a particular GHG is emitted or removed as a result of use of, change of and level of intensity/frequency of use/number of activity will generate/remove GHGs under certain defined conditions. Therefore, the product of AD and EF gives the total GHGE for a particular activity.

This is represented in an equation as follows:

*E = AD * EF*
Where:

E = *Emission*
AD = *Activity Data*
EF = *Emission factor*

Extrapolation and interpolation techniques were used in line with IPCC good practice guidance (GPG) to generate missing data and replace outliers in the time series. In cases where there were no data, expert judgment was applied, and the assumption was documented.

Tools for GHGE Reporting in the Livestock Sector

- IPCC Guideline: The IPCC guideline provides guidance on methods to estimate emissions of methane from Enteric Fermentation in livestock, and methane and nitrous oxide emissions from Manure Management.
- IPCC Inventory Software: The IPCC Inventory Software implements the simplest Tier 1 methods for all sectors and Tier 2 methods for agriculture categories under AFOLU Sector in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
- The Global Livestock Environmental Assessment Model (GLEAM) is a spatially explicit life cycle assessment model for the livestock sector. Using input data on herd, feed, and manure management, it calculates GHG emissions for livestock supply chains (6 species) using an IPCC Tier 2 methodology.
- Template spreadsheet for assessing the quality of Tier 2 livestock activity data: This spreadsheet complements the Livestock Activity Data Guidance (L-ADG) published by the GRA and CCAFS. L-ADG provides suggestions on how to identify, collect and assess the activity data used to compile Tier 2 livestock GHG inventories for cattle and sheep.
- Smallholder Dairy Methodology: Draft Methodology for Quantification of GHG Emission Reductions from Improved Management in Smallholder Dairy Production Systems using a Standardized Baseline: The methodology, presents requirements for a standardized baseline, guidance for quantification of GHG emission reductions in smallholder dairy production, quantification of project emission intensity, and quantification of net emission reductions. It also outlines monitoring methodology for data, monitored and not monitored parameters. Total emissions are calculated by multiplying the annual FPCM yield by the appropriate emission factors.
- Grazing Land and Livestock Management Methodology: American Carbon Registry (ACR), approved GHG offset methodology for Grazing Land and Livestock Management (GLLM). This methodology is applicable for global dairy and beef production, with mainly focusing on five primary GHG sources, sinks and reservoirs (SSRs): fossil fuel emissions, enteric methane, manure methane, nitrous oxide from use of fertilizer, and biotic sequestration in biomass and soils.
- Clean Development Mechanism (CDM) methodology for manure management systems: This methodology is applicable to manure management on livestock farms where the existing anaerobic manure treatment system is replaced by a manure management system that results in fewer GHG emissions compared to the existing system. It is intended for monitoring of CDM projects.

Table 3: Existing Data and Data Sources

Category	Sub-category	Data Type	Data Source	Principal Data Provider
Livestock	Enteric Fermentation	Animal population (Cattle, goats, sheep, asses and mules, camels, swine, horses, and poultry)	FAOSTAT	FAO
	Manure Management	Type of manure management systems	FAOSTAT	FAO
	Indirect emissions from manure management	Animal population (Cattle, goats, sheep, asses and mules, camels, swine, horses, and poultry)	FAOSTAT	FAO

Source: Third National Communication 2020

2.5.2.1 Description, Tools, Challenges and Gaps

The TNC methodology covered emissions from enteric fermentation and manure management for the livestock sector. Other activity data needed for robust representation were reported as not available at the time of the report. The lack of country specific emission factors has limited the scope of activity data subcategories and tier one level also being used. Default data set from FAO database was the major source of data giving room for bias, deviations from the actual national circumstance and lower accuracy of inventory. IA for activity data collection, archiving, monitoring, and reporting are weak in the sector.

Stakeholders reported lack of standardized methods and tools for data collection, calculations, and reporting structure.

Table 4: Summary of Needs and Gaps in the Crop and Livestock Sector

Components	Key activities, Analysis and Comments	Needs (Activities for Implementation)
Institutional Arrangement	Review of current MRV sectoral circumstance • To meet the criteria of the enhanced transparency framework, the sector requires MRV of emissions, mitigation actions and support. • The DCC has built institutional capacity to integrate, coordinate, and monitor sectoral MRV implementation activities to achieve NDC goals. • Sectoral Institutional Framework • No clear roles and responsibilities of relevant MDAs in activity data collection, archiving and processing for developing a robust sustainable MRV system in the sector. • No clear definition of institutional arrangements, data collection methodology and reporting structure, data transfer and sharing. • There is currently no specific finalized legal instrument in form of MoU or data sharing agreements between stakeholders in the Crop and Livestock Sector. There is therefore no definite legal obligation by any of the key emission sectors or MDAs to collect, process, and share GHG data • Small teams with limited resources and multiple responsibilities. • difficulty in retaining expertise (transfers within the civil service system);	• DCC and key stakeholders needs to formally agree on what is to be included in the sectoral MRV systems derived from the requirements of the enhanced transparency framework and build the capacity (knowledge transfer) of all relevant staff within the MDAs to ensure adequate awareness and capacity for implementation. • The DCC will work towards developing a functional interagency linkage needed for a robust national MRV system however this cooperation needs to be formalized and institutionalized. The roles of the respective institutions and staff members regarding GHGI and MRV must be clearly defined. • The National MRV Framework (to be developed) to be used as the basis for the crop and livestock sectors' institutional arrangements for the sectoral MRV, but with possible modification. • Appoint specific staff within the DCC and other identified sectoral lead institution, with responsibilities for the coordination and oversight of the sectoral MRV work and build capacity through training as appropriate. Build on ICAT work and training to formalize the roles and responsibilities of lead institutions. • A system must be designed for identifying and tracking climate finance for NDC implementation for the crop and Livestock sector.
Tools, Data and Capacity Building	• GHG data was captured from sectoral data with default IPCC emission factors but there is need to improve quality and completeness of the data for the sector, and to ensure continuity of the process.	• Review, design and develop a greenhouse gas inventory system covering data capture and sharing, QA/QC, archiving and the coordination of the activities for the crop and livestock sectors that

Components	Key activities, Analysis and Comments	Needs (Activities for Implementation)
	- Consider how existing data flows, responsibilities and processes could be adjusted and extended to build a system which can collect the required data for tracking NDC and SDG implementation, for the crop and livestock sectors. This step has not been done formally and documented but some considerations have been made at different for a during stakeholder engagement. - The coherence within some of these institutions is lacking in terms of harmonization of already existing datasets which are held by individual officers instead of institutions. This hinders sustainability of the data management processes. - Incomplete or non-existent activity data for some categories, and lack of experimental data for developing country-specific emission and stock change factors. - Insufficient documentation and absence of an archiving system from previous inventories. - No quality assurance and quality control (QA/QC) plan within the relevant MDAs identified as key stakeholders; and no defined path/working document to improve future national GHG inventory in the Crop and Livestock sector. - Lack of support, capacity building and technology transfer to facilitate data collection, reporting, archiving and transfer.	- is to be integrated with the national MRV system for GHG inventory - Formalize existing data capture, sharing and reporting arrangements through data sharing memoranda of understanding (MOUs) between data sharing parties that specify type, format and frequency of data with clear responsibilities for the sector stakeholders. - Set up QA/QC systems for the crop sector - In the MRV system for the crop sector, technology transfer and some capacity building to be captured for the actions prioritized in the updated NDC - Support must be provided at various levels in setting up an efficient and effective robust data collection, archiving and reporting system that is sustainable. These systems must be transparent, accessible, and reliable. - Collaborative research must be commission between the MDAs and research institutes for the development of accepted national emission factors to increase accuracy and reliability of data generated. - Identify how existing data systems can be extended to address MRV data gaps in the crop and livestock sector in order to include NDC indicators.

3.0   Land Use, Land Use Charge and Forestry (LULUCF) Sectoral MRV

3.1   Introduction

It is a generally accepted principle that it is nearly impossible to monitor or track the progress of any activity or human endeavor if those activities cannot be measured, whether we want to lose weight or track greenhouse gases emissions. Organically generated data from centres of those activities is critical for such measurement. The concept of MRV, is the process that accounts, tracks, verifies and reports GHG sources and sinks within a geographical jurisdiction. A robust MRV includes accounting for any capacity building, technological or financial support that impacts the GHG emissions within the assessment period.

Data generation, processing and archiving in Nigeria have been a problematic endeavor. From a universal perspective, Nigeria's data management ecosystem seems burdened with structural challenges, statistical gaps and reputational deficits. This is as a result of statistical data generation being on the Concurrent Legislative List [CLL] of Nigeria's Constitution and the perennial underinvestment in statistical data management in the last 5 decades. The CLL empowers Federal, State and Local Governments to generate statistical data which they do mostly in silos. This imposes gaps on statistical data management. The Nigeria Statistical Act [2007], created the National Bureau of Statistics [NBS] as "the main national [interventionist] agency responsible for the development and management of official statistics, the authoritative source and custodian of official statistics in the country with mandate to coordinate the national statistical system and also to collect, compile, analyze, interpret, publish and disseminate statistical information alone or in collaboration with other agencies."

In the prevailing disorganized statistical data ecosystem in Nigeria, environmental data which had been on the margins of statistical discourse gained currency in 2015 when the Paris CC Agreement was adopted. Nigeria as a signatory to the Paris Agreement has obligations to report her GHGE to the UNFCCC via the BURs, NCs and NDCs. Nigeria's previous efforts to deliver on these reporting obligations through the NDCs, BURs and NCs experienced low contribution of organically generated local datasets leading to adoption of default IPCC emission fact values. This is viewed as a manifestation of the structural challenges, statistical gaps and reputational deficits embedded in Nigeria's data management ecosystem.

The concept of MRV framework for was introduced in 2009 via the Copenhagen Accord, which states that supported NAMAs will be subjected to international MRV. The Cancun Agreements in 2010 reinforced MRV further by stating that "*Domestically supported mitigation actions will be measured, reported and verified domestically in accordance with general guidelines to be developed under the Convention*" (Decision 1/CP.16 The Cancun Agreements).

MRV is critical for evaluating whether Nigeria is on track to meet the targets in her NDCs as part of building blocks of the Paris CC Agreement.

This national MRV sectoral review report is the first post-inception meeting/project launch step in the development of a national MRV system for LULUCF as a component of the broader ICAT-Nigeria MRV Systems Project.

It is a generally acknowledged fact that it is almost impossible to track or monitor what we cannot measure -whether we want to lose weight or reduce GHGs emissions. The first step on the journey is to establish a "metrics mechanism" that will enable tracking and monitoring of progress made or otherwise.

A robust national MRV system will enable Nigeria to improve existing capacity not only for reporting of GHG abatement and mitigation actions to the United Nations UNFCCC or any other international agreement but also for preparing landscape level forest management plans with special criteria and indicators for climate change and contribution to the Sustainable Development Goals (SDGs) (FREL, 2018).

This review report for LULUCF sector MRV system provides an insight into the current national circumstance, guidelines, and requirements for the implementation of an operational MRV tailored for the LULUCF sector and its activities demonstrating multiple environmental benefits by showing direct impact on SDGs. This MRV review is anchored on the philosophy of:

- using existing data sources and processes where possible (to avoid disrupting functional reporting channels) and,
- creating more than just a national mechanism of GHG abatement and carbon accounting system with a view to using insights from data collected and reports produced to support decision makers in their day-to-day management. Manifold benefits are created while sustainable forest management becomes part of the overall planning process of national economic and infrastructural development.

This review gained insights from series of target-specific workshops and multi-level consultations involving relevant stakeholders from various MDAs to gauge and harness their expectations from an MRV system and to communicate proposed MRV architecture and the project's broader development objectives. These included rigorous consultations, review of various technical studies, collaborative cross sectoral engagements at various stages of the preparation process. Based on their inputs, a robust sectoral MRV architecture will be shaped and a national MRV framework established as a major output of this project.

Following robust stakeholder engagement, the project consultant moved into the next phase of analyzing technical feedback with a view to understanding the subsisting data collection, processing, and archiving ecosystem. Surmounting the challenge of data collection will be based on the information and data received from the key stakeholders which in turn will enable critical recommendations that will facilitate the development of a robust MRV system.

The insights gained from inputs made by the key stakeholders in the LULUCF sector triggered continued engagements with the stakeholders which yielded widened vista through which more knowledge that will shape the MRV architecture was captured. To enhance transparency, this sectoral review report will be subjected to some peer review and quality assurance process in accordance with best standard practice which we hope will help improve the report before the end of this project cycle.

With Nigeria moving towards innovative integrated GHG abatement approaches and NAMA implementation, this proposed MRV architecture will provide an ideal basis for GHG abatement calculation and mitigation activity impact reporting for the LULUCF sub-sector in a challenging data environment.

Figure 3: Proposed MRV Development Approach and Documentation Levels for the LULUCF
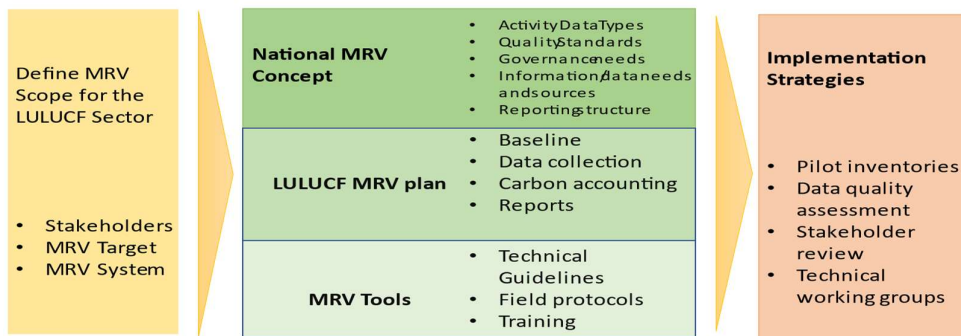
3.2   Existing Institutional Arrangement and Stakeholder Identification

3.2.1   Description, Challenges and Gaps

Parties to the UNFCCC are required to develop and submit national inventories of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol. The concept of MRV framework for NAMAs was introduced in 2009 as part of the Copenhagen Accord, which emphasized that supported NAMAs will be subjected to international MRV. The Cancun Agreements in 2010 reinforced the necessity for MRV with Decision 1/ CP.16 The Cancun Agreements stating that "*Domestically supported mitigation actions will be measured, reported and verified domestically in accordance with general guidelines to be developed under the Convention*".

For Non-Annex I (NAI) Parties, the periodicity of inventory reporting is dependent on the requirements for submission of NCs and BURs or BTR (IPCC, 2007).

The operationalization of the PA necessitated and established a universal system of transparency under the ETF for MRV, with built-in flexibility taking into certain account countries' different capacities. The emergence of the ETF -especially in the context of an ongoing, two-year cycle of GHGI preparation and reporting -enthroned the necessity to institutionalize the related processes within a National System for MRV, compliant with the reporting requirements for NAI Parties under the UNFCCC.
The government of Nigeria's establishment of the DCC in the FMEnv is demonstrable evidence of the *commitment to pursue* vigorous implementation of the adaptation and mitigation measures required to reduce Nigeria's extreme exposure and high vulnerability to the disruptive and destructive impacts of climate change.

The DCC is the lead Agency responsible for implementing and reporting climate action. The DCC comprises four divisions comprising GHG and Flexible Mechanism division, Vulnerability and Adaptation division, Mitigation division, as well as Education, Training, Public Awareness, and other information division coordinating activities within various components (DCC, 2021) . The DCC also convenes and chairs the ICCC. The **Figure *4*** blow depicts the current IA for the National MRV framework.

Figure 4: Current Institutional Arrangement
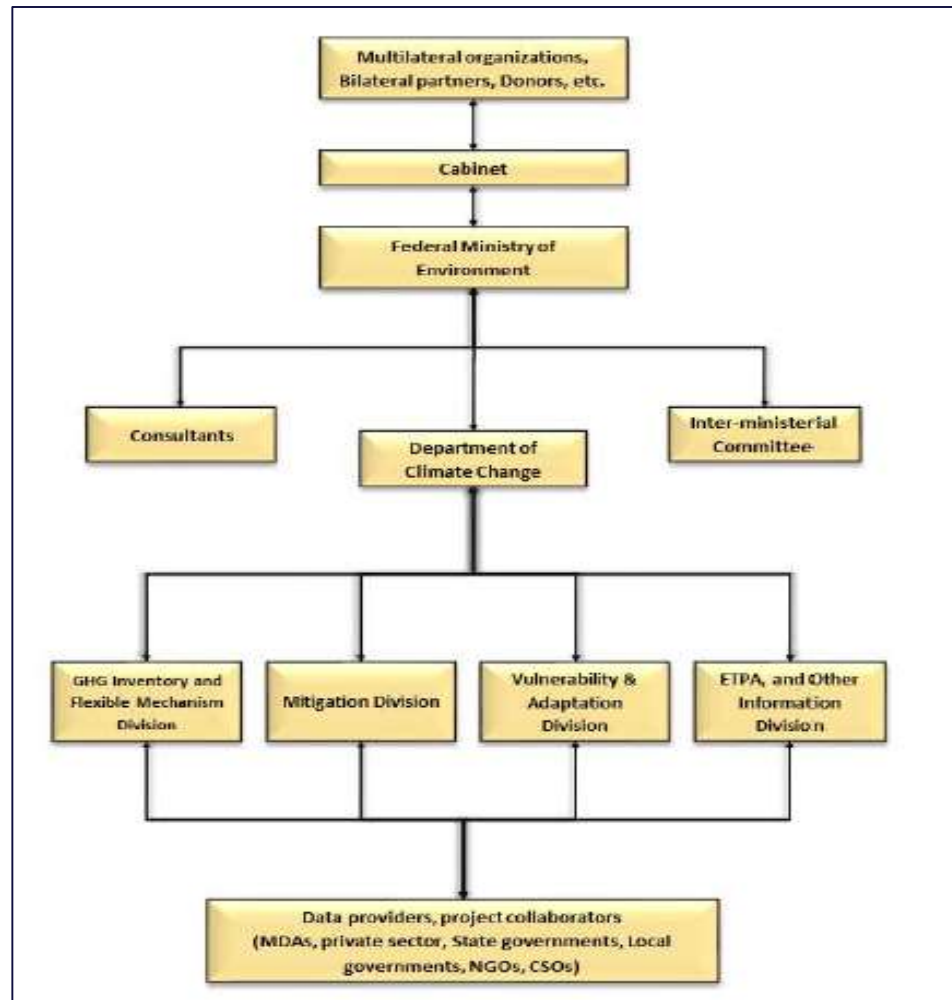
Source: Nigeria's Third National Communication 2020

In doing our stakeholder analysis, we mapped and identified horizontal -Federal/National MDAs], vertical -Sub-National and Local Government Areas (LGAs) MDAs], and diagonal-Non-State organizations - Independent research institutes, NGOs, Private sectors, CSOs and development partners as the stakeholders responsible for generating, collecting and collating data required for the delivery of the Sectoral LULUCF MRV System in particular and meeting Nigeria's National reporting obligations to the UNFCCC in the post-Paris Agreement era in general. These are illustrated in the diagram below:

Figure 5: Full-spectrum, Broad Based Stakeholder Mapping

1. VS
VERTICAL STAKE HOLDERS
(SUB NATIONAL & LGA'S MDA'S)

2. DS
DIAGONAL STAKE HOLDERS
(NON STATE ORGANIZATIONS
E.G PRIVATE COMPANIES,
NGO'S, CSO'S,
INDEPENDENT RESEARCH INSTITUTES)

3. HS
HORIZONTAL STAKE HOLDERS
(NDA'S NATIONALS)

1. VS: VERTICAL STAKE HOLDERS
SUB NATIONAL & LOCAL
GOVERNMENT AREAS,
MINISTERIES DEPARTMENTS &
AGENCIES

2. DS: DIAGONAL STAKE HOLDERS
NON STATE ORGANIZATIONS
E.G PRIVATE COMPANIES,
NGO'S, CSO'S,
INDEPENDENT RESEARCH INSTITUTES

3. HS: HORIZONTAL STAKE HOLDERS
NATIONAL MDA'S.
MINISTERIES DEPARTMENTS & AGENCIES

Source: (Ijeoma, 2019)

This review also benefited from further consideration of the stakeholders of the dysfunctional data collection ecosystem impact on most of the stakeholders as well as what the roles and interests of these different stakeholders might be in addressing the observed structural challenges, plugging the embedded statistical gaps, and abating likely reputational deficits.

Specifically, the following MDAs, NGOs and other key sector experts were engaged during the review process as listed in the table below.

Table 5: List of Stakeholders in LULUCF

S/N	Name of Organization	Address	Stakeholder Characterization
1	**African Development Bank Group**	1521 Cadastral Zone A0 Off Memorial Close Central Business District, Abuja	Diagonal
2	Agricultural Research Council of Nigeria	Agricultural Research House, Plot 223D, Cadastral Zone B6 Mabushi, Abuja	Horizontal
3	Nigerian Environmental study Action Team (NEST)	1 Oluokun Street, Off Awolowo Avenue Bodija Ibadan, Oyo State	Diagonal
4	International Institute of Tropical Agriculture (IITA)	Oyo Road, Ibadan, Oyo State	Diagonal
5	Institute of Agricultural Research & Training (IAR&T)	Obafemi Awolowo University Moor Plantation Ibadan, Oyo State	Horizontal
6	National Horticultural Research Institute (NIHORT)	P.M.B. 5432, Jericho Reservation Area, Idi-Ishin, Ibadan	Horizontal
7	Forestry Research Institute of Nigeria (FRIN)	Idi-Ishin Jericho Road Ibadan.	Horizontal
8	National Agricultural Extension and Research Liaison Services (NAERLS)	Ahmadu Bello University Zaria, Kaduna	Horizontal
9	Cocoa Research Institute of Nigeria (CRIN)	Km 14 Ibadan-Ijebu Ode Rd, Idi-Ayunre, Oyo.	Horizontal
10	Institute of Agricultural Research (IAR)	Samaru, Ahmadu Bello University Zaria, Kaduna	Horizontal
11	National Root Crop Research Institute (NRCRI)	Km 8 Umuahia-Ikot Ekpene Rd, Abia State	Horizontal
12	Economic Community of West African States (ECOWAS) Department of Agriculture and Environment & climate change	Abogo Largema Street CBD, Airport Road Abuja	Diagonal
13	Food and Agricultural Organization (FAO)	Old CBN Building, No 4 Zaria Street Ladoke Akintola Boulevard Garki II, Abuja.	Diagonal
14	Federal Ministry of Agriculture and Rural Development (FMARD)	Area 11, Garki, Abuja	Horizontal
15	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	No 4 Julius Nyerere Crescent Asokoro, FCT, Abuja	Diagonal
16	European Union Delegation to Nigeria and ECOWAS	No 21 Crescent off Constitution Avenue CBD, Airport Rd, Abuja	Diagonal
17	International Fund for Agricultural Development (IFAD)	AFDB Building 1521 Cadastral Zone A0, Off Memorial Close CBD, Abuja	Diagonal
18	Nigerian Agricultural Insurance Cooperation (NAIC)	Plot 590, zone AO, Cadastral zone, Abuja, Federal Capital Territory, Nigeria.	Horizontal

S/N	Name of Organization	Address	Stakeholder Characterization
19	National Agricultural Land Development Authority (NALDA)	3A, Third Floor, Phase 1, Federal Secretariat Complex, Abuja	Horizontal
20	Nigeria Erosion and Watershed Management Project (NEWMAP)	56 Hon. Justice Mamman Nasir Crescent, Asokoro, Abuja.	Horizontal
21	Nigerian Institute for Oil-Palm Research (NIFOR)	KM 7, Benin Akure Road, Benin City, Edo State	Horizontal
22	National Cereal Research Institute (NCRI)	Badeggi, P. M. B 8, Bida, Niger State.	Horizontal
23	Nigerian Meteorological Agency (NIMET)	National Weather Forecasting and Climate Research Centre, Nnamdi Azikiwe International Airport, Abuja.	Horizontal
24	REDD+ Nigeria	Federal Ministry of Environment, Abuja	Horizontal
25	Rubber Research Institute of Nigeria (RRIN)	Off K 19 Sapele Road, Iyanomo Benin, Edo.	Horizontal
26	World Bank	102 Yakubu Gowon Crescent, Asokoro Abuja	Diagonal
27	United Nations Development Program	UN House, Plot 617/618 Diplomatic Drive, Central Business Area Abuja.	Diagonal
28	Nigerian Institute of Soil Science	8, Abdullahi Ibrahim St, Mabushi, Abuja	Horizontal
29	Oxfam Nigeria	11 Ganges St, Maitama 900271, Abuja	Diagonal

During series of the interactive stakeholder engagement, the following were recorded as the recurring critical issues that were highlighted by the stakeholders:

- lack of reliable good quality activity data
- lack of country specific EFs,
- weak IAs,
- lack of a fully operational Inventory Management System (IMS) to cater for the steps of compilation.
- Given the constraints in (i-iv), heavy reliance on international databases for AD estimations leading to adoption of default IPCC EFs while hoping for that the development of a robust IMS for sustainable compilation of future GHGs inventories.
- Lack of dedicated target-specific capacity building of national experts and critical stakeholders relevant to the set-up of robust MRV system.

