

Pacific Islands National Forest Inventory for REDD+



BOOKLET 1: GUIDANCE FOR POLICY MAKERS



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Pacific Islands National Forest Inventory for REDD+

Booklet 1: Guidance for Policy Makers

Booklet 2: Guidance for Planners and Managers

Booklet 3: Field Operations

Booklet 4: Data Analysis

Pacific Islands National Forest Inventory for REDD+

Guidance for Policy Makers

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Executive Summary

The UN-REDD Program (Reducing Emissions from Forest Deforestation and Degradation) serves to identify alternative forest management activities that protect forests and help their capacity to sequester carbon and reduce global Green House Gas emissions.

This series of four booklets explains how to implement the activities required of each participating country under REDD+. Each participant is required to set up a National Forest Monitoring System that includes Measuring, Reporting and Verification of the change in forests. Essential components are mapping using remote sensing and the National Forest Inventory system.

The booklets provide guidance to planning and implementing a National Forest Inventory. Countries must ensure that they are well versed with international guiding policies articulated by the UN-REDD Program and the Intergovernmental Panel on Climate Change (IPCC).

Designing a National Forest Inventory that is specific to a country's circumstances is a complex activity, and will need joint inputs from the Ministry of Forestry and/or Agriculture, and stakeholders directly affected to ensure flow of work during its implementation phase.

Countries must also consider their available resources and the opportunities for a 'Resource Pooling' scheme. This will enable a country to gain capacity and resources from other Pacific countries. The Secretariat of the Pacific Community National Forest Inventory Regional Support Facility is available for member countries to request training, workshops or expertise to build on their capacity, and improve on their skills and knowledge on all components.

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The purpose of the booklets is to encourage their free use. The booklets may be copied in full or in part provided that SPC is acknowledged.

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List of Abbreviations

COP/C.P: Conference of the Parties of the UNFCCC

EF: Emission Factors

FAO: Food and Agriculture Organization of the United Nations

GHG: Green-House Gas

IPCC: Intergovernmental Panel on Climate Change

MRV: Measuring, Reporting and Verification

NFMS: National Forest Monitoring System

NFI: National Forest Inventory

PICs: Pacific Island Countries

QA: Quality Assurance

QC: Quality Control

REDD+: Reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

SPC: Secretariat of the Pacific Community

UN-REDD: United Nation Collaborative Program on Reducing Emission from Deforestation and Forest Degradation

UNFCCC: United Nations Framework Convention on Climate Change

Foreword

Booklet 1 was designed for policy makers working within Pacific Island Countries (PICs). The booklet is a collaborative work between Pacific Island Countries (PICs), the Food and Agriculture Organization of the United Nations (UN-FAO) and the Secretariat of the Pacific Community (SPC). It provides an overview on international policies and guidelines that guide decision making and actions when creating and planning a National Forest Inventory.

This booklet is part of a series of four booklets to provide the appropriate guidance to policy makers, managers, technical and field personnel on the proper conduct of a national forest inventory, from planning to implementation.

The booklet series will ensure a common understanding that would help facilitate the regional sharing and mobilization of relevant expertise to support the conduct of national forest inventories in Pacific Island Countries. The aim is to foster a consistent approach to the planning and conducting of NFI within the Pacific communities, noting that the specific details may vary from country to country.

Background

Specific international policies by the Intergovernmental Panel on Climate Change (IPCC) provide a framework for national forest monitoring projects for REDD+ in the Pacific. REDD+ is a climate change mitigation approach supported by many institutions, including the UN-REDD Programme (UN-REDD 2015). Together with national governments, the UN-REDD Programme serves to identify alternative forest management activities including conservation, sustainable harvest, and carbon stock management. These protect and conserve forest values in a manner that helps enhance the capacity of forests to sequester carbon and reduce global carbon emissions. International agreements such as REDD+ are becoming an increasingly important component of other mechanisms such as forest certification and international market requirements.

The Intergovernmental Panel on Climate Change crafts policies that govern REDD+ activities

International Guidance on NFMS for REDD+

REDD+ requires a National Forest Monitoring System that includes a monitoring function for Measuring, Reporting and Verification (MRV) as specified at Copenhagen, Denmark during the Conference of Parties, C.P.15 (2009), and later confirmed in Cancun, Mexico in 2010 (Decision 1, C.P.16).

