DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
FOREST MANAGEMENT BUREAU

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

Development and Testing of National Forest Stock Monitoring System (FSMS) with Improved Governance Capabilities at All Levels of the Forest Administration
ITTO Project PD 599/11 Rev.1 (M)

TECHNICAL REPORT

Executed by:

Forest Management Bureau

With the assistance of

The International Tropical Timber Organization

Philippines, 14 October 2019

Project Title	:	Development and Testing of National Forest Stock Monitoring System (FSMS) with Improved Governance Capabilities at All Levels of the Forest Administration
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Budget	:	ITTO	US$ 497,930
		Philippine Government	US$ 290,113
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Project Key Personnel	:	**For. Nonito M. Tamayo,** Project Director **For. Ma. Teresa G. Aquino**, Project Coordinator **For. Raul M. Briz,** Assistant Project Coordinator
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LIST OF ABBREVIATIONS AND SYNONYMS

ASEAN	Association of South East Asian Nations
CBFMA	Community-Based Forest Management Agreement
CENRO	Community Environment Natural Resources Office/ Officer
CLO	Certificate of Lumber Origin
CTO	Certificate of Timber Origin
CoC	Chain of Custody
COV	Certificate of Verification
DAO	Department Administrative Order
DENR	Department of Environment and Natural Resources
DMC	Department Memorandum Circular
DMO	Department Memorandum Order
DR	Delivery Receipts
EO	Executive Order
FAO	Food and Agriculture Organization
FIS	Forest Information System
FLEG	Forest Law Enforcement and Governance
FLEGT	Forest Law Enforcement, Governance and Trade
FLGMA	Forest Lands Grazing Management Agreements
FMB	Forest Management Bureau
FOD	Field Operations Department
FSMS	Forest Stock Monitoring System
IFMA	Industrial Forest Management Agreement
ISFP	Integrated Social Forestry Program
ITTA	International Tropical Timber Agreement
ITTO	International Tropical Timber Organization
ITP	Industrial Tree Plantations
LCMS	Log Control Monitoring System
MH	Merchantable Height
MRV	Monitoring Reporting and Verifications
PENRO	Provincial Environment Natural Resources Office or Officer
PD	Presidential Decree
PHP	Philippine Peso
PO	People's Organization
PTTS	Philippine Timber Tracking System
PWPA	Philippine Wood Producers Association
RENRO	Regional Environment Natural Resources Office
SIFMA	Socialized Integrated Forest Ecosystems Management Agreement
SFEMA	Sustainable Forest Ecosystems Management Act
SMF	Self-Monitoring Form
SUDECOR	Surigao Development Corporation
TLA	Timber License Agreement
TLAS	Timber Legality Assurance System
UAT	User Acceptance Testing
UWM	Unit of Work Measurement
VLO	Verification of Legal Origin
VLOC	Verification of Legal Origin Certificate
VPA	Voluntary Partnership Agreement

SUMMARY

The ITTO Project described PD 599/11 <u>Rev.1</u> (M) entitled "Development and Testing of National Forest Stock Monitoring System (FSMS) with Improved Governance Capabilities at All Levels of the Forest Administration" has been implemented by the Forest Management Bureau (FMB) as Executing Agency since May 2013. A 42-month extension without additional funds has been granted by ITTO in order to fully complete execution of all project activities. *(12-12-12-6)*

The National FSMS is composed of the study, development and field testing of a system that will help the government to plan, monitor, and control the trade of Philippine timber resources in accordance to its existing laws and regulations with internationally accepted standards.

Hence, the Forest Management Bureau (FMB) provide guidance in defining the terms of reference for the development of a web-based National Forest Stocks Monitoring System with nationwide application, based on existing rules and regulations of timber production. This system is simply known as NFSMS. The final acronym will be included in the DENR Administrative Order or its implementing rules and regulations is prepared for the adoption of the system nationwide.