The stakeholders were optimistic that the ICAT-Nigeria MRV System Project would be able to plug these data gaps as well as build capacity of national experts for the development of Nigeria's IMS via:

- Plugging of knowledge and capacity gaps in the mining of existing data, and generation of experimental data sets that can be used to derive national emission factors unique to LULUCF components. This can be plugged via robust capacity building and training interventions, equipment procurement, technology transfer and support to help sector experts understand the specific types of data needed during data collection, processing, reporting, and archiving.

- Facilitation of the implementation of a robust legal framework to be built into the sectoral MRV as part of a National MRV System to help define roles and responsibilities among the relevant MDAs and reporting structure.
- Development of sector-specific tools for tracking and recording GHGs emission data in the field.
- In the absence of robust legal framework for data governance, facilitation of a seamless inter-agency collaboration via strengthening of the Inter-Ministerial Committee on Climate Change (IMCCC) to ensure easy flow of information among the participating MDAs.

3.3 Review of Existing MRV Framework

Desk top research revealed the absence of a clearly defined framework for MRV of the LULUCF in Nigeria. This was confirmed via series of stakeholder engagements which validated the desk top research revealing no LULUCF sectoral MRV framework in Nigeria. However, the stakeholders are optimistic and excited at the prospect of the ICAT-Nigeria MRV System Project delivering a robust, clearly defined LULUCF sectoral MRV framework as a concrete key output.

3.3.1 GHG Emission Reporting and Mitigation Actions

GHG Emissions in the LULUCF Sub-Sector
Net emissions from the AFOLU sector totaled 366,730 Gg-CO_2-eq in 2016 (TNC, 2020) and covered the following IPCC categories.
- Forest Land
- Aggregate sources and non-CO_2 emissions sources on land
- Harvested Wood Products

Nigeria's forests, which currently extend over 13.96 million hectares, have been rapidly declining over the past decades. The current deforestation rate is estimated at 110,000 hectares per annum while the annual wood removal rate stands at 0.5% per annum (calculated averages from FAO historical data). These rates are expected to continue under the baseline scenario. Emissions from other sub-categories are expected to grow with sectoral GDP.

Mitigation is guided by the NCCPRS which was adopted in 2012 to better frame and implement the GHG reduction options. The goal of the NCCPRS is to foster high-growth, low-carbon economic growth and build a climate resilient economy, through the following main strategies:
- Implementation of GHGs mitigation strategies to promote low-carbon, high economic growth.
- Enhance national capacity to adapt to climate change.
- Increase public awareness.
- Mainstreaming of the private sector into national programs and projects to address climate change impacts.
- Strengthening of national institutions and mechanisms to deliver robust, fit-for-purpose functional climate change governance framework.

Existing Reporting of LULUCF GHG Emissions

The IPCC Tier 1 methodology was adopted for the preparation of Nigeria's BUR1 (and BUR2 in development), First, Second and Third National Communication estimation of GHGs emissions/removals in the LULUCF sub-sector as there were no reliable country-specific data. Under the subcategories, for Land, emissions from Changes within Forestland and Removals for Harvested Wood Products (HWP) were estimated in the TNC.

Mitigation Actions

Nigeria, like many other developing countries, is currently undergoing industrialization in order to address its developmental challenges. This industrialization process will lead to increased economic growth and increased welfare of its citizens.

The expected increased economic growth will result in an increase in environmental resource consumption which is currently on an upward trend. The increased resource utilization has GHG intensity implications which need to be assessed and reviewed to be able to mainstream GHGs abatement and climate change adaptation measures in national strategies and policies. National development plans and policies were analyzed, and established models reviewed on how the current anthropogenic GHG emissions as determined in the GHG inventory, will change into the future because of implementation of Programs and Measures (P&M) in the national development plans.

The UN-REDD Program

This program aims at consolidating the countries' efforts to reduce emissions from deforestation and forest degradation, and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks.

Modelling Approach

The Low Emissions Analysis Platform (LEAP) model was utilized as the analytical framework for assessing low-carbon development opportunities that can be implemented as mitigation activities in the various sectors of the Nigerian economy (INDC Report, 2015). The modelling involved a comprehensive national-level representation of:

- energy resource extraction.
- transportation of primary energy resources to processing centers.
- processing of primary energy resources to secondary energy forms; and
- the final conversion of secondary energy to useful energy at the end-use level. The leap model used LEAP10 equations to analyze scenarios of energy production and utilization in the different sectors of Nigeria's economy, as well as activities in the Forest sector (AFOLU), over the assessment period (2016 - 2035) and the emission reduction implications of P&Ms implemented in these sectors.

Two ongoing projects will have a positive impact on future sectoral MRV. These are:
- Nigeria's Energy Balance being delivered in partnership with International Renewable Energy Agency (IRENA) and;

- Nigeria Energy Calculator 2050 (NECAL 2050) being implemented by the Energy Commission of Nigeria (ECN) and sponsored by the United Kingdom Department for International Development (DFID).

Forest Management (Afforestation and Reforestation)

The Federal Government of Nigeria, motivated by pioneering efforts from Cross River State, began to engage in REDD+ activities in 2009 and signed an agreement with the UN-REDD program in August 2012.

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is an international effort to create financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and investing in low-carbon paths for sustainable development. REDD+ goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (UNDP Report 2017). In February 2015, Nigeria's REDD+ Readiness Program was extended through 2016, following two years of stakeholder efforts to achieve REDD+ readiness in Nigeria, based on the following:

- Consolidating four key UNFCCC requirements for REDD readiness on a pilot basis in Cross River State:
- the four Warsaw Framework elements of Strategy,
- Safeguards Information System, Forest Monitoring System, and
- Forest Reference Levels for carbon (FRELs, 2018).

Nigeria's REDD+ "readiness" program was anchored on the bottom-up, participation of the stakeholders in the development of a national strategy. The UNREDD funding of the Nigeria REDD+ program developed a strategy for Cross River State as a pilot state for the National strategy framework. Cross River State REDD+ Strategy was meant to serve as a model for other states in the country. The proposed strategy comprises:

- policy reforms,
- development of investment priorities, and;
- a related REDD+ implementation framework, with due monitoring and safeguard systems, as required under the UNFCCC.

The REDD+ strategy was intended to enhance the value of forest resources and to incentivize sustainable forest management via a multi-stakeholder approach and a green, low-carbon development perspective.

With support from the World Bank, Nigeria is currently designing a transformational, socially, and environmentally viable national strategy with issues and options drawn from sub-national Ondo and Nasarawa States as well as Cross River State as pilots in the UNREDD readiness supported funding, building upon what has been achieved so far in Cross River State and at Federal level. The issue of reducing emissions from deforestation and forest degradation, as compared to a reference level is the focus. This national REDD+ strategy is expected to meet international standards and form a sound basis for mobilizing investment and results that are based on the phases of REDD+, namely:

- Biomass Pool and Supply Management.
- Forest Protection
- Reforestation

Report Recommendations for Nigeria's enhanced NDC: Forest Sector

This was aimed at achieving four main objectives of:
- sustainable forest restoration,
- Improved natural forest management.
- Reduced fuelwood harvest, and
- Protection and restoration of mangrove forest ecosystem

3.3.2   Existing Methodological Tools for MRV

AD refers to the intensity, level or quantity of sector-specific activity that led to emissions and/or removals of GHGs while EF represents the rate at which a particular GHG is emitted or removed as a result of use of, change of and level of intensity/frequency of use/number of activity will generate/remove GHGs under certain defined conditions. Therefore, the product of AD and EF gives the total GHG emission for a particular activity. This is represented in an equation as follows:

*E = AD * EF*
Where: *E = Emission, AD = Activity Data, and EF = Emission factor*

Going further, a simple first order approach in the IPCC Guidelines

A) $C_{flux} = \Delta C_{stocks}$
Change in carbon stocks can be estimated from land use/change and management at various points in time, their impacts on carbon stocks and the biological response to them. (IPCC 2006 GL)

Generic Approaches to Estimating Carbon Stock Changes on Managed Land: CO_2 Emissions from Carbon stock changes on land.

Annual carbon stock changes as sum for all land use categories: Equation A (2006 GL, page 2.6)

B) $\Delta C_{LAND} = \Delta C_{FL} + \Delta C_{CL} + \Delta C_{GL} + \Delta C_{WL} + \Delta C_{SL}$

Annual C stock changes for a land-use category - sum of each stratum within category: Equation B (2006 GL)

C) $\Delta C_{LU} = \Sigma \; \Delta C_{LU\,i}$

Annual carbon stock changes for a stratum of a land-use category - sum of all carbon pools: Equation C (2006 GL)

D) $\Delta C_{LUi} = \Delta C_{AB} + \Delta C_{BB} + \Delta C_{DW} + \Delta C_{LI} + \Delta C_{SO}$

For the Nigeria TNC, extrapolation and interpolation techniques were used in line with IPCC GPG to generate missing data and replace outliers in the time series. In cases where there were no data, expert judgment was applied, and the assumption was documented (TNC, 2020).

Table 6: Tools for GHGE Reporting in LULUCF Sector

Tools	Description
AFOLU Carbon Calculator	The AFOLU Calculator employs IPCC-based accounting methods that allow users to estimate the CO_2 benefits and potential climate impacts of eight different types of land-based project activities: forest protection, forest management, afforestation/reforestation, agroforestry, cropland management, grazing land management, forest degradation by fuelwood, and support/development of policies. Each of these tools within the AFOLU Calculator transparently documents the methods, discusses the assumptions, and presents the underlying data along with its associated sources of uncertainties.
Agriculture and Land Use National GHG Inventory and Mitigation Analysis Software Tool (ALU)	The Agriculture and Land Use Greenhouse Gas Inventory (ALU) Software guides an inventory compiler through the process of estimating greenhouse gas emissions and removals related to agricultural and forestry activities. The software simplifies the process of conducting the inventory by dividing the inventory analysis into steps to facilitate the compilation of activity data, assignment of emission factors, and completion of the calculations. The software also has internal checks to ensure data integrity. Furthermore, the software program is designed to support an evaluation of mitigation potentials using the inventory data as a baseline for projecting emission trends associated with management alternatives. Region: Global
FLINT: The Full Lands Integration Tool	The Full Lands Integration Tool (FLINT) is a platform to support Measurement, Reporting and Verification (MRV) of greenhouse gas (GHG) emissions and removals estimates. Users can build on this platform to implement and operate their (national) systems to estimate emissions (and other metrics) for the land sector. FLINT integrates data from remote sensing, ground observations and other sources to estimate fluxes and stocks of greenhouse gasses in different pools consistent with the guidance from the Intergovernmental Panel on Climate Change (IPCC).
Harmonized World Soil Map (HWSM)	HWSD is a global soil dataset that provides 20 soil properties for two soil depths (0-30 cm and 30-100cm), including soil organic carbon pool. HWSD combines existing regional and national updates of soil information with the information contained within the FAO-UNESCO Soil Map of the World.
Smallholder Agriculture Monitoring and Baseline Assessment Tool (SHAMBA)	The Smallholder Agriculture Monitoring and Baseline Assessment (SHAMBA) tool is a methodology and calculation tool to assess changes in greenhouse gas emissions from land use in tropical areas.
Methodology for sustainable grassland management (SGM)	This method is applicable to grazing land but focuses on impacts to soil carbon. It provides procedures to estimate GHG emission reductions with the adoption of SGM in semi-arid regions

Table 7: Existing Data sources

Category	Sub-category	Data Type	Data Source	Principal Data Provider
Land	Forest Land	Forest Area	USGS 2016 Report	USGS
			FRA 2015	FAO
			NBS Report	NBS
		Climate Zone and Soil Classification	IPCC GL	IPCC
		Biomass Estimate for 5 IPCC pools (above-ground biomass, deadwood, herb, litter and soil)	IPCC GL	IPCC
		Harvested Wood Products	FAOSTAT	FAO
		Wood/Fuel Wood Removal	FAOSTAT	FAO

Source: Nigeria's Third National Communication 2019

The Land-use Change is the result of conversion of land categories between and amongst the various IPCC land classes, namely:
- Forestland (FL),
- Cropland (CL),
- Grassland (GL),
- Wetlands,
- Settlements and
- Other Land.

Due to data constraints during preparation of Nigeria's TNC, only activities within Forestland were assessed and emissions estimated. Data on land use changes are still not available and thus emissions stemming from this activity has not been computed.

Based on available data from different sources, a land matrix with areas of the different land categories should be constructed with no movement between them with the total area of the country balanced with corrections made to the other land category. In the TNC, information obtained from the United States Geological Service USGS (2016) together with other sources including FRA (2015), FAO Aquastat and Nigeria's NBS were used to validate the different areas adopted for the period 2000 to 2016. Two default soil types: Low Activity Clay and Climate Tropical Moist Short Dry Season were considered as being most appropriate for Nigeria.

In the TNC, two categories of Forestland were considered: Forestland and Other Wooded Land. The areas of land classified in the USGS 2016 report and FRA 2015 were reassigned to fall within the six different IPCC land classes. The area of Forestland declined during the time series on account of deforestation and wood removals for both commercial wood/timber trade and wood fuel.

Cropland was assumed to fall under three subclasses:
- Cropland Annual for annual crops,
- Cropland Perennial for perennial crops such as Coffee, Rubber, Palm, Tea, etc. and,
- Rice paddy.

Annual Cropland relates to rain-fed crops produced during earlier part of the year and thereafter used for production of fodder and grazing during the remaining part of same year. Cultivation of rice paddy is mainly done in wetlands but due to scarcity of information and confirmation of the different areas involved, they were considered as a separate entity in the TNC as per the 2006 IPCC Guidelines.

There is a mix of permanent grazing land and grassland, and these have been summed up under the Grassland class.

With the rapidly increasing population of Nigeria, an important increasing change in the area of settlement has been identified, but it has not been possible to track from which land category they originated over the time covered by the TNC.

Merchantable wood/commercial timber harvested from Forestland remain as wood products for differing lengths of time after their transformation. This constitutes a carbon pool. HWPs subcategory includes all wood (including bark) that goes out of harvest sites. Slash and other materials left at harvest sites were regarded as Dead Organic Matter (DOM).

The time during which carbon is held in products varies according to product and its uses. For example, fuel wood and mill residue may be burned within year of harvest; many types of paper are likely to have a useful life of less than 5 years which may include recycling of paper; and sawn wood or panels used in buildings may be held for up to ten decades (100 years).

All the data on production, imports and exports of round-wood, sawn wood, wood-based panels, paper and paper board, wood pulp and recycled paper, industrial round-wood, chip and particles, wood charcoal and wood residues were obtained from FAOSTAT database http://faostat.fao.org/. Most data were available since 1960 but there existed some gaps. All data from 1961 from the FAO time series were used and categorized in their required field for calculations.

In closing, it is a globally accepted reality that we cannot track/monitor what we cannot measure, and it does not matter whether we want to lose weight or reduce GHGs.

With AFOLU releasing the highest GHG emissions according to Nigeria's latest official GHG Inventory captured in the TNC, it has become necessary to deliver a LULUCF sector specific MRV framework to track GHGs emissions to ensure Nigeria's climate mitigation actions are in alignment with GHG emissions reduction obligations in Nigeria's NDCs as part of the building blocks of Paris Agreement.

The National GHG inventories are an essential component of climate change policy development and negotiations among party countries to the UNFCCC. This ICAT-Nigeria MRV Systems Setup Project will empower Nigeria to participate in the UNFCCC activities more fully as well as develop more effective policies for her LULUCF sector with inventories that follow good practice as defined by the IPCC (2006). Adoption of the good practice guidelines under the ETF will ultimately lead to transparent, accurate, complete, consistent, and comparable MRV of GHG inventories.

More importantly, the resulting inventories can be used with confidence in development of NAMAs and tracking policies in the NDCs. In turn, the proposed strategies and recommendations may form the foundation for incentives-based strategies to reduce GHG emissions in Nigeria through international cooperation, and improved economy-wide de-carbonization practices.

This LULUCF Sectoral MRV Review has been implemented to support the ICAT-Nigeria MRV System project's empowerment of Nigeria to address GHG data management challenges sustainably and systematically with a view to plugging existing gaps and enhancing public perception of the objectivity, impartiality, and independence of GHGs statistics and datasets captured in the BURs, NCs, and BTRs.

Finally, with the observed absence of LULUCF sector-specific MRV framework, there is a heightened optimism among the LULUCF stakeholders that the ICAT-Nigeria MRV System Project would be able to plug identified data gaps as well as build capacity of national experts as part of the building blocks of a robust MRV system for Nigeria.

Table 8: Summary of Needs and Gaps in LULUCF Sector

Components	Sector Analysis and Comments	Identified Needs and Recommendation
Inventory and Institutional Arrangement	Sector assessment of current state of play in the LULUCF sector • Reviewed and mapped existing national MRV processes/systems in the LULUCF sector. A pilot REDD+ activity. implemented in Calabar. • The lead agency (DCC) with the mandate of climate action reporting has built capacity to monitor and evaluate national MRV system. Such capacity can be strengthened to increase efficiency within the system. • NCs and BURs (BTRs) require sectoral GHG inventories. Data gaps identified in LULUCF sector. Tier 1 estimation applied throughout but needs improvements in data quality. • No national MRV has been established but LULUCF sectoral system proposed as part of an overarching national system being developed, and various sectoral measuring and reporting processes exist some of which feed into the UNFCCC reporting (National Communications and BURs). • The GHG inventory process has been an ad hoc process (no sustainable GHG Inventory system) and highly dependent on external support.	• Formally agree on what is to be included in the national and sectoral MRV systems based on the identified requirements and train all the relevant staff to ensure adequate awareness and capacity for implementation. • Plugging of knowledge and capacity gaps in the mining of existing data, and generation of experimental data sets that can be used to derive national emission factors unique to LULUCF components. • This can be plugged via robust capacity building and training interventions, equipment procurement, technology transfer and support to help sector experts understand the specific types of data needed during data collection, processing, reporting, and archiving. • Formalize existing data capture, sharing and reporting arrangements through data sharing memoranda of understanding (MOUs) between data sharing parties that specify type, format and frequency of data with clear responsibilities for the LULUCF sector. • Set up sustainable robust QA/QC systems for the LULUCF sector.
	Recommend the establishment of institutional arrangements for the oversight and coordination of MRV activities in the LULUCF sector. • Through stakeholder input agree on an overall sectoral lead institution for the LULUCF MRV system and define roles and responsibilities of key stakeholders in the system • Develop appropriate rules and guidance for the LULUCF MRV system and interagency interaction.	• Setup an MRV steering committee for the LULUCF sector. • Setup a sectoral framework (to be developed) to be used as the basis for the LULUCF sector institutional framework with possible modification. • Build the capacity through training of staff with clearly defined roles and responsibilities for coordination and oversight of the sectoral MRV work. • Develop and publish appropriate rules and guidance on data sharing and information management, clearly defining which data is to be shared, by whom, and how often between various government units and

Components	Sector Analysis and Comments	Identified Needs and Recommendation
		within the sectors, the required QA/QC, with clear instructions to guide various staff involved, and to ensure compliance with international level agreements for the LULUCF sector.
Data and Capacity Building	Assess data gaps and needs for the LULUCF sector. • lack of reliable good quality activity data • lack of country specific EFs, • lack of a fully operational Inventory Management System (IMS) to cater for the steps of compilation. • Given the constraints in (i-iv), heavy reliance on international databases for AD estimations leading to adoption of default IPCC EFs while hoping for that the development of a robust IMS for sustainable compilation of future GHGs inventories. • Lack of dedicated target-specific capacity building of national experts and critical stakeholders relevant to the set-up of robust MRV system.	• Design and develop a GHG inventory system covering data capture and sharing, QA/QC, archiving and the coordination of the activities for the LULUCF sector that is to be integrated with the national MRV system for GHG inventory. • Assess and prioritize data gaps, identifying data which are not yet collected, not available, not in the right format or frequency or not of the required quality in the LULUCF sector. Priority to be on the basis of the relative importance for domestic and international reporting. • Develop data collection tools and protocols using sector specific standard approach. • Identify how existing data systems in the MDAs can be improved to address data gaps in LULUCF sector. • Setup of an automated efficient data management system. • Development of sector-specific tools for tracking and recording GHGs emission data in the field. • In the absence of robust legal framework for data governance, facilitation of a seamless inter-agency collaboration via strengthening of the Inter-Ministerial Committee on Climate Change (IMCCC) to ensure easy flow of information among the participating MDAs • Develop and apply guidelines for data verification, audits, quality checks and stakeholder consultations. • Develop and implement a plan for addressing sectoral data gaps.

4.0   Oil and Gas Sectoral MRV

4.1   Introduction

Nigeria is the largest oil producer in Africa. It holds the largest natural gas reserves on the continent and was the world's fifth-largest exporter of liquefied natural gas (LNG) in 2018. Currently has proven crude oil reserves of about 36 billion barrels based on 2018 estimates. This puts the country as the second largest reserve in Africa after Libya, and the tenth largest in the world, just behind the United States. Although Nigeria is the leading crude oil producer in Africa; production is affected by sporadic supply disruptions.

Oil productions in the sector are from a total number of two hundred and thirty-two (232) producing fields from forty-seven (47) oil producing companies. In total, there are about two thousand, six hundred and sixteen (2,616) wells producing from two thousand, nine hundred and thirty-nine (2,939) strings, with Mobil, Star deep and Chevron as the major contributors to crude production as of 2018.

The country exports gas to neighboring countries such as Cotonou (Benin Republic), Lomé (Togo) and Tema (Ghana) through the West African gas pipeline (WAGP). Nevertheless, the country is insufficient in gas infrastructure to meet the local demand in the country.

Operations in the oil and gas industry in the country is categorized across the value chain mainly as; upstream, midstream, and downstream with key players in the industry classified under the joint venture, producing sharing contracts, independents, and marginals.

> *Upstream Operations:* These include activities related to exploration and production. These activities predominantly have two sources of GHG emissions: gas flaring and fugitive methane emissions. However, there exist other sources such as combustion of fossil fuel in engines and venting. The International Oil Companies constitute the highest producers with Nigeria Petroleum Development Corporation (NPDC) of Nigeria National Petroleum Corporation (NNPC) as the highest producer among the Nigeria owned oil companies.

> *Midstream Operations:* These include activities related to gas processing, treatment, and transmission. Nigeria Gas Company (NGC) is predominantly the biggest player in the midstream managing the transmission gas network in the country. It is involved in gathering, treatment, transmission and marketing of natural gas and its by-products to major industrial and utility gas distribution companies in Nigeria and neighboring countries.