*National Forest Monitoring System (NFMS) includes both **monitoring** and **measurement** components*

Monitoring Function for REDD+

The **objectives** of the monitoring function are to:

- Deliver a comprehensive assessment of the outcome of REDD+ policies and measures;
- Monitor national actions and report to international conventions and other commitments;
- Include forest carbon stocks with other information requirements to assess performance and environmental safeguards, such as forest health and condition, biodiversity and socioeconomic functions;

- Develop efficient and equitable resource allocation mechanisms;
- Provide information necessary for purposes other than REDD+, to meet wider forestry and other land-use sector objectives.

In practice, the monitoring function of NFMS is broadly defined, and components will vary depending on the national circumstances.

Therefore, NFMS serves as a tool to assist countries to:

- Assess and refine policies;
- Measure the implementation and performance indicators to track specific policy or indicators for forest carbon (e.g. forest volume harvested through sustainable forest management to estimate carbon impacts);
- Use existing tools where possible (e.g. network of forestry officers) and new tools where necessary (e.g. satellite remote sensing system);
- Harmonize existing tools with new tools and with newly acquired capacities for MRV.

The NFMS monitoring functions will depend on national circumstances

Measurement, Reporting & Verification (MRV)

MRV is the measuring, reporting and verification component of an NFMS system. MRV is based on three main components or pillars:

1. Satellite land monitoring system (SLMS)
2. National forest inventory
3. National Green House Gas (GHG) inventory

The land monitoring and NFI provides input to the forest sector component to the GHG inventory. Countries must progressively develop and operationalize these three pillars over three phases of REDD+ so that by the third phase of REDD+ they have a fully functional NFMS. The overall objectives of MRV are to:

- Measure the emissions coming from forests and land cover change as outcomes of REDD+ activities;
- Report these emissions to the United Nations Framework Convention on Climate Change (UNFCCC) following the most recent methodological guidance of the Intergovernmental Panel on Climate Change (IPCC);
- Verify the results by making the emissions inventory available for review by the UNFCCC.

*The main purpose of the MRV function is to **measure and report** on the **greenhouse gas mitigation** performance of REDD+ activities*

REDD+ in Three Phases

Given the technical and procedural complexity, the implementation of REDD+ should be done in three phases based on country circumstances:

Phase 1: Define a national REDD+ strategy and build national capacity.

Phase 2: Implement demonstration activities (a pilot) to test and refine methodologies, plans and policies.

Phase 3: Implement the REDD+ monitoring function nationally.

National Forest Inventory (NFI)

An NFI gathers forest data and information for the purposes of assessment and analysis of forest resources. The design of an NFI must consider future re-measurements and analysis once the first data collection has been completed. An NFI is an ongoing process, a continuous forest inventory, not a once off project that is only done when funds are available. It is necessary to maintain the institutional commitment and capacity for inventory and reporting into the future.

Forest inventories are a traditional and essential component of forest planning and management. The data from inventories may be used to calculate the sustained yield that may be harvested from a forest. Inventories also help to identify non-wood and conservation values that are to be managed under a forest management plan. NFI has become an important tool for measuring forest carbon stocks and stock changes within the MRV function of the NFMS. An NFI is also helpful in estimating anthropogenic (human-caused) GHG emissions at the national level. For GHG reporting, any removals of carbon from the atmosphere by “sinks” associated with forest growth, or additions by “sources” associated with deforestation or degradation of forests are directly measured in the field and applied to “activities” in the landscape. A country-specific Emission Factor (EF) is calculated to estimate the GHG emissions from land cover changes due to land use activities.

NFI identifies “sources” and “sinks” of GHG emissions and also provides information to guide management decisions at the national level

NFI and assessing Emission Factors

An Emission Factor (EF) quantifies the emissions or removals in areas undergoing human induced changes. Values on GHG emissions from the forest sector are derived from the area change data from satellite remote sensing and forest carbon stock change data from a NFI. The EF is vital in assessing the GHG emissions of a country. Changes in forest carbon stocks are measured in five carbon pools:

1. Above ground biomass (live)
2. Below ground biomass (live)
3. Dead wood (standing and downed wood)
4. Litter
5. Soil (mineral /organic)

Carbon Inventories in the Land Use Sector

In carrying out carbon inventories in the land use sector, estimation must be made:

1. In carbon stock change
2. For diverse ecological conditions
3. Under diverse management regimes

4. For emissions and removals due to human activities
5. For changes in all five carbon pools

Five Carbon Pools are above ground biomass, below ground biomass, dead wood, litter and soil (mineral/organic)

Carrying out an accurate forest carbon inventory in the land use sector using NFI is a complex activity which needs a step by step approach. To ensure quality and correct data, forest area and all five carbon pools must be assessed in this process.