The first eighteen (18) months of project implementation was devoted for administrative procedures in search of a Service Provider through international bidding as required by Philippine laws. There were two (2) failed biddings involving a lone international bidder as Service Provider. Then, towards the end of Calendar Year 2016, the FMB created a new Project Team to implement the project. The new Project Team develop a new set of selection criteria in the first few months. Finally, after six (6) months, FMB commissioned a local Information Technology (IT) company in the Philippines named; CAI-KONEK Ventures, Inc. by way of a contract to develop the system including pilot or field testing. Twelve (12) months later, we were ready to undertake field or pilot testing of NFSMS in Mindanao supposed in the CARAGA Region based on approved project document. However, we were not allowed to travel to Mindanao due to the on-going armed conflict. All official travels to Mindanao were confined to the urban areas and DENR field offices while those in the mountainous areas were temporarily banned. We waited for clearance for the lifting of the travel ban. After almost one year, we were finally granted to travel to Mindanao to field /pilot the NFSMS. The downtime we had experienced has affected us again in terms of completing the project.

The implementation of NFSMS in the country, this will ultimately improve forest governance as well as increase capabilities of the entire bureaucracy of forest administration in the Philippines. All transactions will be recorded electronically and viewed in real time. Thus, transparency will be observed.

The project will see the piloting of a technology system that will satisfy the following three outputs:

i. 100% "Back to Stump" traceability for wood production. This involves the tracking of the logs and lumber while in transit and while they are being sold or marketed.

ii. *Verifications of Legal Origin* (VLO) is a documentary verification system that ultimately result in the issuance called Verified Legal Origin Certification (VLOC) certifying that the logs and lumber that have undergo the process and procedures through the NFSMS are indeed legally sourced. This did not diminish our absence of an online issuance of Official Receipts (OR) for all government transactions i.e. for payment of forest charges in which capability was supposedly included in NFSMS for automated royalty calculations based on CLO/CTO documentation; and

iii. Improved system environment including field data entry capabilities and online, configurable, multi-tiered access. It is online system that is housed at the DENR Central Office Server and can be accessed by all DENR field offices anywhere and anytime through online or internet connection.

1. INTRODUCTION

1.1 Background Information

The Philippines through the Forest Management Bureau (FMB) has implemented forestry projects with the assistance from the ITTO, i.e. the Forestry Information System (FIS) that assisted the Philippine government in the management, monitoring, assessment and reporting of the status of forests and forestland under tenure management and private plantations. The Forestry Information System or FIS is platform that keeps records of information and data of selected forestry tenure instrument consisting at the time it was developed. It is consisted of five (5) modules that essentially deals with long term forest agreements. Then comes the National Forest Stock Monitoring System or National FSMS which is supposed to be the reliable timber tracking system as conceptualized. Currently, the Philippines does not have such a working or functioning timber tracking procedures with back to the stump traceability. Theoretically, the Philippine an existing tracking System but it does not complete the loop or complete traceability.

Moreover, there are doubts that timber and other wood products found in the local market are not totally coming from genuine and legal sources. Thus, there is need to improved forest governance, transparency and accountability in the forestry industry sector become more competitive and hopefully sustainable in its operations in the long run.

1.2 Scope of the Project

The forest products covered by the NFSMS will be limited to log and lumber only. Thus, in forest production, it covers various activities for responsible management of production from pre-harvest inventory of trees to be harvested, tree marking, felling, bucking, scaling, log and lumber transport, and post-harvest inventory. The System can be applied to both natural forests and plantation forests as long as the entire procedures of NFSMS are followed.

1.3 Development and Specific Objectives

The overall goal of the project is to improve forest governance, institutional law enforcement capacity, stakeholders' consultation, forestry sector competitiveness in the long run through improved data management and eventually for the substantial reduction of illegal logging and thereby promoting trade of legally harvested or sourced timber and timber products.

These are translated into three (3) more concrete specific objectives to develop and pilot NFSMS modules supporting the following major Outputs by Modules listed below:

- **Output 1.** Forest Stock Monitoring System (FSMS) to support 100% "Back-to-Stump" traceability for wood production developed.

- **Output 2**: Forest Stock Monitoring System (FSMS) to support Verifications of Legal Origin (VLO) developed.