> *Downstream Operations:* These include activities related to oil and gas storage, distribution, and crude oil refining. To this regard, there are four refineries, storage facilities and network of crude and finished products pipeline across the country. These facilities are managed and operated by the NNPC. There is an ongoing world largest refinery approaching completion owned by private sector developer, Dangote Group.

Major forms of GHG emissions from this sector include CH_4, CO_2 and NO_2. Globally, it has been researched and documented according to IPCC assessment report that CH_4 is responsible for at least a quarter of GWP, and it is over 25 times more potent than CO_2 with a warming gas over a 100 years' timeframe. The global O&G sector is estimated to have lost $30 billion in revenue in 2012, or about 3 percent of global natural gas production, from methane leaks. If companies reduced pipeline leaks and recovered the gas that escapes, they could profit off those losses.

Figure 6: GHG Emission Sources from the various segments of the O& G production
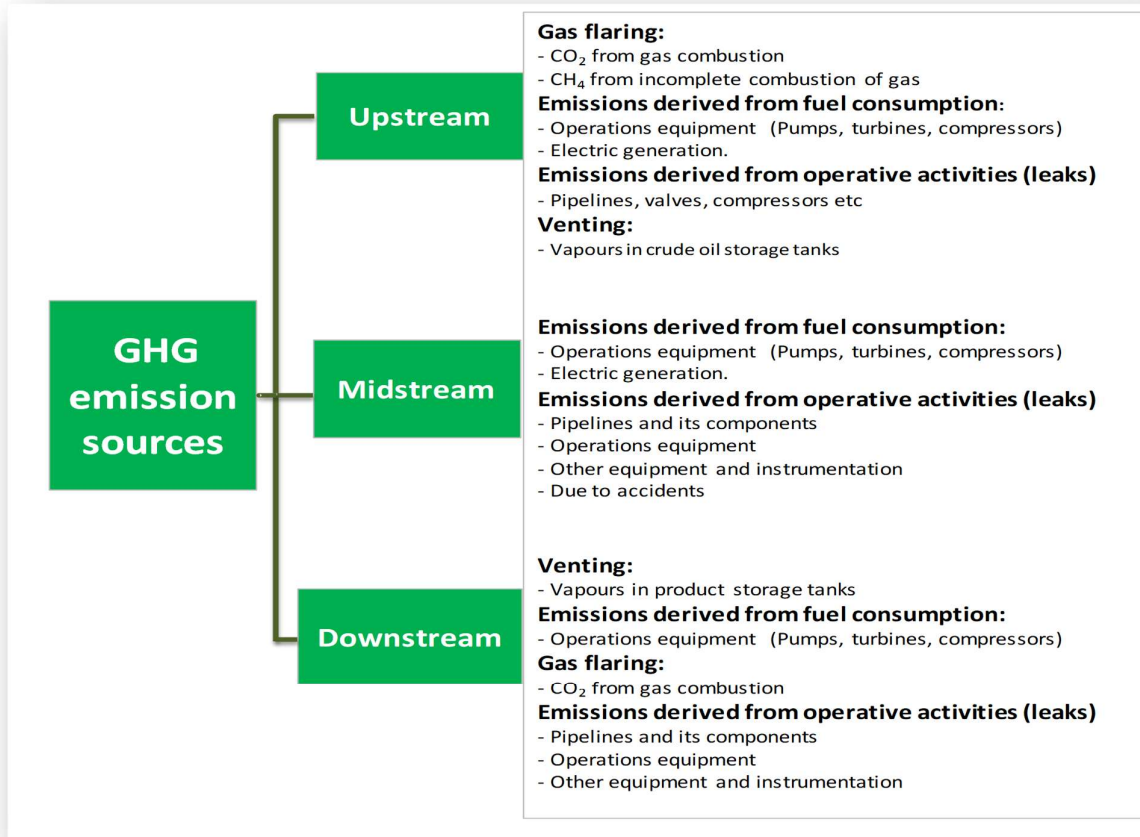
Figure 6 above shows the emission sources from the upstream, mid-stream and down-stream segment of the O&G operations.

Players in the Nigeria O&G sector have had their share of been involved in several mechanisms that are aimed at earning benefits from the reduction of the GHGE by implementing projects that reduce emissions. While the sector is yet to develop any NAMA, it has developed six Clean Development Mechanism (CDM) projects. Due to the fall in the price of certified emission reductions (CERs), Industry players have transitioned from CDM to exploring opportunities in other mechanisms such as the Upstream Emission Reduction (UERs) which is a new instrument to achieving significant GHG emission reduction.

Clean Development Mechanism

The CDM is one of the Flexible Mechanisms defined in the Kyoto Protocol that provides for emissions reduction projects needed to generate Certified Emission Reduction (CER) units which may be traded in emissions trading schemes. CDM allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Example of a successful CDM project in the O&G sector is the Pan Ocean gas plant project, which has reduced emissions upstream by ending flaring at the oil field and supported sustainable development by providing gas for domestic electricity. The table below are the number of registered CDM projects in the Nigeria Oil and Gas sector.

Table 9 : Projects in the O&G Sector registered by CDM Executive Board

Registration	Project Description	Methodology	Reduction
09 Nov, 2006	Recovery of associated gas at Kwale oil-gas processing plant	AM0009 vers.2	1,496,3934
01 Feb, 2009	Pan ocean Gas utilisation Project	AM0009 vers.2	2,626,735
16 Oct, 2010	Recovery and marketing of gas at the Asuokpu/ Umutu Marginal Field	AM0009 vers.4	256,793
24 Dec, 2012	Recovery and utilization of Associated gas from the Obodugwa and neighbouring oil fields in Nigeria	AM0009 vers.5	288,147

Source: UNFCCC website

Upstream Emission Reduction (UERs)

UER, according to Annex I Part 1 3 (d), is the upstream emission reduction of GHG claimed by a supplier, measured in gCO_2eq if quantified and reported in accordance with the requirement of the Fuel Quality Directive (FQD).

Table 7 below shows projects registered under the German Fuel Quality Directive. It should be noted that two of the projects were earlier registered under CDM in 2009 and 2012 respectively as noted in the table above. The two projects were not physically implemented until recently with the German Fuel Quality Directive carbon market managed by Deutsche Emissionshandelsstelle (DEHSt).

Table 7: Projects registered under the Fuel Quality Directive by DEHSt

Project No.	Date of Approval	Emission reductions	Methodology
PNVI	03/02/2020	324,000,000 kg CO2eq p.a.	AM0009 Recovery and utilization of gas from oil wells that would otherwise be flared or vented
MZIV	22/07/2020	330,000,000 kg CO2eq p.a.	AM0009 Recovery and utilization of gas from oil wells that would otherwise be flared or vented

Source: DEHSt website

For the sector to continue to consolidate on achievements that have been made and more importantly achieve the NDC targets of the country, the sector requires a robust institutional framework. This framework will help in implementing an effective and transparent MRV system. This is pertinent to the sector based on confronting issues such as the lack of complete data, the use of proxy EF to estimate emissions and the inconsistency in data sets. These pitfalls depict an urgent need for an effective MRV system within the sector.

However, like most other NDC sectors, there is no structured institutional setup on MRV for the sector. Nevertheless, MRV set up should depend on existing institutional arrangements and national circumstances within the country. In Nigeria, the composition of the IA for O&G sector is structured to encompass the relevant entities and stakeholders within the sector.

The sector, having undergone significant transitions over the years, is represented by key stakeholders with respective roles and responsibilities. This needs to be slightly restructured to meet the country's

commitment towards the achievement of the NDC and ultimately the PA. It is expected that the IA within the O&G sector is geared towards implementing MRV activities such as tracking GHG emissions, implementing mitigation actions, and cataloguing support.

4.2   Existing Institutional Arrangement and Stakeholder Identification

Primarily, the entity in charge of the sector's activities is the Ministry of Petroleum Resources (MPR), while the Department of Petroleum Resources (DPR) plays the role of the regulator. The DPR also acts as the data storehouse where data from NNPC, International oil companies (IOCs), National oil companies (NOCs), Marginal field producers and independent producers are sent and stored. It should be mentioned that to maintain an effective institutional arrangement, a legal framework is imperative.

Figure 7: Existing *IA* for the Oil and Gas sector in Nigeria
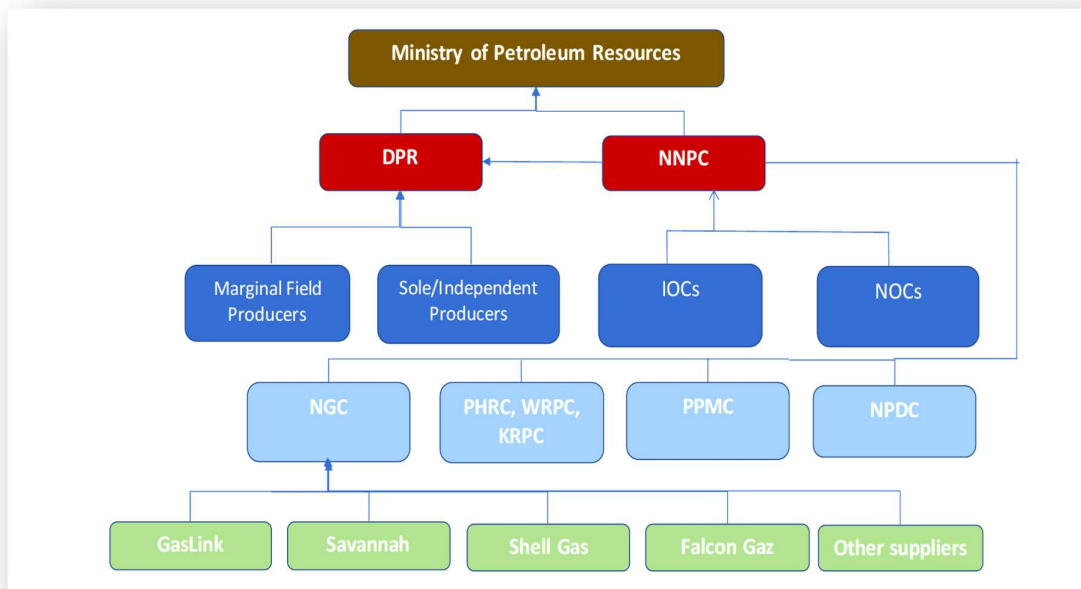
Figure **7** above shows the existing IA of the O&G sector in Nigeria, the arrangement reveals the Ministry of Petroleum resources as the overarching institution controlling the affairs of the sector, with the DPR acting as the regulator and data storehouse alongside the NNPC, through which the federal government of Nigeria regulates and participates in the country's petroleum industry. The existing IA reveals the crucial role played by the relevant stakeholders; data from the IOCs, NOCs, Marginal Field Producers and Sole/ Independent producers are collated by the DPR thus acting as a data storehouse. Seemingly, NNPC also plays an important role as an operator, coordinating the activities of oil companies as such complementing the role of DPR within the sector.

Key Stakeholders of the Oil and Gas Sector

The overview of the existing IA of the sector shows that the sector is composed of key stakeholders with various roles and responsibilities to ensure the functionality of the sector. Basically, DPR and NNPC are the major complementing stakeholders in the sector. While NNPC stands as a corporate organization and an operator representing the interest of the Nigeria's government in all the contractual arrangement in the industry with the IOCs, DPR on the other hand is the single industry body for the sector, empowered

to make periodic declarations on national O&G production status. NNPC's focus is on optimal, efficient, and transparent management of government's business interest in the sector while DPR is in the position to obtain, collate and pronounce the O&G status of the country.

Ministry of Petroleum Resources

The Ministry of Petroleum Resources is the entity that oversees the O&G sector. The Ministry was created to develop and implement sound policies that will serve as a backbone for the rapid development of the then burgeoning O&G sector. The Ministry is responsible for the articulation, implementation, and regulation of policies in the sector. It also exercises a supervisory role over the operators and stakeholders, to ensure compliance with all applicable laws and regulations in oil and gas.

Department of Petroleum Resources (DPR)

DPR has the statutory responsibility of ensuring compliance to all the sector laws, regulations, and guidelines.

These roles include monitoring of operations at drilling sites, producing wells, production platforms and flow stations, crude oil export terminals, refineries, storage depots, pump stations, retail outlets, any other locations where petroleum is either stored or sold, and all pipelines carrying crude oil, natural gas, and petroleum products. As it relates to MRV, DPR is involved in the following activities:

- Monitoring the Petroleum Industry operations to ensure compliance with national goals and aspirations to reduce gas flaring and ensure other gas obligations.
- Maintaining records on petroleum industry operations.
- Data reconciliation (Measurement at well ends) which is usually carried out with companies and calibrations are properly carried out by third party verifiers.
- Also, DPR carries out the annual reconciliation of volume and tracking of oil spill volumes. This is done with all parties involved during reconciliation.
- DPR is involved in the reconciliation of records of gas production, flare gas, routine / operational flare volumes. This is done for the downstream records as well.

Nigeria National Petroleum Corporation (NNPC)

The NNPC functions as an operator and a player across the value chain in the sector under the governance of the Ministry of Petroleum. It is the corporation through which the Federal Government of Nigeria participates in the country's petroleum industry. The corporation is responsible for providing data on emissions from the refineries and acts as a project implementer. NNPC, through its Renewable Energy Division (NNPC-RED) manages and screens mitigation projects within the upstream, midstream and downstream aspects of the of the O & G sector for CDM opportunities and Carbon credits earnings.

International Oil Companies (IOCs)

These are international O&G companies operating in Nigeria. IOCs include Western oil giants like Royal Dutch Shell, Exxon Mobil, Chevron, TOTAL etc. They are the largest producers of crude in the country with operations onshore, swamps and offshore. Almost all these companies are joint venture partner with the Nigeria state owned company, NNPC.

National Oil Companies (NOCs)

These are Independent and indigenous O&G companies operating within the country. NOCs represent the state-owned oil companies such as NNPC, NPDC etc. Other companies include those in partnership with the National company in a joint venture agreement such as Seplat, Aiteo, Neconde Energy, Newcross Exploration & Production etc.

Marginal Field Producers

In Nigeria, these are companies assigned to marginal fields from oil blocks considered to have low production output. This includes companies such as Midwestern Petroleum, Platform Petroleum, Energia Petroleum among a host of others. The growth of marginal players has brought a boost to the reduction of gas flaring in Nigeria, with several Nigerian marginal fields recognized under the United Nation's (UN) CDM programme for their successful reduction of flaring and valorization of natural gas.

Independent Producers

Independent oil companies or producers in most cases focuses on only one aspect of the sector i.e., either the upstream, midstream, or downstream aspect. Aiteo, Folawiyo, Lekoil are example of independent indigenous Nigerian companies.

4.2.1 Description, Challenges and Gaps

Description

The existing IA in the O&G Sector as shown in Figure *7* above gives the reporting structure in the Oil and Gas sector. However, there is a need for the setup to be slightly modified to accommodate data flow, validation, and quality control. The challenges and gaps identified in this existing setup is highlighted below.

Some identified key challenges/gaps in the existing MRV system for the sector are as stated:

- No external entity for QA/QC: the existing MRV system shows that collection and verification of data is all carried out by the DPR. However, there is need to have an entity (third party verifier) who will be saddled with the responsibility of QA/QC for all the data sets that have been submitted to the DPR.
- Existing MRV structure does not clearly state a requirement that allows data to be sent to the DCC, the focal point of the Federal Government. The binding document is currently a memorandum of understanding (MoU) which was the outcome of the ICCC.
- Also, inherent gaps in the Development of the IA for the O&G Sector are due to a weak or non-existent legal binding framework and poor mandate for adequate resources, particularly the existing mandate of the DPR.

4.3   Review of Existing MRV Framework

MRV systems are used extensively in several carbon pricing mechanism and trading schemes world-wide. Importantly, MRV provides information about emission sources and trends; allows tracking progress towards climate change-related targets and steers mitigation actions so that the targets can be achieved.

MRV frameworks help project implementers to increase their energy efficiency and reduce their emissions. They are key elements to guarantee transparency, precision, and comparability on climate change information.

The O&G sector represents a critical sector where the nation expects to achieve significant emission reduction, as such, it is important to develop an MRV framework that will allow a transparent system of reporting GHGE from the sector based on standardized, measurable, adequately reported, and verifiable climate plans.

However, currently there exist no structured or established MRV framework for the sector, but the existing framework seemingly to the MRV, quantifies emissions and GHGs released from the gas and crude oil production within the sector.

In relation to MRV of policies, Nigeria has not yet to establish any national level MRV system. However, for MRV of actions, players in the O&G sector have expertise in applying CDM methodologies. Some of these methodologies have been used in the past for:
- Projects for recovery and conversion of associated gas under UNFCCC CDM.
- Efficiency in power systems.
- Improvement in transmission network to reduce losses.

The experience in the application of the CDM methodologies can be used while developing MRV framework establishment of the baseline, monitoring framework, data management system, etc. This will be in line with a nationally approved IA for NAMA, which includes MRV component as well. Though there is MRV experience for the O&G sector, this has not been fully institutionalized. It is important to build capacity of local experts and ensure MRV is fully implemented.

Challenges and Gaps

Highlighted below are some of the identified challenges and gaps that need to be addressed to develop a robust MRV framework in the sector.

- Incomplete & Inconsistent data: Due to the incompleteness, inconsistency, and unverified GHG inventories it is difficult to create a structured MRV system. It is thus expected that in line with the NDC, the DPR should develop uniform and structured framework/methodology for GHG emission monitoring and reporting for all stakeholders in the sector.
- Scope coverage: It is pertinent to ensure that GHG emissions are reported within the relevant segment adhering to the five-fundamental principle of GHG inventory and accounting.
- Awareness: while the IOCs may be inclined to the need for reporting GHG emission based on the required scope definition and in line with guidelines of their parent companies in developed countries, this may not be same for the NOCs. Hence, there is a need for more awareness and capacity building.
- The non-availability of baseline for Fugitive emissions: The importance of the baseline for fugitive emissions cannot be overemphasized, in the case of fugitive methane emission reduction projects, it is critical to identify all sources of leaks and methane emissions and properly sample them as emission reductions project activities will only be recognized and transparent when they can be compared to the baseline.

- Unquantifiable vented gases: It is important to determine the magnitude of venting in the O&G industry and to understand how the GHG emissions from venting compare to those from other sources. However, inadequacies in technology and drop back in practices such as the low penetration of the Vapor Recovery Unit technology (VRU) in the sector, has led to non-availability of data on the vented emissions.

4.3.1   GHG Emission Reporting and Mitigation Actions

GHG emissions in the sector mostly occur from the following sources:

Process (Vented) emissions: These are emissions from the intentional release or are designed to releases of CH_4 or CO_2 containing natural gas or hydrocarbon gas (not including stationary combustion flue gas), including process designed flow to the atmosphere through seals or vent pipes, equipment blowdown for maintenance, and direct venting of gas used to power equipment (such as pneumatic devices).

Flaring: Flaring is the most significant source of GHG emissions in the upstream sector, and it includes the continuous and operational flaring. Continuous flaring involves the burning of excess AG that has no marketing or reinjection options, posing a significant source of GHG emissions. On the other hand, operational flaring poses a less threat since the flaring activities is being regulated.

Fugitive emissions: These are emissions that occur from intentional and unintentional releases of GHG's such as equipment leaks from joints, seals, packing, gaskets, as well as fugitive emissions from the cooling towers and gas processing facilities.

Fuel combustion: Combustion-related emissions result from the use of petroleum-derived fuels and natural gas as fuel in equipment (e.g., heaters, engines, furnaces, etc.) witin the industry. CO_2 is the predominant combustion-related emission; however, because combustion equipment is less than 100 percent efficient, CH_4 and other unburned hydrocarbons are emitted. N_2O results from both fuel-bound nitrogen and nitrogen from atmospheric air.

4.3.1.1.   Mitigation Actions in the O&G Sector

The industry, over the years has engaged in projects geared towards emission reduction, which has been monitored reported and verified. These projects include the gas flare reduction, energy efficiency projects and Fugitive emissions projects (Leak Detection and Repair).

Gas Flare Reduction: This include projects that recover and utilizes associated gas that should either be vented or flared in the absence of the project activity. Fuel consumed during the project activity for compression, treatment and processing are adequately monitored.

Energy Efficiency: Energy efficiency projects involve using less energy to perform the same task such as eliminating of energy waste. These types of project help in reducing GHGE through process optimization and improved technology.

Fugitive Emissions (Methane) Reduction: This involves reducing methane emissions within a gas network arising from the emissions from normal operations, routine maintenance, and fugitive leaks. Fugitive leaks can occur in almost all parts of the infrastructure; connections between pipes and vessels, valves, and other specific equipment (e.g., flanges, threaded joints, meters) and can be caused by variations of atmospheric conditions as well as natural wear out and corrosion of valves and specific equipment over time.

Monitoring of the fugitive methane can be conducted through sampling and survey and not by using a meter. Thus, the monitoring is carried out by carrying out sampling periodically.

4.3.1.2   GHG Emission Reporting

Operators in the Nigeria O&G sector are expected to make known their annual GHG emissions as part of their obligation in meeting the NDC requirements. For adequate emission reduction within the O&G sector, GHG reporting is a vital step in ensuring the implementation of mitigation measures thus allowing companies within the O& G sector set their emissions reduction targets by measuring and reporting GHG emissions needed for the development of mitigation measures to reduce future emissions.

Although the sector has not standardized reporting framework for MRV, GHG emission reporting within the sector has been captured in policy documents such as the NC which is submitted every four years, and the BUR which is submitted every two years. Activity data are sourced primarily from the Department of Petroleum Resources (DPR) Annual Oil Report (AOR) and the Nigeria National Petroleum Corporation (NNPC) Annual Statistical Bulletin (ASB).

Nigeria submitted its FNC in 2003, SNC in February 2014 to honor its reporting obligations and its INDC in 2015 within the framework of the PA. These reports reflect the National GHGI, which duly includes reporting's from the O&G sector. The first BUR was submitted in 2018 and the second BUR is about to be submitted to the UNFCCC. It should be noted that due to absence of standardized methodology and approach for data collection and estimation of GHGs, the outputs from the NC and BUR slightly varies. This is also considered as a gap that the MRV framework needs to address.

The DPR require specifically that all industry players in the sector must report the following details as a means of demonstrating transparency in reporting:

- Flaring: All industry players must install meters in their facilities and all meters must be calibrated.
- Fuel Gas: All players must install meters and must also be calibrated.
- Venting: Report for venting is captured under material balancing (this is currently not captured as data).
- Other Fugitives: This is also captured under material balancing.

The DPR also require that other AD such as: volume of gas, number of fugitives, amount and type of fuel combusted, the amount and energy content of each energy type consumed, and a host of others must be transparently reported.

The ability to collect and maintain a comprehensive activity data set is a critical component of an effective MRV system. In collecting data for MRV systems (of all scopes and scales). It is important to mention that the ability to acquire AD directly from all industry players is important for both national and NAMA MRV

systems. Although industry players can be reluctant to provide information for a variety of reasons, such as:

- Lack of clarity as to what the data will be used for.
- Such request may be complicated and time consuming to provide as confidentiality could be a concern.

Nevertheless, addressing these issues is important part of designing effective data collection processes.

4.3.1.3 Description and Challenges and Gaps

Description
It should be a goal that Nigeria O&G sector develop a robust MRV Framework that will aid transparent reporting of GHG emissions in the sector. It is also important to gradually introduce basic QA/QC checks in MRV systems. As with other areas of MRV systems, the objective is not to start "perfect", but rather to start with what is feasible and continuously improve the quality of data.

Challenges and Gaps

Highlighted below are challenges and gaps that have been identified from the seemingly existing framework.

- There are no national emission factors for estimating GHG emissions in the sector; hence the sector relies on default estimated EF as provided by the IPCC.
- Challenge of estimating emissions from fugitive methane due to lack of data and technological practices.
- No third-party verifier for QA/QC.
- No Leak Detection and Repair (LDAR) program put in place to monitor fugitive emissions.
- There is no law that states that DCC should be custodian of the O&G data.
- There is also no spell-out on who is responsible for archiving of data and how it should be carried out. Archiving of data is very important and key for sustainability of the MRV system.
- Inconsistencies in the NNPC and DPR Annual Statistical Bulletins, which were the primary sources of activity data for the O &G sector. Inability of the DPR to carry out comprehensive quality checks on all data sent to it by all relevant stakeholders.
- Unwillingness of stakeholders to share information or data as such preventing transparency.