How NFI is used to generate EF

Estimates of carbon stock change can be obtained in different ways where IPCC has classified the methods into three different Tiers which vary according to the quantity of necessary information and degree of analytical complexity. Estimates of emission factors made to Tier 1 uses default values provided by IPCC. Tier 2 or Tier 3 levels require country specific coefficients and data. To achieve Tier 2, the IPCC default assumptions, default methodology and country specific data are needed Tier 3 requires inventory data measured over time, uncertainty analysis and quality assurance/quality control (QA/QC).

A tier represents a level of methodological complexity to estimate GHG emissions

Table 1. Emission Factor Tiers

Emission Factor Tier	Description
1	Requires no new data collection, default values obtained from IPCC factor database
2	Uses country-specific coefficients and data and delineation of more detailed strata for forest biomass estimation
3	Uses actual inventories with repeated direct measurements of changes in forest biomass and/or well parameterized models in combination with pilot data.

Source: IPCC Guidelines, 2006.

This series of booklets estimates:

1. Above ground biomass –Tier 3
2. Below ground biomass – Tier 1
3. Dead wood – Tier 3
4. Litter – Tier 1 (Optional Tier 3)
5. Soil – Tier 1 upland forest , Tier 3 mangroves

When assessing carbon pool changes in the NFI, the approach will be to directly measure changes through stock differences where the methods are applied using permanent sample plots.

Developing an NFI: An Overview of the Process

Guiding Principles

In creating a multi-objective NFI, five main guiding principles were produced by UN-FAO (UN-FAO, 2012). These guiding principles ensure that the inventory will cover all major and minor issues and that all priorities at stakeholder- and country-levels are considered. Tomppo et al. (2010) describe pathways for common reporting for NFI's for many countries worldwide.

Five Guiding Principles: Governance, Scope, Design, Data and Overall Principle

Governance Principle

Under the governance principle, there are three key factors that must be considered: country ownership, legal basis and landscape view. Information produced by an NFI informs governments and provides input to enable informed decision making. To achieve this, there needs to be a legal system in place to act as a foundation for the national forest monitoring system. This will provide the basis for implementation (e.g. legally permitting measurements in private forests).

The NFI should be institutionalized to ensure long-term viability and availability of data and adequate data management, long-term availability of expertise, and long-term vision. Further development of the NFI should occur through time (continuity of related research).

An NFI requires a landscape view and an integrated land use assessment that would look at forests as one component within a broader landscape.

Scope Principle

Agreeing on the scope and objectives of the NFI is crucial, as data on forest and trees will be used by various sectors. Major data users, actors and interest groups should be consulted in this process. It is helpful to analyze existing NFI from the region and to invite experts to report on its possibilities and limitations and on the corresponding cost implications. Additional safeguards should be discussed to ensure that information generated does not violate any agreements with landowners, or cause unwanted or unintended harm.

Design Principle

The five key factors that need to be addressed under this include:

- Ensure that there is integration and consistency of the NFMS with existing information sources;
- There is a flexible approach in order to integrate issues and allow for periodic revisions;
- Ideally, an NFI should follow an approach which is multi-purpose, feasible and cost efficient;
- The NFI should not be considered as a stand-alone initiative but, in the best case, an undertaking that is interlinked with other national and sub-national initiatives that generate national level information;

- Information and knowledge generated by NFI should feed into and support national and international forest-related processes. In order to serve these processes NFI needs to be multi-purpose.
-

A permanent NFI should be feasible and affordable, multi-purpose, and in line with country circumstances

Data Principle

Data and information produced by NFI are of interest to many different parties. They should be accessible to different users, either as original data sets or as aggregated data sets, within the limits of any national legislation on data privacy and protection of individual rights. This may mean having a clear data sharing policy to which national and international interested parties can refer. The policy may, of course, contain restrictions along national interests and legislation. It is also vital that the data collected and information gathered are sufficient and of good quality to meet international reporting requirements.