- **Output 3**: Online, configurable, multi-tiered and FSMS environment with field data entry module

The overall environment of the system would finally greatly benefit from technical features such as field data collection module enabling more efficient monitoring and law enforcement activities on site, reading of radio frequency identification (RFID) and combining electronic and computer processing capabilities which more secured mode of data encoding, data storage and retrieval, a more flexible, online, multi-tiered user interface which is a giant leap or upgrade from the current processes of using timber crayons and marking hatchets to mark timber and lumber products.

2. APPLIED METHODOLOGY

2.1 The Hypotheses

The full execution of the project activities pertaining to Outputs Modules should achieve the specific objective, and achievement of the specific objective should contribute to improved governance capabilities at all levels of the forest administration.

Delivery of individual outputs is to be assessed using the indicators defined in the project document. Likewise, achievement of the specific objective is to be measured using the relevant indicators indicated in the Logical Framework Matrix (Annex 2). The indicators of delivery of outputs and achievement of the specific objective are presented in project Work Plan (Annex 1).

2.2 Implementation Approaches and Methods

The FMB as the Executing Agency of the DENR first started with on existing DENR implementing rules and regulations (IRRs) and other relevant guidelines. Then selected DENR field Offices were involved for the pilot or field testing of NFSMS which was expanded to two (2) other regions instead of just one to fully test the System of its applicability and robustness. Thus, there were three pilot regions for the System.

The FMB used the services of a single Service provider or Sub-Contractor or which is a locally based in the country due to the failure of two (2) international bidding process. The selection process of the Sub-Contractor or Service Provider were likewise in accordance with ITTO guidelines wherein the implementation strategy will follow classic IT system deployment methodologies involving the simultaneous development of all the features through subsequent stages. Then following activities were derived from the report of the Service Provider.

2.2.1 Selection of the Appropriate Service Provider

The selection of the Sub-Contractor or a Service Provider was the project's first start-up phase. This includes focus group discussions, meetings, workshops, brainstorming and levelling-off with the Service Provider and key technical project personnel of the Forest Management Bureau (FMB) as the Executing Agency (EA). This is the discussion of the Functional and Technical Specifications of NFSMS for Modules 1, 2 and 3. This phase runs roughly for three (3) months and is primarily concerned with the review of current systems, a detailed analysis of the legal standard applicable and the various forest and institutional procedures in use and a survey of system users. This discussion resulted in a detailed Functional and Technical Specifications document with the Sub-Contractor which are the bases for the configuration of NFSMS. The Sub-Contractor called this programming as Specifications Document.

2.2.2 Systems Configuration / Documentation

The development phase goes on with the actual implementation and development of the system's Functional and Technical Specifications outline under Programming Specifications Document. This phase lasted for another 5-8 months of the three (3) modules configured in parallel and programmed into the FSMS. The platform configuration is split into three broad categories; system environment, system inputs and system outputs (reports). The system inputs consisted of handheld computers input modes (for field data collection, verification, and temporary storage) in the form of a handheld device, Web input modes (for office-based work) and file transfer input mechanisms (for batch data uploads). System outputs are anticipated to be a major part of the overall configuration/programming work, as it is through the reporting that much of the operational intelligence is derived. A detailed

documentation of the system has been prepared and submitted by the Service provider including the draft System and Report Generation User Guides.

2.2.3 System Testing / User Acceptance Testing (UAT) and Systems Sign-Off

With the development of the System, the NFSMS, it was subjected to a rigorous system's testing called User Acceptance Testing (UAT) at the Forest Management Bureau. Selected Technical staff of the Project Team was involved in the UAT. It took four (4) months to complete the UAT process. On a daily bases, all bugs observed are immediately captured and recorded by the Service Provider and relayed to its head office. Then, the Service Provider inputs and makes correction on the System and have it ready for the continued UAT process on the following week.