4.3.2 Existing Methodological tools for MRV

Nigeria as a Non-Annex 1 country to the UNFCCC has over time adopted the IPCC guidelines for reporting its GHG inventories.

The IPCC GHG guidelines provide detailed methods for estimation of GHG emissions by sources and removals by sinks. The guidelines have been updated over time to include more emission source and removal categories and to improve methods. The good practice guidance (GPG, 2000) adopted the IPCC 2006 on the identification of the key inventory categories, inventory management and planning, such as

selection and collection of data, and quality assurance and control. The guidelines cover for national GHG inventories, and it is the most commonly and widely acceptable methodological approach for emission reporting.

The guidelines provide different tiers of methods for each category of emission source or removal category. There are basically three Tiers under the IPPC guidelines for estimating emissions; details of the different Tiers are provided below:

Tier 1 Approach:
This is the top-down default Emission Factor approach, and this approach is required for simple monitoring processes. In this approach, the activity data alone is required; the approach is fuel-based, and the emissions from all sources of emissions are estimated based on the quantities of fuel combusted. The Tier 1 emission factors are available for all relevant direct GHGs.

It is important to mention that the Tier 1 approach for emission estimations is currently being applied by the sector. This is basically because the country has not developed its own emission factors.

Tier 2 Approach:

This approach is country specific emission factor approach. It is estimated similarly to the Tier 1, but country-specific emission factors are used in place of the Tier 1 defaults factors. This approach considers all sources of emissions or individual plants. The activity data can reflect various disaggregated sources. This approach is not yet applicable in Nigeria.

Tier 3 Approach:
The Tier 3 is a bottom-up approach that involves assessment of emissions from individual sources and the direct measurement of emissions. In this approach, emission models or measurements and data at the plant level are used as appropriate. With these detailed information and efforts, this approach and measurement tends to provide a better estimate primarily for non-CO_2 GHGs.

$$E \ = \ AD \ x \ EF$$

Where:

E= Emission

AD= Activity Data

EF= Emission Factor

$$CO_2\ Emissions = Activity\ data\ X\ Emission\ factor_{fuel}$$

$$CH_4\ and\ N_2O\ Emissions = Activity\ Data\ X\ Emission\ factor_{GHG,technology,fuel}$$

Activity data represents the various sources of emissions such as volume of; gas produced, gas flared, vented, consumed onsite, quantity of gas leaked etc.

4.3.2.1   Description of Challenges and Gaps

Description
Data are aggregated from all stakeholders and reported to DPR in the O&G. However, there are yet some missing information/data that ought to be included in the annual report published by DPR. Also, the

Nigeria O&G sector has overtime adopted the use of the IPCC methodology basically the Tier 1 approach for estimating GHG emissions. This approach relies on default emission factors as provided by the IPCC however, it is important to mention that there the country could at some point develop its own emission factors by getting reliable activity data that would allow the use of Tier 2 and Tier 3 approach which will permit the usage of in-country specific emission factors.

Challenges and Gaps

Highlighted below are some of the challenges and gaps that are observed from the existing methodological tools.

- The usage of default emission factors (Tier 1 approach) hinders better estimates for emissions in the oil & gas sector, especially the non-CO_2 GHGs. It should also be mentioned that the Tier 1 approach do not provide adequate results because estimated factors based on experiences in countries where best practices are applied. This underplays emissions calculated using such emission factors.
- While flaring emissions can be estimated with some degree of accuracy, venting and fugitive emissions are still very difficult to detect, thus creating an important uncertainty in the quantification of their contribution to global upstream emissions.
- Lack of complete activity data published in the annual report.
- The lack of adequate technology in-country especially for Leak Detection and Quantification has prevented the use of the Tier 2 or 3 which would provide a more accurate result than the Tier 1 approach.
- The lack of adequate understanding of methodologies for emission quantification especially for estimating methane emissions.

In conclusion, the table below gives a summary of gaps, needs and the actions that should be taken. It is well noted that the high level of monitoring in the O&G sector makes the MRV framework and institutional arrangement easy process with the support of the stakeholders. The key areas of focus include improving the data collection process, verification process and ensuring the institutional arrangement is clearly defined and spelt out among the stakeholders.

Table 10: MRV Gaps, Needs and Action for O&G sector

Components	Gaps	Needs	Action
1. Data and Methodology	Activity data published by DPR and NNPC are not complete to give comprehensive data. Challenges in the Methodological Tools for better emission estimates. **Usage of default emission factors** (Tier 1 approach) prevents better estimates for emissions in the oil & gas sector, especially the non-CO_2 GHGs. **Difficulty in the estimation of vented and fugitive emissions**, thus creating uncertainty in the quantification of their contribution to global upstream emissions.	**Capacity Development:** It is necessary to ensure all stakeholders understand the sector's activity data, identify emission sources, assessing climate activities and technology development is urgently needed.	It is the responsibility of all stakeholders in training their operators.
2. Technology	**The lack of adequate technology in-country especially for Leak Detection and Repair** has prevented the use of the Tier 2 or 3 which would provide a more accurate result than the Tier 1 approach. **Inadequate Technical expertise**: Lack of adequate understanding of methodologies for emission quantification especially for estimating methane emissions.	More attention needs to be given to the vented emission and fugitive emission considering their contribution towards emission reduction. Implementation of the LDAR across the O&G operation in Nigeria Adequate training on the methodologies and estimation of emissions for capacity building	DPR urgent effort in implementing LDAR program across the sector. In-house training for operators by relevant stakeholders
3. Institutional Arrangement	No external entity for QA/QC: the existing MRV system shows that collection and verification of data is all carried out by the DPR. Lack of clarity in sending data to be sent to the DCC, the focal point of the Federal Government.	There is need to have an entity (third party verifier) who will be saddled with the responsibility of QA/QC for all the data sets that have been submitted to the DPR. A binding document is required like the current memorandum of understanding (MoU) which was the outcome of the ICCC.	External consultant should be employed

Components	Gaps	Needs	Action
	Weak or non-existent legal binding framework and poor mandate for adequate resources, particularly the existing mandate of the DPR.	A legal binding document is required to support the mandate of the DPR as the custodian of data.	
4. Non-Standardized GHG Emission Reporting Framework:	This is due to non-compliance with the directives of DPR that all industry players in the sector must report the following details as a means of demonstrating transparency in reporting.	Installation of calibrated meters within facilities.	Compliance with reportage should be enforced by DPR.
	Absence of a country Specific emission factors for estimating GHG emissions in the sector; hence the sector relies on default estimated EF as provided by the IPCC. **No third-party verifier for QA/QC**	Need for capacity building with the indigenous operators on relevance and how to standardize emission factors. Knowledgeable consultants should carry out QA/QC for adequate verification.	In-house training should be conducted to understand importance and how to identify/determine and report activity data as well as how to calculate emission factors
	Lack of a Legal Binding Framework for emission data: This is a relevant policy however a missing link between the DPR and relevant stakeholders.	Legal binding framework and mandate is required to enhance the submission of emission data.	
	Inconsistencies in the NNPC and DPR Annual Statistical Bulletins, the primary sources of activity data	Get stakeholders to harmonize data through joint committee to review data.	
	Unwillingness of stakeholders to share information or data as such preventing transparency	More awareness on importance of data sharing	

5.0   Road Transport Sectoral MRV

5.1   Introduction

Domestically, MRV is useful for tracking GHG Emission policy development, implementation, revision, targets attainment, multi-level, sectoral or product inventory while internationally, it is a tool to fulfill or meet the International Reporting Requirements (IRR) such as NCs, BUR and MRV of NAMAs (ICAT Climate SI, (2019).

For the Road Transport Sector (RTS), the scope of the assignment at this "Needs and Gaps Analysis" point, is to conduct a Sectoral MRV System Review - through the identification of stakeholders and document analysis.

Meetings and workshops were (and will continually be) organized with the identified stakeholder entities (including but not limited to data providers and MRV experts involved in the GHG inventory compilation and mitigation actions, MRV system. During each meeting with key informants, the source of data will be examined, using QA/QC applied to the data to gauge the reliability, the periodicity and completeness of the data and datasets provided by the key informants. This will lead to a mapping of stakeholders, data flows and tools which will be the basis to develop sectoral MRV systems.

For the RTS, the specific objectives in this phase of the project are as follows:

Initial stock-taking, review, and analysis of development of similar MRV/transparency initiatives in the country to maximize synergies with other initiatives, avoid duplication of those activities, and mobilize appropriate support for identified needs and priorities through Research- and discussion-based establishment and analysis of Needs, Gaps, Challenges and Opportunities.

Focused group discussions and one-on-one Meetings were and will continually be held with stakeholders (such as data providers and MRV experts involved in the GHG National Inventory compilation and mitigation actions MRV system) to define MRV Status Quo - Needs, Gaps, Challenges and Opportunities.

Transportation, a derived demand, is the movement of goods, services, and persons from place to place and the various means by which such movement is accomplished. The growth of the need, ability, and capacity to transport large quantities of goods or numbers of people over long distances at high speeds in comfort and safety has been an index of civilization and, of technological progress.

Mobility is fundamental to economic and social activities, including commuting, manufacturing, or supplying energy and transport systems composed of infrastructures, modes and terminals are so embedded in the socio-economic life of individuals, institutions, and corporations that they may often become "unconsciously' invisible to the consumer.

Sadly, on the flip side of the essential nature of mobility to economic growth, the sector is powered/fueled largely by fossil fuels hence carbon-heavy and exacts a steep price owing to the huge contribution to harmful energy-related emissions.

Concentrations of CO_2 have risen steadily since the early 1980s (U.S EIA Report), except for the period beginning with the start of the last recession in late 2007. Covid-19 era CO_2 concentration figures are yet to be generally accepted.

Globally, the picture is like the above, and in its 2014 report on climate change, the IPCC offered a stark forecast: *by 2050, global emissions of greenhouse gases from transportation could grow to about 12*

billion tons of CO₂e annually – unless there are aggressive and sustained changes in how humans get around. Globally, the transportation sector in 2010 – as reported then by IPCC – was responsible for about 23 percent of total energy-related CO_2 emissions worldwide.

Transportation and the carbon emissions it creates make for a big and unwieldy topic. But reviewing a few key areas can help improve understanding of some of the challenges ahead. Transport has been traditionally looked upon as a challenge in terms of reducing GHGE, and a lot of effort has been rightly directed at that issue.

In recent years, however, with the Sustainable Development Goals and the Paris Climate Agreement, adaptation of transport to the future climate, once a 'poor relation' in terms of climate change response, is increasingly being recognized as vital to the continued success of mobility and global trade and development.

5.2 Existing Institutional Arrangements and Stakeholder Identification

Depending on objective and national circumstances, countries have deployed a wide range of approaches, ranging from top-down integrated MRV systems that cover multiple reporting needs to bottom-up systems that focus on a specific policy, action, or region. Developing a robust institutional framework that encompasses the structures, systems, processes, procedures and most importantly, responsible human resource in relevant institutional entities, is essential for an effective MRV system (WRI 2013).

Factors considered to determine approach are Drivers and Types of MRV, and Commonalities and Differences in Institutional Arrangements (IA).

Drivers and Types of MRV: Based on national circumstances and objectives (including but not limited to domestic and/or international reporting use), a country may prioritize specific drivers and types of MRV and accordingly structure their IA to deliver on these priorities. The range of drivers includes:

Domestically, a country may be keen to track a range of activities including national targets, policies, projects, and inventory at sub-national, corporate, faculty, and product levels hence design their Institutional Arrangements to ensure transparency in reporting of the GHG mitigation effects; design and evaluate policies and actions; quantify mitigation actions in terms of emissions reductions and other non-GHG impacts; facilitate support; and enable financing.

These MRV's may be adapted to contribute to meeting international reporting requirements such as national GHG inventories, BURs and the MRV of NAMAs.

Commonalities and Differences: There is no single set of IA that can be considered "absolute best practice" as of now, but there are commonalities as well as differences in how countries have chosen to approach institutional arrangements.

The table below highlights some of these elements and how the MRV environment in Nigeria compares:

Table 11: Comparison of Commonalities and Differences vs RTS MRV Institutional Arrangements

Commonalities and Differences vs Nigeria's RTS MRV Institutional Arrangements Status Quo	
Commonalities	**Nigeria's RTS MRV Institutional Arrangement**
Coordinating body/Lead institution Most countries have a designated lead institution, usually the Ministry of Environment or equivalent to coordinate the MRV system and direct the activities of other actors in this area.	The Federal Ministry of Environment
Inter-ministerial body/Steering Committee Promotes coordination across key stakeholders and ensures input into other national processes and plans.	The MRV Focal Point and Steering Committee, DCC within the Federal Ministry of Environment coordinates
Technical Coordinator(s) The technical coordinator, which may take the form of a team or individual, often sits within the lead institution and is responsible for the technical outputs of the MRV system. Technical coordinators may also be designated for each of the sectoral working groups.	MRV Focal Point in the DCC and the National Project Coordinator
Sectoral Working Groups Countries also often designate separate working groups to conduct MRV activities within a specific sector. These teams comprise a combination of governmental institutes, research organizations and other public and private sector bodies or individuals.	No specifically defined, designed, setup, and standing/permanent Sectoral Working Group within the Road Transport Sector in most of the stakeholder entities – FRSC, DRTS/VIO, NITT, NADDC, NARTO, NURTW. Private sector stakeholders are yet to confirm status.
Differences	**Nigeria's RTS MRV Institutional Arrangement**
Scope of the System The actual scope of the MRV system varies widely from country to country. While some countries have opted to develop integrated national systems that cover both domestic and international reporting requirements, other countries have taken a more bottom-up approach to MRV with the national GHG inventory remaining the only top-down, national level component to the system.	The MRV System is, at best, largely in pockets of efforts and yet to be integrated hence limits the scope of the reporting system.
Verification Institution(s) Different approaches have been used by countries to tackle verification – government agency or independent third-party verification service providers.	This is not yet available
Centralized Institutional Arrangements for GHG Data Management Some countries have developed a centralized system for data management with all information centralized within the lead institution for compilation and analysis. Where MRV systems are bottom-up, much of the data management, collection and storage takes place in a more decentralized way.	The FMEnv is positioned to achieve this but the different MRV efforts, where they exist, are yet to be consolidated and where absent, yet to be kick started and pulled into a centralized structure. Subject to institutional review, the Standards Organization of Nigeria may be an institution positioned to bear the mandate of enforcement.
Regulations' Compliance Body Like verification institution, compliance bodies can also range from a government entity to third party compliance enforcement arrangements.	The FMEnv currently performs the increasingly conflicting roles of policy development, oversight, verification, regulation, enforcement, etc. This is counterproductive and unlikely to foster transparency and credibility.

Transport is a "system of systems" and resilience of each transport mode to the impact of future GHG patterns along the entire network of global supply chains warrants consideration so that GHG impacts, risks, and vulnerabilities across transport modes especially in Road Transport Sector – the biggest emission contributor in the Transport Sector, are identified and sustainably addressed.

There is growing clarity that transport modes and their infrastructure - seaports, airports, rail routes, roads, inland waterways - have a collective interdependence on each other. This interconnectivity and interdependence also apply to the sectors' stakeholder environment.

Figure 8: Project Stakeholder Environment
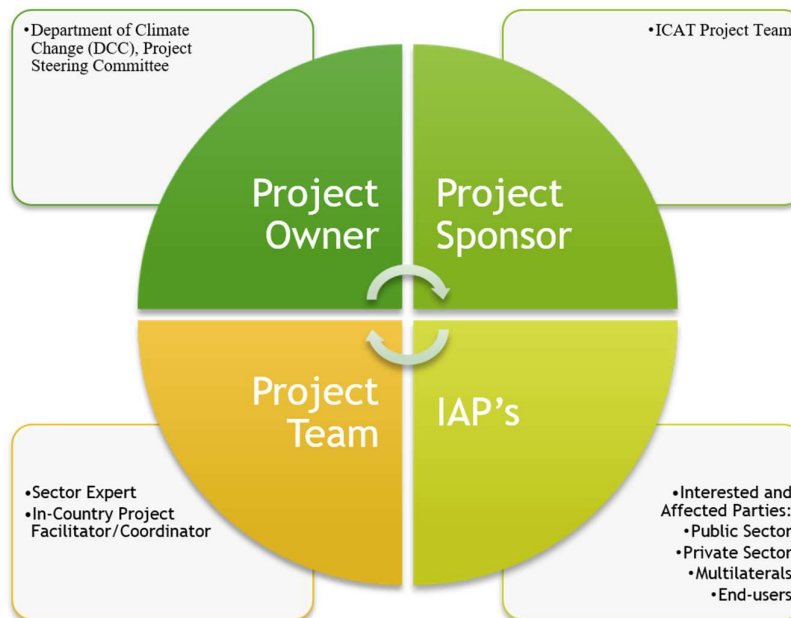
Within the project environment, the stakeholders (IAP's) are batched and described as follows:

- Cross-Cutting: This includes institutions that have financial, coordination, regulatory, operating, impacting, and/or reporting responsibilities and/or influencing on the RTS as well as OTS.
    - Governmental MDAs such as FMoEnv, Federal Ministry of Transport (FMoT), Federal Ministry of Finance, Budget, and National Planning (FMoFB&NP), Federal Ministry of Works & Housing (FMoW&H), Central Bank of Nigeria (CBN), NBS, DPR, Petroleum Equalization Fund (PEF), the bicameral National Assembly (NASS), Nigeria Customs Service (NCS), etc.
    - Non-Governmental Aid/Multilateral such as ICAT, UNDP, etc.

- Governmental Sector-specific:
    - **Aviation**: Federal Ministry of Aviation (FMoAv), Federal Airports Authority of Nigeria (FAAN), Nigerian civil Aviation Authority (NCAA), Nigerian Airspace Management Agency (NAMA), Nigerian College of Aviation Technology (NCAT), Nigerian Meteorological Agency (NIMET)
    - **Marine**: Nigerian Ports Authority (NPA), Nigerian Maritime Administration and Safety Agency (NIMASA), Nigerian Shippers Council (NSC), National Inland Waterways Authority (NIWA)
    - **Rail**: Nigerian Railway Corporation (NRC)

o **Road**: Federal Road Safety Corps (FRSC), Directorate of Road Traffic Service (DRTS more commonly known as VIO), National Automotive Design and Development Council (NADDC), Nigerian Institute of Transport Technology (NITT), etc.

- Non-Governmental (heavy road use operations) Private Sector such as Dangote Group, BUA Group, Nigerian Association of Road Transport Owners (NARTO), National Union of Road Transport Workers (NURTW), etc.

The respective stakeholders (batched) and their roles are as shown below:

Table 12: Nigeria's Road Transport Sector MRV – Broad Stakeholder Outlook

STAKEHOLDERS	ROLES
Executive Arm: The Presidency	• Prepares Executive Bills, for legislation by National Assembly. • Gives (or withholds) Assent to any bill passed by National Assembly. • Sometimes, issue Executive Orders to address urgent issues that cannot, for a host of reasons, wait for the usually long process of being passed by the National Assembly.
Legislative Arm: The Bicameral National Assembly	• Treats every bill (Executive Bill or Individual Bill) on climate change, environment, and ecology for passage or otherwise. Thereafter, sends bill to Executive Arm for assent or otherwise. • Carries out oversight functions on Federal Ministry of Environment (FMEnv) and other Agencies under its control.
Principal Advisory and Implementing Arm: Ministries,	FMEnv • Drives Policy Development • Responsible for providing responses to climate change, through its specialized Divisions (DCC, I&FF, Mitigation, Adaptation, etc). • Designated National Authority (DNA) for CDM Projects. • Coordinate's climate change arrangements nationally and internationally • Responsible for the preparation and submission of National Communication (NCs) to UNFCCC • Co-ordinates the activities of the Policy Advisory Body ICCC - ICCC a body empowered to assemble, on a single platform, multi-sector stakeholders including those in businesses, organizations, ministries, etc. to work together
Principal Advisory and Implementing Arm: Ministries (NRCC Members)	• Federal Ministry of Transport (FMoT) • Federal Ministry of Aviation (FMoAv) • Federal Ministry of Finance, Budget, and National Planning (FMoFB & NP)
Advisory and Implementing Arm: Departments & Agencies (MDAs)	Provides generalized data and currently nothing on sectoral and country specific GHG emissions or factors. • National Bureau of Statistics (NBS) • Central Bank of Nigeria (CBN) Can provide operating unit importation, shipment, and bulk movement volume data but currently does not provide any data on sectoral and country specific GHG emissions or factors. • Nigeria Customs Service (NCS) • Nigerian Ports Authority (NPA) • Nigerian Shippers Council (NSC) • Nigerian Railway Corporation (NRC)

STAKEHOLDERS	ROLES
	Provides more specialized data/information on aggregated energy consumptions, through annual bulletins useful for National Climate Action Policy formulation and implementation. • Nigerian National Petroleum Corporation (NNPC) – plays dominant role • Department of Petroleum Resources (DPR) • Petroleum Equalization Fund (PEF) • Petroleum Products Marketing Company (PPMC)
Advisory, Reporting and Implementing Arm: Departments & Agencies (MDAs)	Presently, not actively involved in climate Actions Policy or Climate Change issues and no MRV structures within • Federal Road Safety Corps (FRSC) • Directorate of Road Traffic Service (DRTS more commonly known as VIO) • National Automotive Design and Development Council (NADDC) • Nigerian Institute of Transport Technology (NITT)
Non-Governmental Organizations: International, Multilateral Donors	Provides funding and/or Technical Support for the development of MRV Systems. • ICAT • UNFCC
NGOs (Awareness): Local NGO's	Pressure Groups creating awareness of Climate Change Actions' policies in the society and influencing Climate Policy Formulations and implementation through Legislative processes. • Various Climate interested NGO's
NGOs (Operating, Reporting, and Implementing): Private Sector Businesses	Can support Government in Climate Actions' Policy implementation through investments and resource commitments/utilization e.g., investments in Green Business Projects aka GHG Emissions Abatement Projects • BUA Group • Dangote Group • NARTO • NURTW

5.2.1 Description, Challenges and Gaps

The challenges of MRV IA varies from country to country as well as sector to sector and institution to institution. Though arrangements for national reporting have evolved throughout the history of the Convention and its Kyoto Protocol into a more comprehensive measurement, reporting and verification framework, at this point in time, due to the diverse circumstances of developing countries, the existing "best practice" framework(s) cannot be said to be "*one size fits all without the need for context-sensitive adaptation to ensure that it recognizes and factors in respective national circumstances and objectives*" hence Nigeria, like other developing countries ideally (need to) review lessons of experience from countries that have attempted the development of MRV Systems and context-sensitively extract and adapt pillars that been found useful in those countries to develop their respective sector and country-specific MRV Systems.

The existing IA for MRV and Stakeholder Identification are characterized by the following challenges amongst others:

• The dynamics of MRV (scope, objectives, and context) and its intended transformational role, are yet to be universally appraised and understood in RTS Modal stakeholder entities at workforce, management, and ownership levels.

- Non/misaligned and conflicting stakeholders' interests, motives, political biases, and differing approaches negatively impact Climate Actions Policy formulations and implementation.
- Design and alignment of all the critical elements – structures, systems, processes, procedures, methodologies, institutional arrangements, domestically-generated data, and knowledge product in proper perspective, in line with National circumstances, to aid domestic measuring, reporting and verifying efforts.
- Absence of appropriate legal and regulatory frameworks on climate change issues to support Institutional Arrangements and to influence climate actions' policy when situations call for it e.g. Mainstreaming CC issues into the National Vision (NV), Annual Budgets, National Development Plans etc. This causes stakeholder disinclination in the Donors, International Bodies' commitment in supporting the implementation of; and
- Political will and policy instability or risk of policy summersault may lead to disinclination of the aid and private sectors to support Climate Actions' Policies and implementation of same. Etc.