Overall Principle

In the end, results must be produced in a manner that is scientifically defensible; each methodological and organizational step of the approach should be fully documented and justified; this includes a comprehensive and critical analysis of all error sources and implementation challenges. It is important to have collaboration in

planning, implementing and analysis of the NFI. This is an excellent way for knowledge to be exchanged, to avoid common errors and pitfalls, and efficiently support national capacity building.

Key Steps

In creating a sound NFI, a country must go through different stages of planning and implementation to ensure that it is successful. Below is a flow chart and overview that aids in the planning process of an NFI.

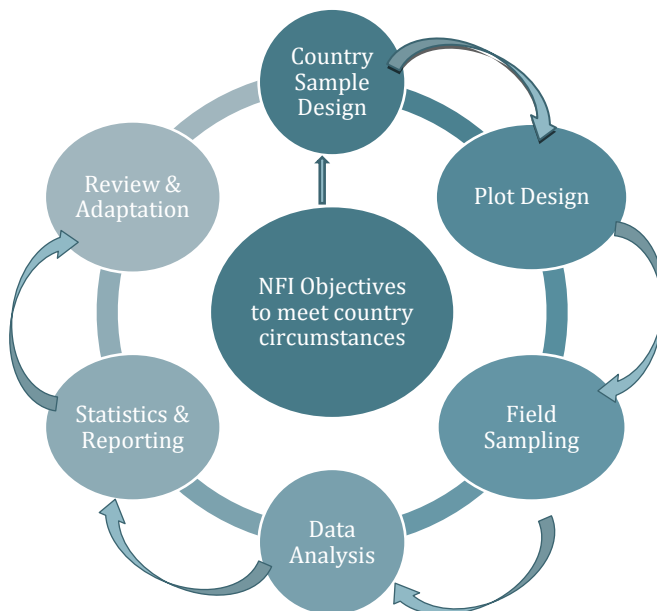


Figure 1: Workflow for NFI Planning

Firstly, it is essential to construct NFI objectives that meet country circumstances and start planning from this. Different countries have different intentions for an NFI, therefore, a stakeholder meeting with focused and facilitated discussions on objectives and underlying issues. The decision on ‘what to measure’ is important and will be a balance between necessity, desirability, practicality and cost. The core of NFI is having clear objectives.

Creating a country sample design emerges after narrowing the objectives of an NFI; objectives are the key determinants on planning how to and what will be sampled. NFI (generally) depends on having good, up-to-date maps. Mapping generally uses remote sensing combined with ground truth analysis. The NFI is based on a field sampling process. Data are analyzed and reported at the appropriate scales. With a formal NFI, a measure of uncertainty in the estimates can be calculated. There should be a formal QA/QC procedure in place that includes the check re-measurements of a small subsample of the inventory. Audits from internal and verification by international teams help to increase accuracy of the reporting and ensure transparency with national stakeholders and the international community.

When designing a new NFI it is necessary to test its procedures in a pilot before implementing the full NFI.

Engaging Stakeholders and Resource Pooling

Engaging Stakeholders

Before deciding on an NFI and finalizing the objectives, the governing party should identify key stakeholders and conduct a series of meetings to engage national interest. An NFI produces information on trees and forests at the large-scale, national level that will not only be used by the forestry department, but other government organizations, institutes, community supported organizations, and non-government organizations that are directly or indirectly affected by forests and forest management (e.g. tourism industry, ministries of agriculture, of infrastructure and developments, etc.) Therefore, the process of deciding on the final objectives of a NFI should involve all relevant groups in government, research and society.

Resource Pooling

Resource pooling is useful in areas where capacity gaps exist. Stakeholder engagement may find institutions with particular expertise that increases the country's capacity to expand objectives, and to minimize the costs and time associated with training personnel.

Resource pooling is the grouping together of personal skills, knowledge and assets to increase capacity

Resource pooling may also involve infrastructural capacity, with laboratories, vehicles, logistical support, and other factors that contribute to the cost of conducting an NFI. Regionally, PICs can source expertise from neighboring countries to assist with capacity gaps, as well as pool costs and opportunities associated with externally funded training events. The SPC NFI Support Facility is available to assist with expertise and resources.