There was no deployment yet of the NFSMS to DENR field offices because such deployment would require some sort of regulations on the part of the Department (DENR) for nationwide adoption. There was no roll-out either undertaken in the field. Instead, the roll-out part was included in the UAT process. Thus, all Technical staff involved in the UAT process is the core group of FMB as technically trained personnel on NFSMS. There have been series and continued familiarization of NFSMS in preparation for the capacity building or training of selected technical personnel from all DENR field offices scheduled within Calendar Year 2019. This will be the first round of training that we intend to undertake this year. A second round of training will follow on a per need basis of DENR field office. This will eliminate putting up a Help Desk at the FMB. Instead, FMB will have small group of Technical Support staff lodged at the Management Information Systems which is an inherent function of that office, that will be task to handle future technical support to NFSMS.

User Acceptance Testing (UAT) procedures are performed in order to validate that all features and functionalities work as per the specifications. Upon successful UAT, the project team assigned in the UAT signs-off on the system development phase and the field piloting of the system can start with the "roll-out" phase.

2.2.4 Pilot Phase and Monitoring and Evaluation

After completion of the UAT of the NFSMS, it was subjected to Field / Pilot Testing. The approved project document provides that the Pilot Site shall be in Mindanao. As it was already mentioned in the previous discussion, the first Pilot Site was in Luzon (Quezon Province in Southern Tagalog). That was in May 2017 when the System was ready for Pilot Testing but Mindanao was under to military conflict at that time. The other two (2) Pilot Sites were finally in Mindanao that was undertaken towards the end of Calendar Year 2018. These were in Region XIII (Agusan Del Sur Province) and Region X (Bukidnon Province).

The System was fully pilot tested in Region X starting from populating the NFSMS with data of tenure holders or permit holders until the last step of issuing the VLO Certificate. While Pilot Testing in Region XIII was limited to the issuance of the transport document only which is the Certificate of Timber Origin (CLO) due to the weather disturbances and local regulations that totally disallowed the entry and/or exit of hauling trucks into and out of the forests.

The main milestones of the Pilot Testing were the review and sign-off of the detailed "Technical and Functional Specifications" by the project team, as well as the User Acceptance whereby following the development stage, all the features of the systems are tested against the Technical and Functional Specifications. This were the bases of the Project Progress Reports that were collated and submitted to the ITTO every six months.

Table 1. The methodologies applied in implementing project activities were based on the submitted report of the Service Provider.

OUTPUT / ACTIVITY	METHODOLOGY	DURATION
Project Planning	• Project Contract Signing • Creation of Work Plan/ Project Timeline • Kick-off meeting – Presentation of Project Plan to Stakeholders and Steering Committee	1 day 2 days 1 day
System Analysis, Development & Testing, & Field Testing		
OUTPUT 1: Forest Stock Monitoring System (FSMS) module to support 100% "Back to Stump" traceability for wood production developed		
Activity 1.1: "Functional and Technical Specification" of traceability	• User Requirements Gathering • Creation and Submission of Functional and Technical Specifications of Traceability • Review, Approval and Acceptance of Functional and Technical Specifications of Traceability	2 months 1.5 months 4 months
Activity 1.2: Traceability module configuration	• Coding • Unit Testing • Creation of System Test Plan • System Testing • Bug Fixing • Creation of Programming Specifications Document • Creation of User Documentation (User's Manual, System Admin Manual) • Creation and Submission of Report on the Configuration of Traceability Module • Review, Approval and Acceptance of Report on the Configuration of Traceability module	4 months 4 months 2 weeks 3 months 3 months 2 weeks 2 months 2 days 1 week
Activity 1.3: Traceability module deployment and testing (User Acceptance Testing-UAT for Traceability module)	• Creation of UAT Test Plan • Creation of Test Cycles • Creation/Identification of Team for testing • Walkthrough Training for users who will be involved in UAT • User Acceptance Testing • Issuance of UAT Completion	1 month 1 month 2 weeks 3 days 2 months 1 day
Activity 1.4: Field testing of traceability module	• Field testing for Traceability module • Creation and Submission of Traceability module Deployment and Field / Pilot Testing Report • Review, Approval and Acceptance of Traceability module Deployment and Field Testing Report	3 months 2 days 1 week
OUTPUT 2: Forest Stock Monitoring System (FSMS) module to support Verification of Legal Origin (VLO) developed		
Activity 2.1: "Functional and Technical Specification" of VLO module	• User Requirements Gathering • Creation and Submission of Functional and Technical Specifications of VLO module • Review, Approval and Acceptance of Functional and Technical Specifications of VLO module	2 months 1.5 months 4 months