Gaps and Needs Analysis of MRV System in Road Transport Sector

- Gaps and Needs Analysis (or Situation Analysis), is required to understand the status quo of the MRV System in Nigeria's Road Transport Sector to be able to chart a path to a desired future approach in line with best practice.
- The table below highlights identified gaps matched with appropriate, needs/interventions/approaches that can be deployed to resolve them:

5.3   Review of Existing MRV Framework – Road Transport

Transport represents almost a quarter of GHGE and is the main cause of air pollution in cities. The transport sector has not seen the same gradual decline in emissions as other sectors. Within this sector, road transport is by far the biggest emitter accounting for more than 70% of all GHG emissions from transport.

With the global shift towards a low-carbon, circular economy already underway, Nigeria should begin to consider sustainable, incremental, and scalable climate friendly responses to the increasing mobility needs of people and goods.

Presently, a larger percentage of the movement of people and all types of goods all over the country is handled by road transport. The major result of the predominant use of road transportation over all the other modes are environmental problems and high frequency of road traffic accidents on Nigerian roads.

Nigeria has a about 193,200km of roads made up of 34,123km of Federal Trunk A Roads, 30,500km of State Trunk B Roads and 129,577km of Local Government Trunk C Roads. There has also been a tremendous increase in the total number of new vehicle registrations since the 1960s except for slight declines during the civil war (1967-70) and during periods of downturn in the country's economy (Tosin O. 2011)

The RTS suffers from the following challenges that limit success in addressing climate change issues:

- Institutional arrangement: The FMoT is the coordinating ministry of the road transport environment. The Ministry does not construct roads (neither does it have much if any influence

in road construction, improvements, PPP's, etc.) but formulates the policies on road transport and monitors its implementation.

- Infrastructure: Inadequacy of connections and poor maintenance which has given rise to increasingly decaying infrastructure
- Policy: Inadequate, inconsistent, and disjointed climate action policy environment in the RTS
- Operations: Deficiencies and misuse e.g., disregard for axle load ratings
- Finance: Inadequate funding of new roads, improvements, and maintenance as well as MRV system requirements. Also, the government is unable to unlock private sector participation in the form of well-structured and depoliticized Public Private Partnerships arrangements.

There are several Mitigation measures. Depending on national circumstances and objectives, they are best combined for complementarity values.

- Set ambitious emission reduction targets and define realistic incremental fuel consumption standards,
- Graduated Vehicle Excise Duty reflective of engine sizes,
- Tax based on fuel consumption,
- Vehicle fleet renewal/recapitalization program,
- Vehicle fuel efficiency classification and labelling program,
- Alternative fuels and technologies,
- Fiscal disincentive measures to discourage private car use,
- Improvement of road traffic flow,
- Land use improvements e.g., to reduce sprawl,
- Transport and travel demand management,
- Pedestrianization of inner cities,
- Set targets for switch in transport modes and target - reducing the use of private cars for intracity commute; increasing the use of public bus transport; reducing noise levels; reducing road crashes; controlling parking and reducing the capacity of the main streets; developing "quiet zones"; keeping transit traffic out of the city centers; etc.
- Develop a strategic network of passenger and freight multimodal interchanges,
- Switch freight to rail.

5.3.1   GHGE Reporting and Mitigation Actions

GHGE Reporting is useful for crystallizing the minds of decision makers as to processes undertaken/missed and outcomes/consequences thus aiding improvements in decision making.

Even though RTS has been established to contribute about 70% of the approximately 30% GHGE from the Transport Sector, there is yet to be a completely, if any/much, structured MRV system arrangement in the Road Transport Sector.

This project will hopefully synchronize all the pockets of efforts, plug the gaps, and present an integrated, far-reaching, and workable MRV systems, structures, processes, and procedures for going forward application in the RTS.

5.3.1.1 Description, Tools, Challenges and Gaps

There is no formal IA for MRV in any of the public sector stakeholder organizations in the RTS yet.

The DCC needs to treat this as a matter of urgency and ensure that each of these institutions have CC Desk Officers responsible for coordinating MRV amongst other CC action plans within each stakeholder entity.

5.3.2 Existing Methodological tools for MRV

Several carbon-footprint-related assessment tools have been developed over the years for varying objectives. Some of the existing tools for MRV are as table below:

Table 13: Existing MRV Tools

Developer	Tool	Description
ICAT	PROSPECTS+	Tracks and projects overall and sectoral GHG emissions trends
	GACMO	Calculates and tracks GHG reduction and economic effects
	Climate Action Aggregation Tool	Identifies, quantifies, and aggregates the impact of sub-national and non-state actions
	Policy Assessment Guides	Assesses impacts of climate policies and actions
GHG Protocol	GHG emission accounting tool	Calculates emissions from personal vehicles, public transport, and mobile machinery
US EPA	The Motor Vehicle Emission Simulator (MOVES)	Estimates emissions from cars and trucks. under different user-defined vehicle operating characteristics and road types
EEA	EMEP/EEA methodology (implemented in COPERT tool)	The origin of vehicles Europe or US is an important indicator for the tool's applicability. (UNECE/EMEP Task Force on Emissions Inventories and Projections (TFEIP))
Transport Authorities Greenhouse Group Australia and New Zealand	Carbon Gauge	Estimates GHG emissions from road projects
GIZ	MRV Tool	Guide countries through the process of setting-up a national MRV system
New Climate	Trace	Transport sector climate action co-benefit evaluation tool

5.3.2.1 Description, Tools, Challenges and Gaps

The core challenge is that existing tools are yet to be widely deployed and properly understood within the RTS hence the resultant gap of "no" MRV systems in most, if any, of the road transport sector entities.

This establishes the need for a context-sensitive approach to policy, funding, deployment, training, and capacity development in the RTS for stakeholders to take ownership for and deliver on MRV actions for Nigeria.

This project is expected to conclusively (characterize strategic and implementable approaches to) address the challenges and gaps in Nigeria's Road Transport MRV.

Table 14: Needs and Gaps Analysis under Road Transport

Components	Gaps	Needs
1. Institutional Arrangements	• Institutional Arrangements for MRV Systems on GHG Inventory, Mitigation Actions and Support for Road Transport Sector is currently non-existent or at best loose and unstructured, both at sectoral and national levels. • Linkages between Road Transport sector stakeholders and the DCC of Federal Ministry of Environment (FMEnv) is yet to be fully consolidated hence even where there are attempts to engage, outputs are too watery to meet UNFCCC Reporting Requirements' standards.	**Institutional Governance** • Set up cohesive Institutional Governance Structures, supported by appropriate legal and regulatory mechanisms, that will enable them to function well. • Create high volume awareness amongst managerial and workforce of every transport mode, of the importance, relevance, and benefits of MRV System at sectoral, MDAs and National levels as well as private and non-governmental sectors. • Put in place a process to continually document and share lessons of experience on best practices, amongst transport agencies, through exchange of knowledge products.
2. Data environment	• Data Collection, analysis, and archiving, particularly GHG Emissions-related in road transport sector organizations, are extremely poor and data automation level is abysmally low. • Lack of disaggregated data on GHG Emissions directly from Road Transport modes (as transport is already subsumed in energy sector, as a unit or sub-sector), is apparent and this has contributed to loss of direct historical data on GHG Emissions and Inventories in Road transport sector. • Data gathering is extremely limited in scope and context, as GHG Emission-related data are not directly captured as expected. • Absence of comprehensive of GHG Emissions-related data, makes it difficult, for emissions reductions quantification.	**Data systems** • Provide support for setting up data collection and archiving mechanisms (procedures, processes, timelines) for MRV System in Units/Divisions/Departments for Road Transport modes, for sake of credibility, transparency, efficiency, completeness, and effectiveness.

Components	Gaps	Needs
3. Technical Expertise	• Absence of technically – sound and professionally – competent experts on climate change and its related issues (i.e., GHG Emissions estimations/calculations, inventory management, Mitigation Actions, QA/QC etc.) is real in these transport agencies. • Non-availability of specifically – tailored, web-based training materials on mitigation of climate change, GHG Emission' estimations, GHG Inventory and support being sought.	**Capacity Building** • Capacity-Building Efforts (i.e., development of human capacities in technical areas of GHG Emissions' Data Collection, Analysis, documentation, and archiving, GHG Emission' estimation/calculations, calculation of Road Transport's sectoral or modal emission factor; Data Reporting; Use of IPCC 1996, 2006, 2019 Guidelines etc., methodologies and approaches etc., as a way to help in the preparation of GHG Inventories Report, (NIMP), NCs, BURs, correctly, timely and transparently. • Specific Training to acquire skills on how to estimate fugitive emissions from transport sector especially from fuels combusted at costal, inland, and deep-sea fishing activities (within national frontiers). • Deliberateness in terms of context-sensitive design of MRV System trainings to cater for all levels of involvement and responsibility.
4. Finance	• Limited financial support to develop and operationalize a Domestic MRV System (Sectoral and National) on a continuous basis; is obvious.	**Climate Finance/Support** • Emplace appropriate mechanism to secure and implement climate finance/support from donors or international climate change bodies.
5. Sectoral Baselines	• Absence of sectoral baselines for the transport modes, especially rail, navigation/water, and Air is real.	**Baseline Development** • Assist Road Transport modes/Agencies/stakeholders, to set up their respective baselines and appropriate methodologies to serve as lead towards identifying the key categories that are equally influencing the country's total GHG Emissions in Road Transport Sector (RTS) that are notably recognized by IPPC 2006, 2003, 2000 Good Practices Guidance.
6. Set Target	• Nigeria has balanced ambitious mitigations economy-wide target, but there is no ambitious mitigation targets-set in Road Transport Sector.	**Define Targets** • Define SMART mitigation targets in Road Transport Sector.
7. Sectoral Emissions Factor	• Non-existing Nationally Approved, Sectoral Emission factor for Road Transport sector.	**Sectoral Emissions Factor** • Define and publish nationally approved, Road Transport Sector Emission factor

Components	Gaps	Needs

8. Regulatory Framework and Policies	• Legal and Regulatory mechanisms, where available, are not cohesive and strong enough for Road Transport institutions, to perform their roles and carry out their responsibilities.
	• Difficulty in monitoring and correlating Government Policies due to improper co-ordination and poor perception or awareness of climate change issues amongst Government officials, in transport agencies; is pervasive. Many policies on GHG emissions are broad in scope and not structured to address direct concerns on Climate Change in Road Transport Sector.
		Regulatory Framework and Policies
		• All hands must be on deck to ensure the prompt passage of the Climate Change Bill to establish and strengthen institutional arrangements/governance structure and mainstream climate change into national vision, planning, budgeting, and implementation at sectoral and national levels with a view to:
		   o Implement climate change plans, strategies, policies, within Enhanced Transparency Framework (ETF).
		   o Establish legal mechanism, which will help to operationalize the NDCs' sectoral and national responses to climate change and providing a Tilt or Push towards low-carbon emissions development.
		   o Facilitate the establishment of MRV Units/Divisions/Departments in Road Transport Sector (RTS) modes and at Federal Ministry of Transport (FMoT) and Federal Ministry of Aviation (FMoAV) and its Operationalization.
		   o Mandate the Federal Ministry of Environment (FMoEnv), through the DCC to coordinate all climate change activities at Sectoral, State and National levels and ensuring that a National Registry, where all NAMAs, by both private NGOs and public bodies, are deposited or submitted for further actions.
		   o Facilitating the establishment of National Climate Change Council (NCCC) and Nigeria Climate Change Fund (NCCF), both as Enablers to GHG Emissions Reductions and other climate change issues.
		   o Giving both general and specific guidelines on setting-up of an entity that will articulate and co-ordinate activities on data-gathering and data-sharing as well as reporting, as and when due.

6.0   Other Transport Sectoral MRV

6.1   Introduction

The continual increase in global warming, as occasioned by anthropogenic activities, has caused a lot of tension, and generated a lot of attention as well, to the impacts of climate change. To remedy the impacts of climate change on lives and human sustainable developments, most countries in the world came together and agreed to work in concert, on a continual basis, though voluntarily, towards ensuring abatement in GHGE, to stabilize land temperatures at 2^0C, through the actualization of individual countries NDCS, in accordance with Paris Agreement, 2015. To this effect, the UNFCCC, - a body charged with the primary mandate to institutionalize, co-ordinate and strengthen all processes and modalities to actualize the global responses to abate the growing GHGE by promoting mitigation actions to checkmate the temperature increase/rise to as low as 2^0C or even better, by 2030; has not looked backwards in its strides.

In years past, reporting of GHGE, Inventories and Mitigation Actions and other related issues in Nigeria and other Non-Annex Parties (NAP I countries), have been on an "AD-HOC" basis, thus making such reports to be suspect, loose, non-transparent and not too credible. However, in order to engender uniformity, credibility, transparency, comparison and consistency, a more pragmatic and reliable tool – "MRV" System was introduced by UNFCCC, to track GHG Emissions and Inventories and capture the performances of NDCs, through mitigation actions and secure climate finance/support, by Non-Annex I Parties, (of which Nigeria, as a developing country is one), makes an avowal to adopt.

MRV System, as a tool, is aimed at primarily ensuring that quantitative and quantitative data, to be presented to UNFCCC (as directed by Paris Agreement), through NC (Every 4 years) and BUR (Every 2years) by Non-Annex I Parties, are credible, reliable, transparent, consistent, and internationally acceptable.

In many of these Non-Annex I Party (NAP-I) countries, of which Nigeria is one, the development and operationalization of a Domestic MRV System, at both sectoral and national levels, have been an issue of great concern, because of the Gaps, Constraints and Needs associated with it.

6.2   Existing Institutional Arrangements and Stakeholder Identification

6.2.1   Description, Challenges and Gaps

The United Nations Development Programmes (UNDP) defined Institutional Arrangements (IA) as the ……" Policies, systems and processes that organizations use to legislate, plan and manage their activities efficiently and to effectively co-ordinate with others to fulfill their mandate" (UNDP). Institutional Arrangement also connotes formal organizational governance structures and informal structures that are necessary for formulating, organizing, and implementing policies in any Government setting, at all levels – Federal, Sectoral/MDAs, State and Local Governments.

These informal structures include the General Public, NGOs, private business concerns, business groups, pressure groups or any group that have any direct or indirect interests in or influence on Climate Change issues. It can also be described as a "Network" of organizations or groups that are involved in organizing, planning, supporting, and implementing climate Actions' (Mitigation and Adaptation) Policies, Projects, Projects, and Practices. IA encourage good and proper linkages between and amongst entities and bodies at all levels of Government on one hand and between Government and informal Groups (NGOs, Business Groups, Donors, Pressure groups, Community leaders), on the other. However, when IA is discussed, relevant issues such as finance, Human Resources, Equipment, facilities, Supplies, leadership, and communication process between and amongst formal and informal organizations are also taken into consideration. It should also be stated that where legal framework is found to be weak, IA can help in improving it and addressing the associated challenges.

One may therefore, be tempted to ask: Why emplacing Institutional Arrangements for MRV? IA for MRV System is very important to:

- Help a Country or an organization to design and evaluate policies and actions.
- Ensure Transparency in the reporting of GHG Impacts.
- Improve existing Institutional Mechanism for measurement and evaluation.
- Seek and obtain climate support (i.e., finance, capacity building, technology, and technology transfer)
- Quantify Mitigation Actions, in the form of GHG emissions' abatements and non-GHG effects.
- Meet the International Reporting Requirements (IRR) such as production of National GHGI, BURs, and MRV of NAMAs.
- Implement Policies and activities and Support received.
- Track a lot of climate activities, domestically and internationally.

Domestically, MRV can be used to track attainment of Targets, Policy Implementation, Project Implementation, Sub-national inventory (State or Local Government) or sectoral inventory, corporate/organization's GHGE (within given geographical spread or boundary), facilitate GHGE Inventory (i.e., from a single operating company) and product level (i.e., carbon footprint of a single product, from beginning to end).

Internationally, MRV is used as a tool to fulfil or meeting the International Reporting Requirements (IRR) such as NCs, BUR and MRV of NAMAs.

One of the greatest issues facing countries or organization in setting up IA for MRV is the Question of whether to continue to manage or tolerate the existing IA, with all the deficiencies or abandon the existing ones and establish a new set of IA; purposely for the MRV System. Again, another challenging issue to many countries is, which approach to adopt in designing their IA for their Domestic MRV System. Should it be the "Top-Down" Integrated National MRV System or" Bottom-Up" approach that lays emphasis on a specific policy, project, action, or region? However, there is no single 'best' IA yet, universally, because of differences and commonalities (or similarities) involved. National Circumstances and Objectives of individual countries, largely determine which IA is best suited for any country. Below, shown in tabular form, are the key elements of these similarities/commonalities and differences of Institutional Arrangements universally.

Table 15: Similarities and difference in the Institutional Arrangement

SIMILIARITIES	DIFFERENCES
1A. Co-ordinating National Entity/Authority. **To drive MRV System and ensure good linkages with all stakeholders.** **(e.g. Federal Ministry of Environment (FMEnv) Department of Climate Change) Nigeria.** **(ii) An Inter-Ministerial Agency.** **To promote an across-board** **Co-ordination amongst stakeholders and facilitate process of mainstreaming MRV into National Visions and National Development Plans. (i.e. special climate change unit, SCCU of FMEnv, Nigeria).** **(iii) Technical Co-ordination Unit: This is peopled by experts that are responsible for ensuring the technical outputs of the MRV System. (e.g. Technical Working Group, of FMEnv, Nigeria)** **(iv) Sectoral Working Group: This is comprised of Experts from Government Agencies/MDAs, research bodies and concerned private and public sectors.**	(i) Scope of the System There is no integrated National MRV System (i.e Top-Down' Approach) that meets both Domestic and International Requirements, presently in Nigeria. Only 'Bottom-Up' Approach, to track National GHG Inventory and specific Policies/NAMAs, is in use in Nigeria. (ii) Verifications Institutions. Different Verifiers (Government Agency or an Independent third party) may be engaged to do so. (iii) Centralized Institutional Arrangements for GHG Data Management. None yet in Nigeria's climate industry. (iv) Regulations' Compliance Body.

From the table above, these inferences could be made:
- No Sectoral working group presently in OTS modal agencies (i.e NRC, NPA, NIMASA, NIWA, NCAA, FAAN)
- Non-Existence of integrated MRV System (Sectoral, National and level wise) in Nigeria and thus limits the scope of the reporting system.
- Absence of centralized GHG-Data Management system in Nigeria's Climate Change Industry.
- No Regulations' Compliance /Enforcement Body in the climate change industry. The present situation where FMEnv performs the oversight function of regulations' enforcement, negates the principles of fairness, transparency, and credibility.

Both IA and Stakeholders' Identification are inter-twined in the treatment of MRV System. Whilst the former talks about processes, systems and policies, the later talks about the human resource that

breathes life into the former, for it to be workable and meaningful. Albeit there are methods and criteria for undertaking stakeholders Identification.

The presence of multi-stakeholders in Nigeria's OTS that is notably known for GHGE, and associated CC impacts poses a great challenge in areas of CC Institutional Governance. At present, the stakeholders in Nigeria's OTS include the following:

Table 16: Stakeholders in the other transport sector

STAKEHOLDERS	ROLES
1. The Presidency: (Executive Arm)	• Preparation of Executive Bills, for legislation by National Assembly. • Gives (or withholds) Assent to any bill passed by National Assembly.
2. The Legislature/National Assembly (or the Parliament) **(The legislative Arm)** **National Assembly is made up of:** **- House of Representatives and** **- The Senate**	• Treats every bill (Executive Bill or Individual Bill) on climate change, environment, and ecology for passage or otherwise. Thereafter, sends bill to Executive Arm for assent or otherwise. • Carries out oversight functions on Federal Ministry of Environment (FMEnv) and other Agencies under its control.
3. Ministries, Department & Agencies (MDAs)	
(A) Ministries: **A1. Federal Ministry of Environment (FMEnv)**	• Is the main National Body generally responsible for providing responses to climate change, through its specialized Divisions (Mitigation, Adaptation). • Is the officially recognized, even at international level, as the Designated National Authority (DNA) for CDM Projects. • Through its SCCU (Special climate change unit), coordinates climate change arrangements nationally and internationally and responsible for the preparation and submission of National Communication (NCs) to UNFCCC. Co-ordinates the activities of the ICCC - a Policy Advisory Body. (ICCC has since 2009, been transformed to NRCC (National Roundtable on climate change) with more powers to assemble multi-stakeholders, especially those in businesses, organizations, ministries, to be on a single platform and work in tandem.
A2. Federal Ministry of Transport (FMOT) **A3. Federal Ministry of Aviation (FMOA)** **A4. Federal Ministry of Budget and National Planning.**	• Serves on Inter-Ministerial Committee on climate change. • Serves on Inter-Ministerial Committee on Climate Change. • Serves on Inter-Ministerial Committee on climate change.
B. Departments & Agencies **B1. Nigerian Railway Corporation (NRC) Rail Sub-sector.** **B2. National Inland Waterways (NIWA) Navigation Sub-sector.**	• Presently, not actively involved in climate Actions Policy or Climate Change issues. • Presently, not actively involved in climate Actions Policy or Climate Change issues. • Presently, partially involved in climate Actions Policy or Climate Change issues. • Presently, partially involved in climate Actions Policy or Climate Change issues.

B3. Nigerian Ports Authority NPA (Marine sub-sector) B4. Nigerian Civil Aviation Authority (NCAA). B5. National Bureau of Statistics (NBS) B6. Nigeria National Petroleum Corporation (NNPC) (Oil Sector)	• Provides National Statistics/Data but not specialized data on GHG-emissions related data e.g sectoral and country-specific emissions factors. • Provides data/information on aggregated energy consumptions, through its annual bulletins. • Plays dominant role in National Action Policy formulation and implementation.
C1. NGOs Group.	• Serves as the Pressure group or mouthpiece in the climate change milieu. • Creates awareness of climate change Actions' policies in the society. • Influences Climate Policy Formulations and implementation through Legislative processes
D. Business Group	• Supports Government in climate Actions' policy implementation through investments and commitments of resources, so as to ensure stability e.g. investments in GHG Emissions Abatement Projects, which is also referred to as "Green Business Projects"
E. Donors and International Bodies	• Stimulates the implementation of climate Action's policy, through financing of training and public enlightenment programmes, technology, and capacity building measures. • Collaborates with NGOs (on climate change matters), Government Agencies to work through, its programmes.

The above table gives a summary pictures of the existing stakeholders in Nigeria's OTS with a clear revelation that MDAs like NRC, NIWA, NPA, NCAA do not have existing IA for MRV System and that only a few of them as at now, been actively involved in Climate Actions Policy or CC Issues.

Challenges
The existing IA for MRV and Stakeholder Identification are characterized by these challenges:
- The major challenge of domestic national MRV System in Nigeria is the difficulty in designing and aligning all these critical elements-processes, methodologies, institutional arrangements, domestically generated data and knowledge product in proper perspective, in line with National circumstances, so as to aid domestic measuring, reporting and verifying efforts.
- The scope, objectives, and context of MRV and its intended transformational roles, are yet to be propagated and understood in OTS Modal Agencies.
- Low knowledge and appreciation of MRV as a tool, in both the workforce and management team levels in OTS' Modal Agencies.
- Multi-faceted stakeholders' interests, motives, political biases and differing approaches, are variously contending for attention and negatively affecting Climate Actions Policy formulations and implementation.
- Apathy and bureaucracy-induced lethargy have both bogged down existing IA, to a level of inefficiency on the part of FMEnv's responses to climate change issues. This informed past call

by some critical and vociferous stakeholders (especially NGOs) for the scrapping of existing IA and replacing it with a new one that is more vibrant, efficient, and effective. This call created two opposing parties, with differing opinions. The first group proposed that an NCCC Bill (National Climate Change Commission Bill), be legislated upon and passed by the National Assembly and sent for the Presidential Assent, to make it a National Law. By this, an Agency, NCCC would be established, to be independent of FMEnv but made directly answerable to the Presidency.