Formulating NFI Objectives

In planning and creating a set of NFI objectives, there are four principle guidelines that should be considered to ensure an NFI that meets country circumstances (UN-FAO, 1998) These are:

1. Objectives should be determined jointly by the people who will use the results (forest managers, planners, decision-makers, inventory specialists and indigenous people), sufficient to meet the REDD+ requirements.
2. Not all inventory objectives have the same level of importance. Priorities can be assessed at the national level through policy and management goals, stakeholder issues, and through the international community. The NFI should address objectives that meet national goals as well as the international reporting obligations.
3. Inventory objectives should reflect the physical effort that will be required to conduct an inventory, the organization, estimated costs and time, the existing knowledge of resources, the availability of specific aspects of inventory technologies, and institutional capability. These objectives are ongoing through time.
4. All NFI objectives should be SMART (**Specific, Measurable, Agreed, Realistic, and Time-framed**).

Designing an NFI

Sampling and Plot Design: A Pilot NFI

Sampling design and plot design are two distinct key stages. The sampling design is a framework that serves as a foundation for the selection of a survey sample.

The plot design provides the method to collect data from the field. Different plot designs are available to meet different needs. Both sampling design and plot design are discussed in more detail in Booklet 2 of this series on NFI for Planners & Managers.

Questions of design and methods should be tested in a pilot exercise before the full NFI is implemented. These booklets provide assistance in designing and implementing this pilot NFI.

Resource Consideration

Time to Conduct a Pilot NFI

The pilot NFI is carried out to test if the objectives and design will be executable according to plan. Efforts and time required for the different phases in forest inventory, from design planning, imagery acquisition, mapping, data collection and data processing varies. Hence, a "test run" of the procedure is needed to work out details, adapt, and determine if the assumptions of the design meet the objectives. The main objectives and outcomes of conducting a pilot NFI are:

1. Allow for scheduling to obtain needed background information. Past maps needs to be collected, information on cultural and heritage resources needs to be gathered and advance work with communities for ordering of equipment and data products are some things that need to be considered. Charting the schedule, requirements and personnel will help ensure that the pilot NFI gets completed in a timely manner.
2. To allow for gap analysis in capacity and infrastructure. Countries must identify skills, gaps and also conduct skill-based training for personnel to accomplish tasks ahead of time. Also allow for the acquisition of imagery and equipment ahead of time in close liaison with teams in other countries to maximize purchase value.
3. Document the decision making authorities, procedures, quality control & assurance, traditional land owner outreach and protocols, data stewardship and auditing. Test these protocols during the Pilot and adapt as necessary for full implementation.

4. Allow for testing measurement and analysis protocols, with time for revision and corrections.

Cost Implications with Different Objectives

Key considerations with costs include the level of effort associated with planning, training, traditional owner outreach, field data collection, and post-analysis processing. An overview of major steps is displayed in Figure 2.

Increasing the number and complexity of NFI objectives will have a direct bearing on cost. For example, a forest inventory targeting forest extent (what is forest, what is not), forest volume and carbon requires a level of training that is focused on physical measurements in the field. Adding flora and fauna biodiversity as an objective increases complexity. Species identification to obtain the diversity of all plants may require knowledge of over 1,500 species. Fauna diversity will also increase costs, as different skills and equipment are required.

It is preferable to implement an NFI where the objectives and costs are sustainable over a long period of time, rather than an ambitious inventory once only.

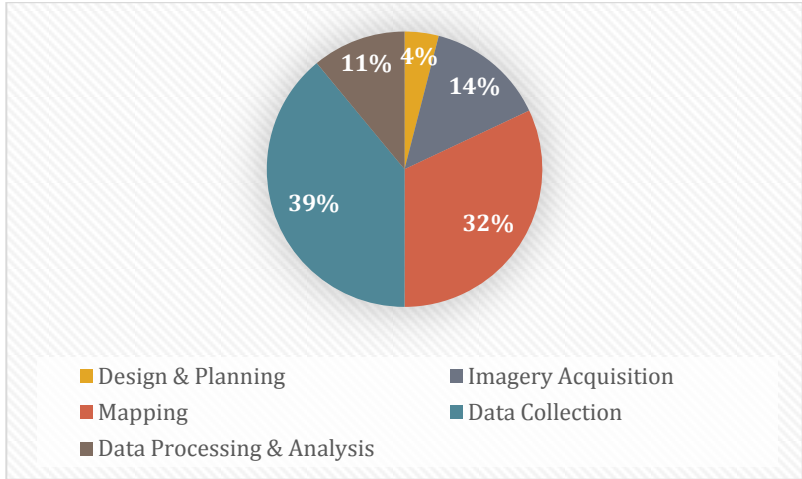


Figure 2. Amount of effort required for different phases of forest inventory. Source USDA Forest Service.2014.