Activity 2.2: VLO module configuration	● Coding	4 months
	● Unit Testing	4 months
	● Creation of System Test Plan	2 weeks
	● System Testing	3 months
	● Bug Fixing	3 months
	● Creation of Programming Specifications Document	2 weeks
	● Creation of User Documentation (User's Manual, System Admin Manual)	2 months
	● Creation and Submission of Report on the Configuration of VLO module	2 days
	● Review, Approval and Acceptance of Report on the Configuration of VLO module	1 week
Activity 2.3: VLO module deployment and testing	● Creation of UAT Test Plan	1 month
	● Creation of Test Cycles	1 month
	● Creation/Identification of Team for testing	2 weeks
	● Walkthrough Training for users who will be involved in UAT	3 days
	● User Acceptance Testing	2 months
	● Issuance of UAT Completion	1 day
Activity 2.4: Field Testing of VLO module	● Field testing for Traceability module	3 months
	● Creation and Submission of Traceability module Deployment & Field Testing Report	2 days
	● Review, Approval and Acceptance of Traceability module Deployment and Field Testing Report	1 week
OUTPUT 3: Online, multi-tiered and integrated FMS environment with field data entry module configured		
Activity 3.1: "Functional and Technical Specification" of online, multi-tiered module design and Analysis for Field Module	● User Requirements Gathering	2 months
	● Creation and Submission of Functional and Technical Specifications of online, multi-tiered module	1.5 months
	● Review, Approval and Acceptance of Functional and Technical Specifications of online, multi-tiered module	4 months
Activity 3.2: Field module and FSMS environment configuration	● Coding	4 months
	● Unit Testing	4 months
	● Creation of System Test Plan	2 weeks
	● System Testing	3 months
	● Bug Fixing	3 months
	● Creation of Programming Specifications Document	2 weeks
	● Creation of User Documentation (User's Manual, System Admin Manual)	2 months
	● Creation and Submission of Report on the Configuration of Traceability Module	2 days
	● Review, Approval and Acceptance of Report on the Configuration of Traceability module	1 week
Activity 3.3: Field module and FSMS environment deployment and testing	● Creation of UAT Test Plan	1 month
	● Creation of Test Cycles	1 month
	● Creation/Identification of Team for testing	2 weeks
	● Walkthrough Training for users who will be involved in UAT	3 days
	● User Acceptance Testing	2 months
	● Issuance of UAT Completion	1 day

Activity 3.4: Field Testing of field data entry and law enforcement module	• Field testing for Traceability module	3 months
	• Creation and Submission of Traceability module Deployment and Field Testing Report	2 days
	• Review, Approval and Acceptance of Traceability module Deployment and Field Testing Report	1 week
Technical Infrastructure Procurement and Setup	• Procurement of materials for the field testing (RFID, Adhesive and Paper, drill, rubber hammer)	1 month
	• Procurement and Installation of HW/SW Infrastructure	4 months
	• Set-up of UAT Environment	1 week
	• Set-up of Training Environment	1 week
	• Set-up of Field Testing Environment	1 week
Training	• Creation of Training Plan	1 week
	• Creation of Training Materials	1 month
	• Identify the Trainers	2 weeks
	• Conduct "Train the Trainer"	1 week
Planning for Deployment for Field Testing	• Creation of Deployment Plan	1 week
	• Submission/Presentation of Deployment Plan	1 day
	• Deployment of NFSMS for Field Testing	1 week
PROJECT CLOSING		
Creation and Submission of Project Terminal Report	• Creation and submission of Final Report on the Development of NFSMS Module to support 100% 'Back to Stump' Traceability for wood production	1 week
	• Creation and submission of Final Report on the Development of NFSMS Module to support Verifications of Legal Origin (VLO)	1 week
	• Creation and submission of Final Report on the Configuration of Online, multi-tiered and Integrated NFSMS environment with field data entry module	1 week
Submission/Turn-over of Documents/Project Outputs	• Submission of Programming specifications and source codes	1 day
	• Submission of Functional and Technical specifications Report	1 day
	• Submission of Users' Manual *(Electronic copy and Print-out)*	1 day
	• Review, Approval and Acceptance of Project Terminal Report and Project Outputs	1 week