The Second opposing group would rather prefer the establishment of an Agency, that would be directly under the control and supervision of FMEnv, as it accused the proponents of NCCC Bill of collusion with Parliamentarians to deliberately whittle down the powers and emasculate FMEnv, because of their vested interests.

- Absence of appropriate legal and regulatory frameworks on climate change issues to support Institutional Arrangements and to influence climate actions' policy when situations call for its e.g. Mainstreaming Climate change issues into the NV, Annual Budgets, National Development Plans etc. This also discourages Donors, International Bodies' commitment in supporting the implementation of Climate Actions' Policies.

- Dearth of political support for Business Investors to protect and stabilize their investments in GHGE Mitigations Projects.

Gaps and Need Analysis

The Gaps and Needs Analysis (or Situation Analysis), as a strategic planning tool, is required in understanding the MRV System in Nigeria's Other Transport Sector, its status quo, its future situation, and ways of reaching or getting to the future.

What are the Gaps?
- Data Factor:
  Data Collection, analysis, and archiving, particularly GHGE -related in these transport organizations, are very poor and data automation level is still very low. Lack of disaggregated data on GHGE directly from Other Transport modes (as transport is already subsumed in energy sector, as a unit or sub-sector), is apparent and this has contributed to loss of direct historical data on GHGE and Inventories in transport sector. Data gathering are very limited in scope and context, as GHGE -related data are not directly captured as expected. Absence of comprehensive of GHGE -related data, makes it difficult, for emissions reductions quantification.

- Institutional Arrangements
  IA for MRV Systems on GHG Inventory, Mitigation Actions and Support are non-existent, both at sectoral (other transport) and national levels, and where there is any semblance, it is very loose and weak.
  Linkages between Other Transport sectoral institutions with the DCC of FMEnv, where such exist, are not solid enough and information emanating from them are equally not technically – strong, to meet UNFCCC Reporting Requirements' standards.

- Technical Expertise
  Absence of technically – sound and professionally – competent experts on climate change and its related issues (i.e., GHGE estimations/calculations, inventory management, Mitigation Actions, QA/QC etc) is real in these transport agencies.

- Finance

  Limited financial support to develop and operationalize a Domestic MRV System (Sectoral and National) on a continuous basis; is obvious.

- Sectoral Baselines
  Absence of sectoral baselines for the transport modes, especially rail, navigation/water, and Air is real.

- Training
  Non-availability of specifically – tailored, web-based training materials on mitigation of climate change, GHG Emission' estimations, GHGI and support being sought.

- Legal
  Legal and Regulatory mechanisms, where available, are not cohesive and strong enough for Other Transport institutions, to perform their roles and carry out their responsibilities.

- Sectoral Emissions' Factor
  Non-existing Nationally Approved, Sectoral Emissions factors for Transport sector (or on modal basis)

- Policies
  Difficulty in monitoring and correlating Government Policies due to improper co-ordination and poor perception or awareness of climate change issues amongst Government officials, in transport agencies; is pervasive. Many policies on GHG emissions are broad in scope and not structured to address direct concerns on Climate Change in Other Transport Sector.

- Set Target:
  Nigeria has balanced ambitious mitigation economy-wide target, but there is no ambitious mitigation targets-set in other Transport Sector.

  What are the needs?
  As Nigeria is making great strides to develop its MRV Systems (GHGE, Mitigation Actions/NAMAS and Support/climate finance), sectorally and nationally, these NEEDS, must be identified for it to make fruitful contributions in reporting its efforts on NDCs implementations, to UNFCCC, through NC (every 4years), BURS and compiling its National Inventory Report annually. Some of these NEEDS are:

- Capacity Building
  Capacity-Building Efforts (i.e., development of human capacities in technical areas of GHG Emissions' Data Collection, Analysis, documentation and archiving, GHGE' estimation/calculations, calculation of Other Transport's sectoral or modal EF; Data Reporting;

Use of IPCC 1996, 2006, 2019 Guidelines etc, methodologies and approaches etc, as a way to help in the preparation of GHG Inventories Report, (NIMP), NCs, BURs, correctly, timely and transparently.

- Data
Provide support for setting up data collection and archiving mechanisms (procedures, processes, timelines) for MRV System in Units/Divisions/Departments for all Other Transport modes, for sake of credibility, transparency, efficiency, completeness, and effectiveness.

- Baseline Development:
Help with all Other Transport modes/Agencies, to set up their respective baselines and appropriate methodologies to serve as lead towards identifying the key categories that are equally influencing the country's total GHG Emissions in OTS that are notably recognized by IPPC 2006, 2003, 2000 Good Practices Guidance.

- Training

Specific Training to acquire skills on how to estimate fugitive emissions from transport sector especially from fuels combusted at costal, inland and deep-sea fishing activities (within national frontiers).

- Climate Finance/Support
Emplace appropriate mechanism to secure and implement climate finance/support from donors or international climate change bodies.

- Institutional Governance
Emplace good and cohesive Institutional Governance Structures, supported by appropriate legal and regulatory mechanisms that will enable them to function well.

- Awareness
Create an Awareness amongst managerial and workforce of every transport mode, of the importance, relevance, and benefits of MRV System at sectoral, MDAs and National levels as well as private sector and non-governmental levels.

- Lessons Learnt
Institute the process of sharing lessons learnt or experiences on best practices, amongst transport agencies, through exchange of knowledge products.

- Climate Change Bill
Purse, logically and quickly too, at the National Assembly, the Passage of Nigeria's Climate change bill, to an Act of Parliament, with a view to emplacing and strengthening IA/governance structure and mainstreaming properly, climate change into national vision, planning, budgeting, and implementation at sectoral and national levels with a view to:
  o Implementing climate change plans, strategies, policies, within ETF.
  o Establishing legal mechanism, which will help to operationalize the NDCs' sectoral and national responses to climate change and providing a Tilt or Push towards low-carbon emissions development.

- o Facilitating the establishment of MRV Units/Divisions/Departments in OTS modes and at FMOT and FMOA and its Operationalization.
- o Mandating FMEnv, through the DCC to coordinate all climate change activities at Sectoral, State and National levels and ensuring that a National Registry, where all NAMAs, by both private NGOs and public bodies, are deposited or submitted for further actions.
- o Facilitating the establishment of National Climate Change Council (NCCC) and NCCF, both as Enablers to GHGE Reductions and other climate change issues.
- o Giving both general and specific guidelines on setting-up of an entity that will articulate and co-ordinate activities on data-gathering and data-sharing as well as reporting, as and when due.

Notwithstanding, all these gaps and constraints, Nigeria is consciously working towards putting in place, a robust, workable domestic MRV System (Sectoral and National), in conformity with the PA, as espoused by UNFCCC, to meet 2030 NDCs' targets and to serve as a basis or linch-pin for the adoption of the new ETF, which canvasses mutual trust, confidence, transparency and promotion of an effective implementation of NDCs as demanded by Article 13 of the PA, December, 2015.

6.3   Review of Existing MRV Framework Other Transport Sector, OTS

Nigeria's ever-increasing population and expanding economy, have both challenged the OTS, to wake up to the clarion call and contribute towards engendering a low-carbon, high-growth sustainable developments as well as environmentally friendly society. Sadly, the poor state of infrastructure in OTS (in terms of inadequacy, decrepit state, poor maintenance culture), Policy Issues (Inconsistencies, lack of Transparency), Operational Deficiencies, Low level of investments and Inadequate private sector involvement have severally and collectively hindered OTS in addressing climate change issues.

In 2014, Nigeria took a bold step to address the critical infrastructural deficits in OTS, when the National Planning Commission (NPC) submitted the Nigeria's National Integrated Infrastructure Master Plan (NIIMP)'s Final Draft Report, (August 2014). This Report was broad in scope, content, and context, sectorally indicating Action Plans and Investment drive required to close the infrastructural gaps; so as to meet Nigeria's Growth Aspirations. The Main Focus of this Strategic Document is on promotion of Investments in Transport Systems (generally), proportionally to the growth in Nigeria's economy, to improve the nation's socio-economic benefits. Such investments are required in rehabilitation of major rail lines and construction of new, modern lines, renovation and upgrade of Airports and aviation facilities and systems improvements of inland waterway and maritime transport.

OTS, being a major player in Nigeria's Economy and enabler for other sector's growth and development, require gradual, sustained improvements in infrastructure, capacity expansion (through continual investments) and a conducive environment that encourage private sector participation (PPP) (Through legislative support, taxations, regulatory changes), for it to be effective. Also, more attention needs to be given to Policies on Integrated or Inter-Modal Transport System, which is seen as one of main drivers of Nigeria's Mitigation Actions, as explained in Nigeria's NDCs i.e., to reduce carbon/particulate emissions (NIIMP 2014, p.52). As such, CC, a slow-acting long term, with high Impact risks, affect all parts of human endeavors (including OTS), nationally and globally, in different ways, with resultant beneficial (positive) and catastrophic (negative) consequences but regularly require active virile and robust leadership to plan, evolve and take consistent climate actions (Mitigation and Adaptation) through P&M to minimize the impacts and vulnerabilities, respectively.

Railway

It is an established fact Rail mode does not emit much of GHG when compared to other modes. As such, it has great opportunity to improve its energy efficiency and to reduce its GHGE (particularly through electrification). Its ability to move freight in large quantities and passengers en masse, over a considerable geographical space, given economies of scale that reduces GHGE and fuel consumption per work done. It has great future potential in that there is ample room to use electrical energy that produces carbon-free emissions.

The Railway System in Nigeria is being managed by a Federal Government-owned Parastatal, Nigerian Railway Corporation (NRC) – a legal entity with a perpetual succession, to sue and be sued and is majorly responsible for rail construction, maintenance, and operations, as stated in the Enabling Act of Parliament – NRC Act 1955 (as amended in 2010). It is under the supervising control of the FMOT. The railway network in Nigeria, is comprised mainly of two networks:

- Narrow Gauge Lines with a total route kilometrage of 3,505km, and has been in existence since colonial era in Nigeria, from 1898. This network is made of two parallel lines, with the one on Western Line running from Apapa Seaport through the hinterlands to Nguru station, and the second one, from Port Harcourt seaport to Maiduguri, on the Eastern line. These two parallel narrow gauge rail lines are linked together, with a spur running from Kaduna Junction Station on Western line to Kafanchan station on Eastern line. NRC provides both passenger and freight services mainly, on those narrow-gauge lines since inception in 1898 till date.

- Standard Gauge Line: is relatively new on Nigerian Railway System, with its first line Abuja (Idu Station-Kaduna (Rigasa Station) coming into operations in 2010.

The other two standard gauge rail lines, also in commercial operations are: Itakpe-Warri Line and Iju-Ibadan completed line (a segment of Apapa-Kano standard gauge line, (yet to be constructed due to funding challenge). Somehow, these three standard gauge lines, only provide passenger train services.

Sadly, the operating performances, measured in terms of key performance indicators (KPIs) (i.e pass-km, tonne-km, revenues, and numbers carried/moved), have steadily declined, despite many National Government Interventions. Some of the reasons that may be adduced are: Insufficient and Ageing locomotives and rolling stock, Dilapidated infrastructure (track, rolling stock, workshops, running sheds, tracks bridges, culverts), Law and inconsistent funding (of infrastructure etc.), lack of Renewal/Replace programmes infrastructure, high staff turnover (through retirements, dismissals, resignation), how service level etc.

The geographical spread of rail lines (i.e. rail network) in Nigeria attracts increase in rail operations (commercial and non-commercial) with potential for more GHG emissions, as fossil fuel (i.e. diesel) is still in use to power its trains but still far better than Road and Air Transport. This calls for mitigative actions for GHG emissions reductions in railway in Nigeria.

Notwithstanding these, shortcomings, NRC still operates its rail services, emitting GHG into the atmosphere. Unfortunately, there is no record on ground, as at today, that shows that NRC is officially aware of CC Elements – GHGE and Accounting, GHGI, Mitigation Actions and Support. Data presently collected by NRC, has no relevance to GHGE and inventory, but shown as. KPIs (Key Performance

indicators), to track program of its operational performance, monthly and annually. The level of awareness of climate issues officially in the NRC, is very, very low, especially on the part of staff and Management and all the climate change technical words or terminologies or phrases are strange or novel in NRC. The level of climate expertise in this Organization especially in GHGE (collection, estimation, and archiving) is virtually non-existent. No wonder, the use of MRV as a tool, in this Agency, to facilitate compliance with International Reporting Requirements, as demanded by UNFCCC, is not in vogue.

Even though GHGE related data are not collected in NRC, the existing process of data collection and archiving, from the grassroots, is still largely, characterized by manual handling than by automation.

There is also no formal IA for MRV in this organization, as there is no Unit/Section/Division, (not to talk of a Department) tasked with CC Matters.

Aside all these, the interactions of CC with railway operations, affect planning and operational efficiency (i.e. travel demands, punctuality, reliability, scheduling, maintenance) of rail services and contribute to inefficient fuel use and air quality reduction.

Railway operations are further faced with environmental challenges arising from CC impacts, due to varied, severe weather situations. In Nigeria, these include reduced visibility, washouts (arising from heavy rain falls & massive floods), landslides, severe heat (especially desert heat, in far North like Nguru, Maiduguri), thunderstorms and lightning. As a result, specific mitigation actions, through proper planning are required to deal with the gravity of these environmental occurrences.

It needs to be mentioned here that identification, collection, analysis and archiving of relevant GHG emissions-related data is very much important, to establish inter-relationship that exists between CC and rail operations, right from the grassroots to the organization/national level. Taking cue from the foregone, it might be difficult for Nigeria's Rail Sector at present, to set any ambitious targets that could seek improvements in rail efficiency and GHGE abatements. This is a big challenge that is not insurmountable and two globally acceptable approaches are available to address it.

- A Programme of Action on Energy Consumption and Carbon Intensity, detailing:
  o Set Ambitious Target for it to be met say, 30% reduction by 2030 and 50% reduction by 2050 of final energy consumption from Train Operations.
  o An Ambitious Target to reduce specific average GHG emissions reduction from trains operations, by say 30% by 2030 and 60% by 2050.

- Modal Shift
  The second approach is by encouraging and promoting modal shift i.e. by moving transport activity from high carbon mode intensity to low carbon intensity, rail transport. The two elements to achieve this target are:

  o Increasing railway share of passengers' transport (in pass-km) in Nigeria's Transport by say: 50% by 2030 and 75% by 2050; at least.
  o Increasing railway share of freight land transport (in tonne-km) by say: 60% by 2030 and 80% by 2050; at least.

A modal shift from road to rail, in the coming decades, is highly anticipated considering Nigeria's ever-increasing population, and associated socio-economic activities and increase in travel demands.

The Nigeria's Rail Sector is expected to work assiduously for the realization of these ambitious targets by undertaking these measures:
- decarbonize the system.
- improve load factor.
- undertake energy management scheme and efficient driving.
- procure more fuel-efficient motive power and rolling stock.

Aviation

Aviation is one of the highest-emitting sectors and it is feared that its GHGE will continue to increase exponentially by 2050, if the trend is not checked. Existing policy measures and technologies are not adequate yet, to fully decarbonize this sector by mid-century. As a remedy, concerted efforts, on all fronts (i.e. from all stakeholders in the industry) must be made in ensuring full decarbonization using improved technologies and adequate policy measures to achieve GHGE reductions by 2050, provided this sector is seriously committed in achieving the goals of the PA.

Aviation's Climate Impacts do not only come from CO_2 emissions; in fact, but more climate impacts are also from non-CO_2 effects. For instance, aircrafts release water vapour and other GHG into the atmosphere and thus warm it.

Presently, this sector is highly exposed to climate impacts and there is no sign of any abatement, now or in the nearest future. Such climate impacts include.
- High Temperatures that may ground flights.
- Violent Turbulence
- Extreme weather, similarly, climate impacts on Airports in the form of flooding, extreme weather variations, sea-level rise, heat-buckling runways, may affect airport workers performance. Current policies to treat aviation's GHG emissions are not sufficient to decarbonize this sector by mid-century.

Inland Waterways

The Inland Waterways in Nigeria covers both River Niger and River Benue, their main tributaries, lakes, creeks, lagoons, all totaling 10,000km in waterways. But only 3,000km is presently navigable, seasonally. (NIIMP 2014). This represents major limitation to serious inland waterways transportation business in Nigeria. Out of 36 states in Nigeria, only 28 states are navigable presently. With rising sea levels, intense storms, wetter and warmer conditions, the coastal infrastructure as exposed to more risks at the river ports. For the Inland Waterway to be more impactful, in terms of GHG emissions reduction, following steps should be undertaken:
- Intensify the "Dredging of the lower Niger from Baro (Niger State) to Warri (Delta State), a distance of 570km and provisions of Buoys for the dredged channels". (NIIMP 2014)
- Initiate the construction of four more, new River Ports in Makurdi, Lokoja, Baro and Oguta (in Onitsha, Anambra State)
- Undertake All year maintenance and clearance of all navigable Inland Waterways.

Maritime/Shipping

Nigeria has six major functional seaports located viz; Apapa and Tin Can Island Ports (both in Lagos, Lagos State), Onne and Port Harcourt Ports (in Port Harcourt, Rivers State), Warri Port (In Delta State), and Calabar Port (in Cross River State). In addition to these six existing seaports, is the multi-billion dollars Lekki Deep Seaport, now under construction (in Phases), financed by private investors and consortium of Banks. When completed, it will be the largest deep seaport in Nigeria, with a designed capacity of "6million" TEUs of containers and a significant volume of liquid and dry bulk un-containerized cargoes." (Wikipedia, Lekki ports 2021). It is expected to come on stream, in 1st Quarter of 2023.

Some of the challenges facing Maritime sector in Nigeria are:
- Inadequate capacity at Ports, to meet the traffic demands, leading to congestion at ports and at times, on high seas-thus increasing GHGE.
- A long, non-automated, bureaucratic clearing process, involving many multiple agencies.
- Absence of skilled and trained staff in CC issues, especially in GHGE' estimations and inventory, mitigation Actions and support.
- Non-implementation of climate Action policies/policy instability.
- Improper management of current operational facilities.

The International Shipping/Maritime transport in Nigeria, contributes to no small measure, to the anthropogenic GHGE and there is no inkling that this will go down, in the decades to come, due to increasing Shipping activities. CO_2, CH_4 and NO_2 are the main GHG being emitted into the Atmosphere in this sector. One of the challenges in the sector is how to contribute towards attainment of the global goals to bring the mean temperature to below 2^0C as agreed upon at Copenhagen Accord (UNFCCC 2009), through sustained decarbonization of its operations in decades to come. As such, focus is now on ensuring energy efficiency through reduction in fuel use and more—by replacement of fossil-based fuels renewable fields. Until recent times, not much attention was given to CC issues, whereas environmental impacts have received so much attention, due to these reasons:

- Failure to capture shipping/maritime inventories as demanded by Kyoto Protocol.
- Emphasis placed on environmental impacts of pollutants (i.e. Sulphur oxide and nitrogen) because of health risks.

6.3.1   GHGE Reporting and Mitigation Actions

Reporting of Monitored results, within a time scale, is an important element of GHGE. Such reports become meaningful, comprehensible, and comparable if the monitoring processes and outcomes or results are clear, lucid, and transparent.

Reports aid decision-makers to decide, if the project(s) being reported is in line with set targets or if there are variations to it. In contemporary world, Reporting takes the forms of printed books, electronic formats (i.e posting monitored results and data online) and thus makes such data to be accessed easily by wider readership, within shortest time possible, from any part of the world.

Basically, following should be the contents of a GHG Report:

- Boundaries used for the monitoring work and reasons should be clearly defined.
- Presentation and Analysis of GHGE' Calculations. Tools and/or Methodology used must be indicated.
- Assumptions must be clearly stated.
- Brief and concise explanations of Data Sources for the transport activities and GHG Emissions factors.
- Explanatory Notes on the Accuracy or Uncertainty of the monitoring methodology and Data used. Specify whether local data or default data (instead of local data) is used.

Monitoring of the implementation of and progress made, towards attaining set targets, are expected to be reported, by using a dedicated Reporting System, that will be centrally managed by FMEnv itself and verified by external, independent body. The results are expected to be published on annual basis, on-line, via a dedicated Internet Climate Site.

Tools for GHGE Reporting

There are many tools and methods for estimation of GHGE from Transport project for Reporting and these shall be summarily stated, on a modal basis or on combined mode basis.

Rail Mode

- TEEMP MRT MODEL: "It enables user to consider the Energy characteristics of Electricity generation used to power electrified trains."
- CDM ACM 0016: "Mass Rapid Transit Vehicles-version 3.0.0. This is the registered, consolidated methodology for Mass Rapid Transit (MRT) projects which are eligible for crediting under the CDM. It covers rail-based systems such as subways and Metros, Light Rail Transit (LRT) System including trains, or sub-urban heavy duty rail systems or road-based bus systems."
- Railway Handbook: "The International Union of Railway (UIC), in partnership with International Energy Agency, publishes handbooks containing information on rail energy use and emissions statistics that can be used as reference when estimating rail CO_2 Emissions."
- Emissions Factors for Locomotive: "The United States EPA has established emissions standards for NO_x, hydrocarbon (HC), Carbon Monoxide (CO), PM and Smoke for newly manufactured and re-manufactured locomotives."
- Rail Carrier Partner 2.0.15 Tool: "This is US EPA's Smart Way 2.0.15 Rail Tool with technical documentation of method to calculate emissions, fuel consumption and comparison metrics based on data provided by railway components to the Department of Transportation's Federal Railroad Administration."
- CDM AM 0090: "Modal Shift in Transportation of Cargo from road transportation to water or rail transportation version 1.1.0." It is one of the approved Baseline and Monitoring Methodologies.

Water Transport (Maritime/Shipping and Inland Waterways)

The following is the list of some notable tools and Reference for Water Transport Projects:

- Carbon Foot – Printing for Ports: "This Guidance document prepared by the Carbon Foot printing working Group of the World Ports Climate Initiative Series as a resource guide for Ports wanting to develop or improve their GHG emission's inventories".

- Inland Waterway Transport Tool Kit (Draft):" This Paper provides basic information to   assist the formulation of inland waterways projects".

- Third International Maritime Organization GHG Study 2014:" This study provides updated GHG emissions' estimates for ships."

- Shipping Emission in Ports:" This International Transport Forum paper provides useful data on Shipping emissions in Ports across the world."

- Contribution to Impact Assessment of Measures for Reducing Emissions of Inland Navigation:" This research project by the European Commission outlines key issues affecting Emissions from Inland Water ways Transport and Measures to reduce them."

Air Transport/Aviation

The List of Tools for Air Transport Project are:

- International Civil Aviation Organization (ICAO) Carbon Emissions Calculations:" This ICAO has developed a Methodology to calculate the CO_2 Emissions from Air Travel which applies the best publicly available industry data to account for various factors such as aircraft types, route specific data, passenger load factors and cargo carried."
- The European Environment Agency (EEA, 2021) provides a methodology that can also be used to calculate emissions.
- Guidebook on Preparing Airport GHGE Inventories:" This report for the United States' Federal Aviation Administration provides detailed methodologies for accounting for airport emissions."
- Airport Carbon Certification: This is an institutionally endorsed carbon management certification standard used by major airports across the world."
- ACRP Report II: Guidebook on Preparing Airport Greenhouse Gas:" This provides a framework for identifying and quantifying specific components of airport contributions to GHGE. This Guidebook can be used by Airport Operators and Others to prepare an airport specific inventory of GHGE." http//www.transportation.gov

Combined Modes' Basis

- CDM Methodologies when a project requires climate financing from the CDM e.g. AM0031: "Bus Rapid Transit Project Version 7.0"
- CDM Tool 17: Baseline Emissions for Modal Shift measures in urban Passenger Transport:" This that provides methodological guidance to estimate baseline emission for transport project's implementing modal shift measures in urban passenger transport."