Cost considerations are related to the complexity of the objectives

Community Outreach

A reconnaissance to communities that lies within the NFI is an essential element for all NFI. It is necessary to obtain permission from the community for access on their land in order to measure NFI plots. A team should be allocated to carry out community awareness and briefings to promote mutual understanding between the concerned parties on the activities that will be carried out on their land. This will

ensure that there is consistency and flow of activity during the actual field inventory work. Not only will the team be preventing any potential disruptions during the data collection process, they will also be able to obtain the help of the communities, who are vital assets during the inventory work as they are better versed with their landscapes. This is a good moment to Integrate Traditional Ecological Knowledge (TEK) with science by including villagers/communities as part of the NFI field team as field guides. In addition, it offers an opportunity for direct benefit-sharing with communities; often inventory teams will require accommodations nearer to the sites and this provides an excellent opportunity to directly pay villages for accommodation, food and guide services. This also helps to build ownership in the NFI process with local communities.

The SPC NFI Support Facility

In the past, PICs have had gaps in effective forest resource management because of the lack of personnel and infrastructural capacity resources and up-to-date forest data. In addition, NFI in the past has been carried out by international consultants funded by donors and did not add capacity to Forestry Departments. To address this issue, the need to establish a SPC NFI support facility has been recently identified. Through the guidance of the Pacific Regional Framework of REDD+, the Secretariat for the Pacific Community (SPC) in partnership with the Food and Agriculture Organization (FAO) of the United Nations and funding from the UN-REDD Program, a forest inventory regional facility was recently established within the SPC Land Resources Division. This facility will provide capacity support to host external and regional experts in PIC designs for NFI.

The Role of the Facility: to strengthen capacity building

Operating Concept of the Facility

Member countries who would like to obtain support for carrying out a NFI should make a request to the facility. The facility, with its team of experts will then mobilize resources, including the setting of a response team to send to the country in need. The response team will carry out training, inventory and data analysis for member countries to adopt, modify (option) and implement (Figure 3).

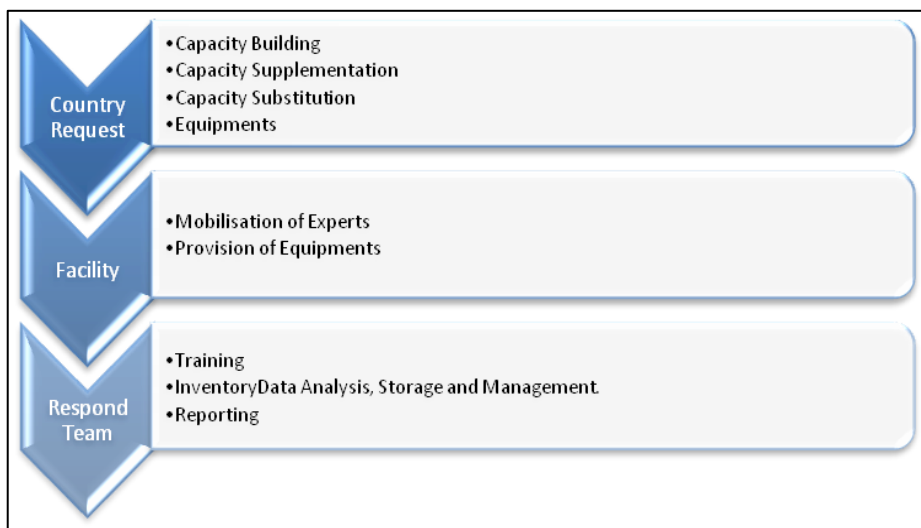


Figure 3: Operation Concept of the NFI Facility: Source: Jalesi Mateboto

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