3. RESULTS AND DISCUSSION

There are three Outputs that the Project has to complete and they are in a Modular format. These Outputs were developed based on existing forestry laws, rules and regulations in the country. Mus as we would want to completely depart from our current practices in terms of forest management, we are constraint due to our policies and institutional structures.

3.1 Output 1: Forest Stock Monitoring System (FSMS) module to support 100% "Back to Stump" traceability for wood production developed

The 100% back-to-the-stump traceability for wood production is guaranteed for all trees cut or harvested that were covered by a corresponding and valid cutting or harvesting permit. There is an

inventory and tagging of trees before cutting or harvesting commenced. Eventually, the system i.e. NFSMS will be capable of generating a transport document called Certificate of Timber Origin (CTO) for sound logs from the cutting area to the sawmills or wood processing plants and Certificate of Lumber Origin (CLO) for lumber coming out of the sawmills or wood processing plants.

3.2 Output 2: **Forest Stock Monitoring System (FSMS) module to support Verifications of Legal Origin (VLO) developed**.

The Verification of Legal Origin (VLO) within NFSMS was originally designed for the automatic collection of taxes in the form of forest charges for all natural-grown timber harvested in the Philippines. Fortunately, due to the absence of an online procedure for the issuance of Official Receipts which is final proof of purchase for paid taxes or revenues, it was decided to refocus the VLO mechanism in a Certification mechanism whereby such timber and lumber are legally harvested when subjected to NFSMS. This is the initial step of the government to follow international standards of legal timber trade at the second level which is an opportunity for traders to export wood products.

The VLO Certificate (VLOC) is the final or last document that NFSMS will be issuing to logs or lumber covered by a CTO or CLO which is also issued by NFSMS. The VLO Certificate further certifies that a particular shipment of log or lumber covered by a CTO or CLO is legally sourced or harvested. This will be our backbone for the establishment of timber legality assurance system anchored on the ASEAN Criteria for Timber Legality. The System will verify uploaded documents that correspond to the indicators of the ASEAN Criteria for Timber Legality.

3.3. Output 3: **Online, multi-tiered and integrated FMS environment with field data entry module configured.**

The FSMS is a full online configurable, multi-tiered and integrated system with field entry module. This means that it can be accessed by multiple authorized users with different access roles, DENR field offices i.e. Community Environment and Natural Resources Officers (CENROs), Provincial Environmental and Natural Resources Officers (PENROs), Regional Offices and Central Offices.

The project focused on the development of a web-based system to support true "back-to-stump" traceability, semblance of a Chain of Custody (CoC) management and features of a Verification of Legal Origin (VLO), that needs the following:

a) Improved data validation and processing capabilities to facilitate the reconciliation of all new datasets across the supply chain with information already stored in the system;

b) An integrated Certificate of Timber Origin (CTO) / Certificate of Lumber Origin (CLO) module by verifying uploaded Official Receipts as proof of payment of taxes or forest charges for cutting or harvesting naturally-grown trees *(plantations and planted trees are exempted from paying taxes or forest charges)* nationwide instead of performing an automated royalty calculations and verifications, thus ensuring that Forest Revenues are correctly collected, duly recorded and fully accounted for.