- CDM Tool 17: Baseline Emission for Modal Shift Measures in Inter-Urban Cargo Transport-Version 1.0:" This tool provides methodological guidance to determine baseline emissions for transport projects implementing modal shift measures in Inter-Urban Cargo Transports.
- Transport Emission Evaluation Model for Projects (TEEMP): ''Its for rapid evaluation of GHG Emissions when limited data are available to conduct a fuller analysis."
- Emissions by Transport Sector-Rail and Inland Waterways: "This is the on-going research by Euro stat on identifying and evaluating suitable data and methods for assessing the Impact of railway and inland waterways transport on GHG Emission."
- Guidance on measuring and reporting GHGE from freight Transport: ''This Guidance provides clear instructions in calculating the GHGE from freight transport operations."
- GHG Protocol Emissions Calculations Tool Version 2.6 (For Mobile Combustion: "This tool calculates the CO_2, CH_4, NO_2 Emissions from Public Transport (Road, Rail, Air & Water) and others."

  Sources: Asian Development Bank (2016): Guidelines for Estimating GHGE of Asian Development Bank Project. Additional Guidance for Transport Projects 50 years ADB.

The Existing Gaps in GHG Emissions' Reporting

The Reporting Framework developed by UNFCCC is primarily aimed at requesting information from countries; on how well they understand their individual or collective pledges and commitments, through their respective NDCs; monitoring progress and ensuring an enhanced transparency and accountability of quantified information, so provided. This thus gives credibility, builds mutual trust and gives confidence to the report.

The Transparency Framework, which is MRV, contains elements that will enable member-countries to evaluate their Actions or commitments and monitor progress. The Reporting component of the MRV Framework clearly specifies which countries to report, what to report, which information to report, how to report, why the report and what frequency to report.

Unfortunately, information and data so provided by Non-Amex, I parties (NAI), are usually found to be incomplete and untimely and not prepared on a standardized template-hence gaps, variations, inconsistencies, and uncertainties are noticed, leaving no room for comparison at both national and international levels. The existence of such gaps, variations, inconsistencies, and uncertainties in exiting UNFCCC Framework (Report and Reviews only) for pre-2020 regime, has necessitated the need for a new, better, robust, and transparent Reporting Framework for the post-2020 era.

For reporting to be adjudged as being complete, credible, and transparent, these three elements must be present.
- Clear Guidelines on WHAT to measure and report.
- Clear Methodologies/Methods on How to measure and report (e.g. GHG Inventories)
- State explicit consequences for non-reporting (e.g. suspension from International Carbon Markers (ICM).

Although, developing countries are mandated to submit BURs and developed countries are expected to submit Biennial Reports (BRs), as agreed at COP.17/2011, these reports do not currently meet the needs of International Community, as these Reports cannot, comprehensively evaluate the progress towards

the attainment of pre-2020 pledges and commitments. As such, in post-2020 regime, a new Reporting Framework that will provide information required for evaluation of progress, as well as collective efforts and National Contributions (i.e NDCs) in post-2020 era. It should be noted that the existing Reporting Framework (Report & Review) was designed to provide information on long-standing obligation and mitigation pledges/commitments for pre-2020 regime. But with Kyoto Protocol all parties are obligated to do robust, comprehensive, and more transparent reporting especially by giving quantified information on GHG Emissions, Inventories, and Incentives to promote compliance. This anticipated change to be incorporated in MRV was adopted at the COP.16 (2010). Clearly, the current Reporting Requirements for Annex I Parties are different from the Non-Annex I Parties, as shown in their Reporting Frequency's difference and contents of National Reports as required by UNFCCC. The scope, frequency, and flexibility of Reports under UNFCCC for Annex I and NAI parties are also different.

The existing Gaps in Reporting are clearly notable Variations in the International Objectives of Parties on developed countries reads:" To ensure the provision of consistent, transparent, comparable, accurate and complete" information from developed countries (UNFCCC 2011) Whereas, for developing countries, the Objective of the BUR is to ……" encourage the presentation of information in a consistent, Transparent, complete, accurate and timely Manner" (UNFCCC 2011).

Also, Untimely or non-compliance with international-set objectives for BURs makes it difficult for the estimation of progress towards collective GHG emission trends or mitigation objectives (UNFCCC). Incomplete information is contained in and are submitted through BURs. Reason being that Reporting Guidelines do not make it mandatory (i.e., use of "shall") for such information being requested, to be reported. For example, Reporting on Support required, as submitted through BURs, varies greatly. No existing standardized templates for Reporting in Nigeria's OTS Modal Agencies as at today.

GHGE Mitigation Actions

GHG Emissions Mitigation Actions entail measures taken or may be taken now or in future, to abate human emissions of greenhouse gases and those activities that would help to limit the concentration of GHG emissions in the atmosphere and thus limit GW and its associated impacts.

The greatest concern, so far, is how to fully eliminate the use of Gas, Oil, Coal and replace them with clean, renewable energy/fuel in compliance with UNFCCC Objective GHG Emissions Mitigation Actions or Measures that can be taken in order…." to stabilize atmospheric concentrations of GHGs at a level that would prevent dangerous human interference with the climate system" (UNFCCC). Therefore, some of the Mitigation Measures, as attested to by Literature, can broadly be categorized into two viz.

- Mitigation Technologies and Practices; and
- Non-Technologies Mitigation and Practices

The GHG Emissions Mitigation Technologies and Practices can be classified into two viz.

Table 17: GHG Emission Mitigation Technologies

GHG Emissions Mitigation Technologies and Practices Currently in Use	GHG Emissions Mitigation Technologies and Practices Projected to be in Market by 2030
• Cleaner diesel-powered vehicles • Modal Shift Practice from Road to Rail and Water. • Energy-efficient vehicles • Electric road vehicles • Public Transport System (Metros, LRT, BRT) • Non-motorized Transport (i.e. Walking, Cycling**).**	• Electric Vehicles and Rail Electrification • Photovoltaic, Solar and Wind powered systems. • Bio-fuels development & production • Highly energy efficient aircrafts. • Hybrid Vehicles with well enhanced and powerful batteries.

Non-Technological GHG Emissions Mitigation and Practices

- Behavioral Patterns and life-styles changes contribute to GHG emissions abatement. Examples include:
  - Changes in consumption or Travel patterns (i.e. Avoid) and Modal Shift (i.e. Shift) elements of components of ASIF Framework.
- Sustained Public Awareness, through education, training, and mass public communications will help to promote the introduction into the market and acceptance of Energy efficiency measures by the society.
- Transport Demand Management (TDM) schemes such as Urban Planning, (to reduce travel demands) and measures to improve driving styles or techniques; reduction in car usage etc, should be promoted.
- Political and Economic responses e.g. Use of Carbon taxes, abolition of subsides for fossil fuels (coal, oil, gas).
- Divestment from financing fossil fuels
- Management tools such as training & self-development, record system, documentation of processes and procedures.

GHG Emissions Mitigation in Rail Transport

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

- Fuel Efficiency, with the aid of technology e.g.
  - Introduction of fuel management systems software which enables the 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 efficiently optimized.
  - Introduce 'STOP-START' Idling system on Locomotives to reduce fuel wastage and improves environment e.g. On-board Computer on Locomotives that determines power needs and when to start or stop a locomotive's engine.
- Modal Shift from Road to Rail, especially for freight movements.
- Improvements in rail operations to decrease GHG emissions and adverse impacts on the environment.

- Afforestation programmes-by planting trees at strategic locations in railway stations and along the track, to reduce carbon prints.
- Enforcement of compliance with Rules and Regulations, standards.
- New Technology and Innovations e.g. improvement in aerodynamics of motive power and rolling stock reduces fuel consumption and GHG emissions; as well as reduction of frictions between wheels and rail surface, to increase fuel efficiency.
- Minimization of the need for large quantities of Iron and steel in the construction and expansion works of railway.

GHG Emissions Mitigation in Aviation/Air Transport

There are many Mitigation measures in the forms of plans, actions, programmes, and initiatives) that may be taken to ensure GHG emissions abatements, in this sector, in post-2020 era.

- Introduction and adoption of, on a commercial scale, Sustainable Aviation Fuels (SAFs), with, for instance, about 80% lowered GHG emissions' life cycle.
- Introduction of cleaner Emissions standard for Aircraft.
- Strengthen efforts through R&D to improve aircraft and engine technologies.
- Improvements in Airport Operational efficiency through changes in Air Traffic control and Airline Operations
- Continuous aircraft renewal programmes, to improve fuel efficiency.
- Substitute the existing turbo-fan engines with improved versions to save energy consumption.
- Promote Aircraft weight reductions through removal of cabin materials (e.g. bottles, fittings, cutleries), and replace with lighter materials and re-configuration of aircrafts interior.
- Introduce and adopt fuel optimization programme through tinkling with aircraft speed, flight schedules and flight paths.
- Improvements in aircraft aerodynamics
- Improvement in Load factors as it contributes to lower fuel consumption.
- Optimization of ground operations through use of single engine for taxiing, minimization of queues.
- Manage Air Traffic control with new technologies e.g. use of RVSM (Reduced Vertical Separation Minimum) Technology, RNP (Required Navigation Performance)
- Tarmac/Ground Operations – use of low carbon emission vehicles for operations.
- Provision of incentives to encourage R&D in aviation technologies, design, and development of new, energy-efficient, and low-carbon emitting aircrafts etc.
- Timely policy intervention by Federal Government of Nigeria.
- Substitute airplane Auxiliary Power Units (APU) by Ground Power Units (GPU) and Air Conditioning Units (ACU)

Despite of all these good innovative ideas aimed at GHG emission abatement in Aviation sector, it is still faced with some challenges. The continued reliance on use of fossil-based fuel, is limiting the use of low-carbon based alternative fuels. Lethargy on the part of ICAO member states in adopting ICAO standards on climate change, as binding national laws. Political misunderstandings amongst member nations of ICAO, arising from vested national interests, are forestalling setting of ambitious targets for GHG

emissions' reductions. Time constraint in the process of developing and introducing new, modern technologically improved aircrafts into the markets, is equally an issue of concern.

GHG Emissions Mitigation of Inland Waterways (IWT)
GHG Emissions from vessels on Inland Waterways, are not currently and properly captured (i.e. measured and reported) in Nigeria, 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. To properly consider and include the GHG Emissions from this sector, the Federal Government and other Policy makers, will have to undertake a comprehensive assessment of emissions from different transport modal sources and to also, develop and evaluate policies on Intermodal shift of freight traffic, from road to Inland Waterways. Vessels used on Inland Waterways, with in-board engines, use diesel as fuel type, whilst smaller vessels (i.e. coastal working boats and commercial boats) use Gas oil. Vessels with outboard engines (4-stroke type) use petrol.

Measures of mitigating GHG Emissions in Inland Waterways include:
- Operational measures e.g. optimizing speeds of vessels and improving the operating conditions.
- Switch to Alternative propulsion system to ensure efficiency.
- Adopt Alternative sources of Energy and Fuel, that are of low-carbon or carbon-free; that its future is guaranteed or assured e.g. Liquid Bio-fuel, LNG (Liquefied Natural Gas) or a hybrid of LNG and Bio fuels; On-Board Electricity supply; 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 standards, that are not at variance to Nigerian Laws.
- Seek Improvements in ECO Hulls.
- Seek Improvements in navigation-related infrastructure e.g. Terminals (Parts or Nodes), locks, river, channels, Bridge pillars (along or in the channels)
- Introduce Alternative Fuel sources for navigation-related infrastructure e.g. on shore power supply through hydro-power supply.

GHGE Mitigation in Maritime/Shipping
In Maritime Transport, the major thrust is on carbon emissions' reduction and fuel consumption reductions, despite of the fact that shipping contributes modestly to carbon dioxide emissions.

The International Maritime Organization (IMO), based on its (IMO) adoption of its initial IMO strategy (2018), on the GHG Emissions reductions from ships and ports, and as a sign of commitment to emission reduction in International Shipping, came 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 a signatory), by giving support for implementation of Energy efficiency and other related mitigation measures in maritime/international shipping sector.

The IMO targets at GHG Emissions Reductions 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 been noted that technological innovations, adoption of alternative fuels, efficient sources of energy, Research & Development, and Investment drive, improving operational measures, upon which to build up the anticipated zero carbon regime. Specifically, the mitigation measures are:

- Lowering of ship's speed on high sea, to reduce fuel consumption.
- Improvement in ship's designs (e.g. on energy efficiency design, optimization of superstructure, Hull shape, propulsion machinery. Peripheral systems 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 ship are for greater than those of operational activities at Ports.
- Pro-active drive to turn conventional ports to "Green Ports."
- Ports to Incentivize ship operatives/owners, to operate their vessels, to produce lower (or reduced) GHG emissions, through ship's speed-reduction programme, or reduced port charges/fees.
- Link ships at berths, to On-shore power supply system, sourced from hydro-power generation or wind turbines.
- Improve turnaround times at Ports for ships, arising from improved stevedoring operations, berth's availability, and efficiency of loading and off-loading equipment.
- Switch from fossil-based fuels (oil, gas, coal) to alternative sources such as LNG (Liquefied Natural Gas), Methanol to provide low-carbon fuel. This shift also results into considerable reduction of CO_2, particulate matter, nitrogen Oxide (N_2O) and Sulphur Dioxide (SO_2). Use of dual engine that runs on both LPG and a reasonable fraction of Oil (LPFO) for ignition. The drawback of this in the methane content of LPG, whose potency rate is …… "72% more powerful than CO_2 in a 20year perspective and 25times as powerful for a 100year perspective" *(Forster et al 2007)*. This is because methane that slips through combustion is not fully burnt. Also use of methanol as a fuel in a dual-fuel engine may be investigated. Methanol is a liquid at room temperature that is easily stored and distributed than LNG. Its production and consumption release lower carbon dioxide than LNG in a time horizon of 100year but it performs worse than LNG in a 20year time horizon." *(Brynoff, friedell and Anderson 2014)*
- Operations-related measures are dependent on both parts and ship operations. Ship's fuel consumption is dependent on ship's speed, albeit ships are built to operate at a given design speed.
- Streamline Hull and Propeller Designs. The ship builders are doing this so that ships can move faster, with less fuel consumption. Streamlining of ships and drag reduction are ensured through Hull's Optimization.
- Support R&D and Investment drive in design and manufacture of zero-carbon ships; innovative Sustainable Technologies (IST); development of infrastructure to support zero-carbon fuels; Provision of Power supply on ships or On-shore, or Shore from renewable energy sources.
- Optimization of logistics supply chain at ports.

6.3.2   Existing Methodological Tools for MRV

Tools, Methodologies and Methods are meant for establishing baselines and monitoring greenhouse gases, similarities in scope, mechanism, and indicator variables, through mitigation Actions. Mitigation Actions have four characteristics namely. ASIF Framework, type of instrument, the Scale and the affected modes. The description also covers mechanism by which GHG emissions are reduced through mitigation Actions and anticipated co-benefits.

In the structure of the mitigation effects, there is cause-impact chain graphical expression that shows the exact activities within mitigation Actions that intend to cause GHG emissions to fall or decrease. Each activity relates to the directional effects, it is expected to have one or more indicators within the transport emission's cause impact chain, that leads to changes in the intermediate variables and the eventual result of lowering emissions. The table below is a graphical representation of the basic approach of each mitigation Action type and the associated monitoring requirements.

Figure 9: Basic Approach of each Mitigation Action Type and the Associated Monitoring Requirements
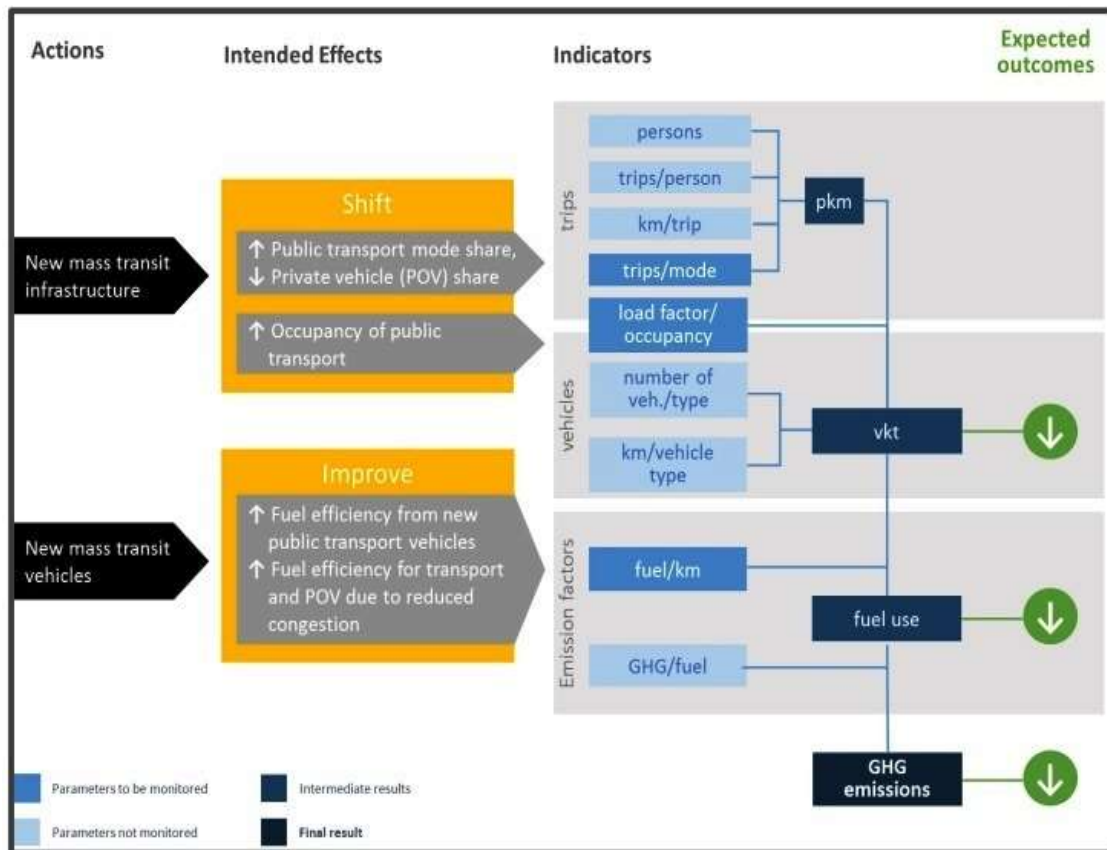
Source: Chuks Koostian et al (Nov. 2016) Transport volume of the compendium of Baselines and Monitoring

Certain indicators are coloured to show that they are to be monitored for the magnitude of change caused by the actions. The remaining variables are in a different colour to show that the actions are not expected to affect them, and therefore it is permissible to use default values in calculating the

Factors that affect change magnitude in key variables may cause weaker or stranger GHG abatement from the same mitigations. These are:

- Boundary Setting: This refers to available options amongst many parameters that are used for setting the analysis boundaries for the mitigation Action to be adopted.
- Main Methodological Issues: Different methodological issues are present in each mitigation Action type, based on the causal mechanism and data availability.
- Potential for double counting: These are other policies or Actions undertaken to mitigate other GHG emissions outside the Analysis Boundaries that may have synergistic effects, thus leading to the difficulty in assigning the emission reduction to any specific or amounting to double counting for different Actions.

Table 18: Key to description: [scale, instrument type, ASIF lever, mode]

Scales	Instruments	ASIF levers	Modes
▪ **Project level** ▪ **Intermediate level /sub-sector** ▪ **National/sector level**	▪ Regulatory ▪ Investment ▪ Economic (dis-) incentives or fiscal ▪ Planning ▪ Information & communication	▪ Travel activity ▪ Mode shift ▪ Energy intensity ▪ Fuel type	▪ Private vehicle ▪ Public transit/ bus/ trolley/etc. ▪ Non-motorized ▪ Passenger/freight ▪ Road/rail/water

Class or Type of Tool:

The tools or methodologies are put in one or more categories, based on their characteristics, to cover a wide range of different mitigation Action types in terms of interaction type, scale, and the affected modes.

- Mitigation Action Type 1: Intra-Urban Mass Rapid Transit Investments: (Project or Intermediate, investments, mode shift, passenger bus or Rail).

Tools and Methodologies available:

- o ACM 0016: Mass Rapid Transit Projects
- o CDM Methodological Tool 18: Baseline Emissions for Modal Stiff Measure in Urban Transport.
- o Metro – TEEMP
- o WRI GHG Protocol Policy and Action Standards: Transport Sector Guidance.
- o AMS.III.U: Cable cars for Mass Rapid Transit System (MRTS)

- Mitigation Action Type 2: Comprehensive Urban Transport Programme: (Intermediate, planning/investment/economic, activity/mode shift, all ground modes including NMT).
  Tools and Methodologies available
- o EERPAT – Energy and Emissions Reduction Policy Analysis Tool.
- o Tools for ex-ante estimate of emission reduction potential for project level activities, that may be part of a comprehensive programme.
  - ▪ Bike – sharing – TEEMP
  - ▪ Bikeways – TEEMP
  - ▪ TDM – TEEMP

- Walk ability - TEEMP

- Mitigation Action Type 3: Vehicle Efficiency Improvement Programmes (Sub-sector, economic/regulatory, intensity/fuels, road transit, freight modes)
  Tools and Methodologies available
  o AMS – III.AA: Transportation Energy efficiency activities using retro-fit technologies.
  o AMS-III.AT: Transportation Energy efficiency activities installing digital tachograph systems to commercial freight transport fleets.
  o AMS-III.BC: Emissions reductions through improved efficiency of vehicle fleets.
  o TEEMP – Vehicle Replacement

- Mitigation Action Type 4: Alternative Fuels Incentives: (Sub-sector, economic, fuels, road transport modes)

  Tools and Methodologies available
  o AMS –III-AK: Bio Diesel production and use for transport application.
  o AMS-III.AQ: Introduction of Bio-CNG in transportation application
  o AMS-III.C: Emission reductions by electric and hybrid vehicles

- Mitigation Action Type 5: Inter-Urban Rail Infrastructure: (National, Investments, mode shift passenger/freight, rail):

  Tools and Methodologies Available:
  o MRV Blueprint based on Indian Railways.
  o Railway TEEMP
  o Railway Freight Electrification: JICA – Climate Finance Impact Tool.
  o Railway Freight Mode Shift: JICA – Climate Finance Impact Tool
  o Railway Passenger Mode shift: JICA-Climate Finance Impact Tool
  o AM 0090: Modal Shift in transportation of Cargo from road transportation to water or rail transportation.

- Mitigation Action Type 6: Freight Transport Infrastructure Investments to shift mode: (Sector, or sub-sector, investments, mode shift, freight rail/water)

  Tools and Methodologies available
  o Ref Doc Section 4.1: Switching Freight to short sea skipping (Brazil)
  o Railway Freight Mode Shift: JICA Climate Finance Impact
  o AM0090: Modal Shift in transportation of cargo from road transportation to water or rail transportation.
  o CDM Methodological Tool 17: Baseline emissions for modal shift measures in inter-urban cargo.

- Mitigation Action Type 7: National Fuel Economy Standard:
  (National regulation, intensity, passenger and/or freight) Tools and Methodologies Available.
  o New Methodology under development by the ICCT on behalf of GIZ

- Mitigation Action Type 8: Pricing Policies:

(National or Local, regulations/fiscal, activity, mode, intensity, road transport)
Tools and Methodologies Available:
- o ICAT Methodology on taxation (upcoming)

Source: Chuks kooshian (CCAP), Steve Winkelman (CCAP), Urda Eichorst (G12), Daniel Bongardt (G12) (Nov 2016). Transport volume of the compendium on Baselines Monitoring. A comprehensive Guide through existing methodologies for GHG quantification of different types of transport mitigation Actions.

- Mitigation Action Type 9: Sustainable Development Mitigation Co-Benefits: (National, Local, activity, mode).
  ICAT TRACE: Transport sector, climate Action co-benefits evaluation tool. *New Climate Institute*

Challenges to Existing Methodological Tools for MRV in OTS
- Use of existing methodological tools for MRV, yet to be properly understood and rooted in Nigeria's Climate Industry, sectorally and nationally.
- Nitty-gritty of the Methodological tools for MRV and application yet to be fully comprehended by the very few available local experts.
- No good training arrangements for staff in MDAs and Governments to acquire the skills for application of the tools.
- Training materials are not readily available locally.
- Absence of Institutional settings in MDAs that would promote encouragement in learning, acquiring skills and applying these methodological tools at sector and national levels.
- The technical nature of the contents of these tools and methodologies is not attractive enough for people to be interested in using them.
- Funding deficiency.

Existing Methodological Tools for MRV in OTS Identified Gaps
- None of the modes in OTS has domestic MRV System.
- Institutional Capacity (i.e. experts) to undertake GHG Emission's Reporting and Mitigation Actions in OTS is very poor.
- None of the modes in OTS has any existing GHG Emissions' Reporting and Mitigation Actions System in place.
- Methodological Gap exists in OTS except in NCAA that uses an ICAO – provided tool, called ICAO GHG Protocol. This makes it very difficult for assessing GHG Emission and undertaking Mitigation Actions.
- Determine baselines in OTS is difficult because of the technicalities involved.
- Lack of timeframe or time series, makes it difficult for modes in OTS to understand GHGE' trends and mitigation Actions.

Table 19: Methods for MRV for Mitigation Actions

Type of MRV	Measurement		Reporting	Verification
	Method	**Data Requirements**		
GHG effects	For Mitigation goals and policies: ▪ GHG Protocol Mitigation Goal Standard for mitigation goals set by governments (Company/Entity) ▪ GHG Protocol Policy and Action Standard for Mitigation policies. ▪ Guidance to be developed for tracking of nationality determined contributions by countries as per the Paris Agreement. For Mitigation Project: ▪ Methodological guidance developed under the Clean Development Mechanism (CDM) ▪ GHG Protocol Project Standard ▪ Gold Standard ▪ Verified Carbon Standard (VCS)	For Mitigation goals: ▪ National GHG inventory ▪ Other data requirements may include data on emissions and removals from the land sector, transferable emissions units (e.g. carbon credits and tradable allowances). Depending on the kind of goal. For Mitigation policies and projects: ▪ Defined by GHG emissions quantification method and the policy/project type. ▪ Typical include activity data, emission factors, and socio-economic data	▪ To domestic stake holders ▪ To the UNFCCC as part of National Communications, Biennial Reports, and/or BUR ▪ To donors supporting the implementation of goals, policies, and projects. ▪ Any reporting requirements developed in future as per Paris Agreement for post=2020 contribution For Mitigation Project: ▪ To the relevant program (e.g., CDM or emissions trading program) under which the project has been undertaken.	▪ May be prescribed by domestic laws. ▪ Under the UNFCCC, review is carried out as part of International Consultation and Analysis (ICA) and International Assessment and Review (IAR) processes ▪ The Paris Agreement sets up a technical expert review process for the information provided by countries. ▪ For credited mitigation projects, verification prescribed by crediting scheme (e.g. CDM, VCS, Climate Action Reserve (CAR)

Source: MRV 101: Understanding measurement, reporting, and verification of climate mitigation by WRI, 2016.

Table 20: Summary of Mitigation Actions on NDCs for Prioritized Transport Sector in Nigeria

	Category	NDC	Sub-NDC	Policy	Project(s)
A	Traffic Management	A1: Moving freight from Road to Rail	• Movement of heavy, homogeneous traffics, in containers or specialized wagons.	• Adoption of Nigeria's Draft National Transport Policy August 2010. • Nigeria's National Integrated Infrastructure Master Plan (final draft report, August 2014). • Nigeria's 25years Rail strategic Master plan. Repeal of NRC Act (2004, as amended)	• Rehabilitate existing rail Infrastructure. • Expand and modernize rail network. • Link all seaports (Apapa Wharf, Tin-can Island, Port-Harcourt, Warri, Calabar, Onne, etc) to nearest rail heads. • Link Important Industrial Hubs and Economics Centre (Ikeja, Apapa, Kano, Jos, Maiduguri, Aba, Port-Harcourt, Ibadan etc) to nearest rail lines. • Procurement of new locomotives with higher hauling capacities. • Procurement of new specialized wagons to carry containers, box wagons etc. • Provision of logistics and maintenance equipment. • Adoption of Rail Concession System (a private sector led approach) to help in reducing financial burden and in raising rail operations and its profitability. • Introduction of modern telecommunications and signaling system. • Encouragement of private investments in railway development in term of network expansion, haulage/transport capacity increment (through local manufacturing, operations) and rail ownership.
		A2: Moving freight from Road to Inland waterways	• Movement of bulky Goods/freight traffics by waterways	• Adoption of Nigeria's Draft National Transport Policy August 2010.	• Making Nation's Inland Waterways, more navigable through constant removals of sediment build-ups, physical obstructions (e.g. rock outcrops, wrecks) to navigation.

	Category	NDC	Sub-NDC	Policy	Project(s)
				• Adoption of Nigeria's National Water Policy, July 2004. • Adoption of Nigeria's Cabotage Policy.	• Promote government's continual investment in infrastructural developments e.g. river ports infrastructure, navigational aids, communication facilities, etc) • Promote pricing policies that will encourage shift from road to water mode. • Encourage private sector (indigenous and foreign) participation in inland and coastal waterways development, operations, and ownership. • Establish a Safety unit (e.g. inland waterways safety inspectorate to monitor and curtail, high rates of accidents (minor or major). • Develop and link up, existing inland, waterways/coastal ways, nodal points (in about 26 out of 36 states) to Agricultural producing areas of middle-belt region (i.e Makurdi, Lafia, Otukpo axis to Onitsha & Port Harcourt), Warri Port, for movement of coal, scrap metals and imported iron ore-all as raw materials for Ajaokuta Steel Complex.
B	Improving the Transport System	B1. Improving the Efficiency of <u>Railway System</u>	• Efficiency in Rail Operations and Infrastructure through: System scope, Assets procurement &utilization, human resource utilization, operational performance, financial performance and customer-oriented service quality.	• Adoption of Nigeria's Draft National Transport Policy August 2010.	• Segmented but continual track Rehabilitation of existing 3,505 narrow gauges in areas of track renewals, reduction of dangerous/severe curves, etc. • Introduction & use of long-welded rails on existing narrow gauge to increase speed and reduce GHG emissions. • Link major seaports, industrial hubs, major cities, state capitals to rail network. • Improve technical performances of motive power and rolling stock. • Investments on Rail Green field projects as espoused in Nigeria's 25years Rail strategic master plan. • Build & link ICDs to nearest rail heads.

Category	NDC	Sub-NDC	Policy	Project(s)
				• Encourage rail haulage of containerized freights, from ports to hinterlands.
				• Encourage passenger movements through the introduction & operations of DMU-based coaches on urban rail routes.
				• Introduce new, modern signaling & communications system.
				• Rehabilitate existing moribund sidings and link up with viable industrial centres/companies.
				• Rehabilitate & Upgrade existing rail stations, to accommodate more passenger flows.
				• Rehabilitate & upgrade existing workshops and maintenance/Running for (both motive power & rolling stock)
				• Upgrade the exiting fuel (Diesel) Supply system.
				• Set up a full-fledged climate change department to handle GHG emissions, mitigation actions and support issues.
				• Open new viable operational routes through construction of standard gauge lines and also increase track network capacity.
				• Provide more economic passenger services, on remunerative routes that are duly mapped out.
				• Eliminate or drastic reduction of crossings and precedence at Arrangements for trains.
				• Introduce human behavioral change programmes e.g. driving techniques, marshaling techniques.
				• Change in Business practices, necessary e.g. carrying of homogenous freight traffics, instead of heterogeneous ones.
			• A new Government policy, supported by an Act of Parliament is canvassed for.	• Not moving freight by road, beyond a given distance, of say 700km. Beyond this, by rail.

Category	NDC	Sub-NDC	Policy	Project(s)
	B2. Improving the Efficiency of Inland water ways system	• Efficiency in Inland waterways operations and infrastructure	Adoption of Draft National Transport Policy.	• Address, critically, the interest supremacy and regulatory conflicts between states and Federal Governments' control of Inland waterways. • Committed implementation of Nation's Cabotage Policy and Cabotage Act 2003, to catalyze development and growth of this sector. • Faithful implementation of dredging and channeling activities. • Enforcement of safety rules, for the sake of commuters and operating facilities. • Provide quality, safe infrastructure (e.g. ferries, boats, engines, jetties) and water guards for patrolling water-ways. • Promote security to prevent illegal access on water ways. • Introduce mechanized means of clearing water ways. • Improve navigation through constant de-silting, prevention of refuse dumping, Defecations on waterways. • Modernization of vessels (Inland ships) for inland water ways freight transport (i.e. vessels' hydrodynamic improvements, efficient ship operations, reduction in hull resistance, powering vessel and engine, ship structure and weight). • Encourage pricing policy that will move traffic from Road to water. • Work on the ambience of ferries. • Encourage private sector participation in operations and owner ship of infrastructure.

	Category	NDC	Sub-NDC	Policy	Project(s)
		B3. Improving the Efficiency of Air Transport System	• Efficiency in Air Transport Operations and Infrastructures.	• Adoption of Draft National Policy on Transport (Aug 2010) • Nigeria Civil Aviation Policy (NCAP) 2013	• Continual Improvements in traffic control and navigational and regulatory standards. • Continual Improvements in Airport Structures (e.g. Buildings, Airport Ambience, Facilities, Hangars, Runways, Aircrafts etc) • Improvements in safety standards (in operations, compliance with navigational rules etc) • Adoption of modern airspace management technologies. • Promote competition in provision of domestic aviation services. • Promote private sector participation (local and foreign). • Finance infrastructure renewals/replacements and operations to improve standards.
C	Modal Shift	Modal shift from Air to High-Speed Rail	Improving Transport Efficiency.	• Draft on National Transport Policy, Aug 2010.	• Promote use of HSR through the expansion and modernization of rail network and link with major airports in Nigeria. • Facilitate involvement of foreign private investors in the construction, operations, overhaul and maintenance of rail-links to major airports. • Institute electrified HSR services.

Selection of Appropriate MRV Standard to Identify the GHG Impacts for Transport Sector in Nigeria.

Having gone through available Literatures on Methodologies/Approaches and analyzed them, following methodologies/approaches, were found to be very applicable in the identified NDCs/Sub-NDCs of the transport Sector of Nigeria. The level of appropriateness to an NDC, strengths and weaknesses of each methodology (either policy-inclined or project-inclined) were some of the determinants in choosing or selecting it.

In selecting these Methodologies, Guidance or Tools, priority was also given to UNFCCC's CDM (Clean Development Mechanism) on project-related NDCs/Sub-NDCs, whilst ICAT Methodologies (e.g., ICAT's Transformational change and ICAT's sustainable development methodologies) are found to be more applicable to Policy-related issues. Other Methodologies such as IPCC Quantification Approaches (for quantifying GHG Emissions Inventory, GHG Reduction, GHG Benefits of Climate Change Mitigation projects) and JICA Tool-Transport (For electrification project, Transport Modal Shift etc), are also available for use. Table 10 shows the list of selected. appropriate MRV standard to identify the GHG Impacts…" in Transport sector of Nigeria.

Table 21: List of Selected MRV Standard/Methodologies for NDCs/Sub-NDCs in Transport Sector

	NDC	Sub-NDC	Policy or Project	Mitigation Action	Methodologies/Guidance/Manual
A	A1: Moving Freight from Road to Rail	A1: Movement of Heavy, homogeneous traffics, by Rail	Project	Haulage of freight by trains, in containerized form or by specialized wagons, from Seaports, ICDs, Refineries, Industrial Hubs etc.	UNFCCC's CDM. AM0090
		A2: Movement of Freight by water	Project	Movement of Bulky Goods /Freight by water/ Navigation	UNFCCC's CDM. AM0090
B.	Improving the Efficiency of Transport System.	B1. Improving the efficiency of Railway System	Project	Procurement of: (a) More modern rolling stock, fuel efficient motive power (diesel-electric or electric). (b) Track modernization and expansion. (c) Modern Communication & Signaling	JICA – Transport (Railway) Freight/Modal Shift.
		B2: Improving Efficiency of Inland water ways system.	Project	Procurement of: (a) ferries, boats, engines (b) Build/Upgrade Jellies. (b) Continuous Dredging and channeling of Routes. (c) Modernization of Vessels (Inland Ships)	JICA – Transport/Modal Shift.
		B3: Efficiency in Air Transport Operations and Infrastructure	Project Policy	• Procurement of Control, Navigation, and safety facilities. • Infrastructure (e.g. Airports, Runways etc) renewals/upgrades and construction of new ones. • Focus on Fuel Intensity and Fuel Economy	• JICA – Transport • ICAT's Transport Change Methodologies.
		B4. Efficiency in Road Transport Operations and Infrastructure.	Project Project Project Policy Policy	• Introduce hybrid or electric vehicles. • Introduce low-emission vehicles/technologies to commercial vehicle fleets. • Focus on fuel intensity and fuel economy. • Enhancement of Traffic Management schemes.	• UNFCCC.CDM: AMS-III.C • UNFCCC CDM: AMS-III.S • UNFCCC CDM: AMS III.BC • ICAT's Transformation change methodology. • ICAT Transport Pricing Methodology.

				• Reduction of Import Duties for electric vehicles.	
C	Improving Urban Transport System.	C. Improving efficiency of Urban Mass Transit.	Project Project Project Project Project	• Use of CNG-based vehicles/Buses. • Use of LPG-powered-buses. • Use of Cable Cars • Use of Intelligent Transport service (ITS) on Bus Routes • Introduce Mass Rapid Transit Services (Rail, Road, Water) • Construction & operation of new BRT System.	• UNFCCC.CDM: AMS-III.S • UNFCCC.CDM: AMS-III-AY • UNFCCC.CDM: AMS-III.U • UNFCCC.CDM: AMS-III.BN • UNFCCC.CDM:ACM.0016 • UNFCCC.CDM:AM 0031
D	Reform Petrol/Diesel Subsides	D1. Removal of subsides on petrol/diesel and use of alternative sources of fuel. D2. Toll Roads/Pricing	Project Policy	• Use of CNG-powered vehicles. • Use of LPG-powered vehicles. • Use of electric vehicles/buses. • Construct Toll Roads & infrastructure. Increase fuel tax and tax on conventional vehicles.	• UNFCCC.CDM.AMS-III.S • UNFCCC.CDM: AMS-III.AY • UNFCCC.CDM: AMS-III.C • JICA-Transport ICAT Transport Pricing Methodology.

GHGE Reductions Initiatives

A combination of management strategies and adoption of emerging technologies is required to ensure GHG emissions' reductions. This includes but not limited to:

- Placement of emphasis on energy-efficiency, by focusing more on fuel intensity, fuel economy, vehicle technologies, use of alternative fuel, use of electric and/or hybrid vehicles.

- Introduce fuel improvements' standard to reduce GHG emissions.

- Introduce and install a good and functional telemetry system on all vehicles that ensures proper recording and handling of vehicle behaviors (in stationary and in running modes) and fuel efficiency. These data, when collected and analyzed, will show key performance metrics that would be helpful in emissions' abatement and fuel efficiency.

- Encourage Research and Development programmes on Alternative' Energy for Other Transport sector by giving Grants to Universities, Polytechnics or Research Organizations, to develop emissions reduction technologies, processes and practices. Some of the critical areas to be researched upon, but not limited to are: (i) transport mode energy modeling software's, (ii) Green-hybrid drive modeling tools (iii) light weighting materials.

- Undertake, periodically, fleet/vehicles renewal or upgrade, as occasioned by age.

- Encourage investors (foreign and local), to invest on innovative fuel efficiency technologies and programme.

In summary, the Gaps and Needs Analysis (or Situation Analysis) is required in understanding the MRV System in Nigeria's *Other Transport Sector*, its status quo, its future situation, and ways of reaching or getting to the future. Gaps and Needs must be identified for it to make fruitful contributions towards MRV framework and NDC implementations.

Table 22: Need and Gap Analysis Other Transport

Component	Gap	Need
Data Factor: **Institutional Arrangements**	Data Collection, analysis, and archiving, particularly GHGE -related in these transport organizations, are very poor and data automation level is still very low. Lack of disaggregated data on GHGE directly from other Transport modes (as transport is already subsumed in energy sector, as a unit or sub-sector), is apparent and this has contributed to loss of direct historical data on GHGE and Inventories in transport sector. Data gathering are very limited in scope and context, as GHGE -related data are not directly captured as expected. Absence of comprehensive of GHGE -related data, makes it difficult, for emissions reductions quantification. IA for MRV Systems on GHG Inventory, Mitigation Actions and Support are non-existent, both at sectoral (other transport) and national levels, and where there is any semblance, it is very loose and weak. Linkages between Other Transport sectoral institutions with the DCC of FMEnv, where such exist, are not solid enough and information emanating from them are equally not technically – strong, to meet UNFCCC Reporting Requirements' standards.	*Data* Provide support for setting up data collection and archiving mechanisms (procedures, processes, timelines) for MRV System in Units/Divisions/Departments for all Other Transport modes, for sake of credibility, transparency, efficiency, completeness, and effectiveness. *Capacity Building* Capacity-Building Efforts (i.e. development of human capacities in technical areas of GHG Emissions' Data Collection, Analysis, documentation and archiving, GHGE' estimation/calculations, calculation of Other Transport's sectoral or modal EF; Data Reporting; Use of IPCC 1996, 2006, 2019 Guidelines etc, methodologies and approaches etc, as a way to help in the preparation of GHG Inventories Report, (NIMP), NCs, BURs, correctly, timely and transparently. *Awareness* Create an Awareness amongst managerial and workforce of every transport mode, of the importance, relevance, and benefits of MRV System at sectoral, MDAs and National levels as well as private sector and non-governmental levels.
Finance	Limited financial support to develop and operationalize a Domestic MRV System (Sectoral and National) on a continuous basis; is obvious.	**Climate Finance/Support** Emplace appropriate mechanism to secure and implement climate finance/support from donors or international climate change bodies.
Sectoral Baselines	Absence of sectoral baselines for the transport modes, especially rail, navigation/water, and Air is real.	**Baseline Development:** Help with all Other Transport modes/Agencies, to set up their respective baselines and appropriate methodologies to serve as lead towards identifying the key categories that are equally influencing the country's total

Component	Gap	Need
		GHG Emissions in OTS that are notably recognized by IPPC 2006,2003,2000 Good Practices Guidance.
Training	Non-availability of specifically – tailored, web-based training materials on mitigation of climate change, GHG Emission' estimations, GHGI and support being sought.	*Training* Specific Training to acquire skills on how to estimate fugitive emissions from transport sector especially from fuels combusted at costal, inland, and deep-sea fishing activities (within national frontiers).
Technical Expertise	Absence of technically – sound and professionally – competent experts on climate change and its related issues (i.e. GHGE estimations/calculations, inventory management, Mitigation Actions, QA/QC etc) is real in these transport agencies.	
Legal	Legal and Regulatory mechanisms, where available, are not cohesive and strong enough for Other Transport institutions, to perform their roles and carry out their responsibilities.	*Institutional Governance* Emplace good and cohesive Institutional Governance Structures, supported by appropriate legal and regulatory mechanisms that will enable them to function well.
Sectoral Emissions'	Non-existing Nationally Approved, Sectoral Emissions factors for Transport sector (or on modal basis)	*Lessons Learnt* Institute the process of sharing lessons learnt or experiences on best practices, amongst transport agencies, through exchange of knowledge products.
Policies Factor	Difficulty in monitoring and correlating Government Policies due to improper co-ordination and poor perception or awareness of climate change issues amongst Government officials, in transport agencies; is pervasive. Many policies on GHG emissions are broad in scope and not structured to address direct concerns on Climate Change in Other Transport Sector.	**Legal Framework** Set up legal framework that sort of
Set Target:	Nigeria has balanced ambitious mitigation economy-wide target, but there is no ambitious mitigation targets-set in other Transport Sector.	• Establishing legal mechanism, which will help to operationalize the NDCs' sectoral and national responses to climate change and providing a Tilt or Push towards low-carbon emissions development. • Facilitating the establishment of MRV Units/Divisions/Departments in OTS modes and at FMOT and FMOA and its Operationalization.

Component	Gap	Need
		- Mandating FMEnv, through the DCC to coordinate all climate change activities at Sectoral, State and National levels and ensuring that a National Registry, where all NAMAs, by both private NGOs and public bodies, are deposited or submitted for further actions. - Facilitating the establishment of National Climate Change Council (NCCC) and NCCF, both as Enablers to GHGE Reductions and other climate change issues. - Giving both general and specific guidelines on setting-up of an entity that will articulate and co-ordinate activities on data-gathering and data-sharing as well as reporting, as and when due.

7.0   Conclusion

The need and gap analysis assessment across the focus sectors show that MRV system can be put in place with support of stakeholders and input of experts. Identified needs of the priority sectors include the establishment and sustainability of an efficient national MRV system aligned to plug the identified gaps by meeting the core needs of the stakeholders. Resolving such needs will lead to feeling of ownership of the MRV system by the stakeholders. Defining with high level of clarity the roles and responsibilities, standardized reporting structures, and collaborative inter-agency relationship are very important towards establishing a robust MRV system.

The core needs are summarized below:

Establishment of a Robust Data Management System

- Support must be provided at various levels in setting up an efficient and effective robust data collection, archiving and reporting system that is sustainable. These systems must be transparent, accessible, and reliable.

Institutional Framework (Governance)

- The department of climate change has established working relationships with various MDAs that are critical in the development of a robust national MRV system however this cooperation need to be formalized and institutionalized. The roles of the respective institutions and staff members regarding GHGI and MRV must be clearly defined.

  The roles and responsibilities for data collection and sharing represented during the review were mainly hypothetical and were currently not supported by any legal or formal operational frameworks. It is important to formalize the roles through clearly defining them in the employment contracts at the individual level, and institutional frameworks such as Memoranda of Understanding/Agreement for GHG data sharing and coordination, to operationalize the GHGI and MRV systems for effective reporting.

Capacity Building
- Capacity-Building Efforts (i.e., development of human capacities in technical areas of GHG Emissions' Data Collection, Analysis, documentation and archiving, GHG Emission' estimation/calculations, methodologies and approaches. Such activities create awareness, builds the efficiency of the workforce, and ensures community and continuity within the system.

Climate Finance/Support
- The sustainability of the MRV system is frequently confronted with several challenges, which particularly depend on political support and correspondingly, allocation of financial resources. High-level internal political support is an important factor to ensure the continuous and sustainable operation of a national MRV system, especially when it comes to budget allocation and delivery of GHG-relevant data and information from data providers and stakeholders. An appropriate mechanism must be put in place to secure and finance the operations of various national MRV related activities and research at various levels.

Research and Development for Sectoral Emission Factors
- Collaborative research must be commission between the MDAs and research institutes for the development of accepted national emission factors to increase accuracy and reliability of data generated.

As it is reiterated that we cannot track/monitor what we cannot measure, the National GHG inventories are an essential component of climate change policy development and negotiations among party countries to the UNFCCC.

Adoption of the good practice guidelines under the enhanced transparency framework will ultimately lead to transparent, accurate, complete, consistent, and comparable MRV of GHG inventories. In turn, the proposed strategies and actions can form the foundation for incentives-based strategies to reduce GHG emissions in Nigeria through international cooperation, and improved economy-wide de-carbonization practices.

Finally, there is a heightened optimism among the key industry stakeholders that the ICAT-Nigeria MRV System Project would be able to plug the identified gaps as well as build capacity of national experts for the development of a robust MRV system for Nigeria. The understanding of the needs and gaps in the existing MRV system will assist in developing an institutional MRV system in line with the NDC guidelines and transparency framework.

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