4. ANALYSIS AND INTERPRETATION OF THE DATA AND RESULTS

4.1 Assessing Achievement of the Outputs

The primary forest products covered by NFSMS are logs and lumber being harvested, transported, processed and marketed or traded. Other wood products i.e. veneer, plywood, particleboard, etc. is envisioned to be covered at later version of the NFSMS. This also includes information on the management of tenured area or areas under forest management regimes, private lands and wood processing plants.

The activities of NFSMS includes, **registration in the system, timber inventory, felling, bucking, scaling, transport to wood processing plant, checkpoint inspection as part of law enforcement, transport of lumbers from wood processing plant**.

The NFSMS likewise considered the integration and adoption of technologies such as the use of Radio Frequency Identification (RFID) in the form of nail tags, barcode tags, QR codes in the transport certificate, global positioning system (GPS), range finder, etc., to the system to facilitate the achievement of the three major objectives based on the approved project document. The use of these electronic equipment or handheld device will help reliability of data collection or measurements *(i.e. standing tree inventory in measuring merchantable height, diameter and volume calculation, etc.),* minimize errors in measuring other field data, and as well accurate process of field data (*i.e. automatic preparation of Stand and Stock Table, Tree Cutting List*).

4.1.1 100% "Back to Stump" Traceability for Wood Production

Developing a System with a 100% Back to the Stump traceability was a tall order. Forest management in the Philippines has existing traceability of logs and lumber up to the retail through transport documents called Certificate of Timber Origin (CTO) or Certificate of Lumber Origins (CLO). With the development of tree farms and tree plantation for the last three decade and eventual relaxation of regulation for planted trees especially exotic and fast-growing species, new set of transport document called Self-Monitoring Form (SMF) has been widely use, provided such tree plantations are registered with the DENR Field Offices.

The main innovation introduced in the system in this Module is the use of RFIDs or Nail Tags. During inventory, trees to be cut will be tagged with RFIDs. Tree information and coordinates will be recorded and saved to the central database at the DENR Head Office Server. These RFIDs and Nail Tags can be easily read by a handheld device while transport certificates' QR Codes can be verified by mobile android phones. This allows users such as field law enforcement officers to instantly verify the origin of logs as well as lumber. This allows tracking of logs and lumber literally back to the stump to where the subject trees were cut.

The NFSMS integrates the issuance of the *Certificate of Timber Origin* (CTO), *Certificate of Lumber Origin* (CLO) and Self-Monitoring Form (SMF) in the system that will facilitate automated verification of the shipment. This also enables efficient monitoring and effective law enforcement in the field. The verification of the RFIDs in the form of Nail Tags can be done both on-line and off-line modes. But the verification of QR Codes embedded in the transport document requires on-line or internet connection to access the Central Database housed at the DENR Central Office.

The Field/Pilot Testing of the NFSMS were conducted in three (3) different sites in the Philippines. The first Pilot Test was in the Province of Quezon in Region IV-A in October 2016. It was successfully demonstrated that the system can actually trace the origin of logs and lumbers transported to and from the Wood Processing Plant (WPP) using the NFSMS mobile application, as presented in Annex 3.

The second field testing was in the Province of Agusan Del Sur in Region XII in Mindanao in November 2018. However, due to heavy rains in the pilot area, the pilot testing ended only on the issuance of Certificate of Timber Origin (CTO) by System to transport timber or round logs to the wood processing plant. Besides, the shipment of timber covered by a CTO issued by the System could not proceed because of a Local Provincial Ordinance (local law) that prohibits movement of timber using public non-concrete roads from the cutting going to the wood processing plant when a heavy down pour has just occurred. These requires three days to resume the transport of timber.

And the Third field testing was in the Province of Bukidnon in Region X on the first week of December 2018. This time, the entire System was tested from tree inventory up to the issuance of a Verified Legal Origin Certificate (VLO Certificate). This finally proved that the System will work reliably when fully operational.

4.1.2 Verification of Legal Origin (VLO) system

The VLO module of the NFSMS provides authorized users to assess and verify the origin of logs using the various applicable transport documents i.e. CTO, CLO, SMF (Self-Monitoring Form), and CoV (Certificate of Verification) as reference. Documents associated with the shipment being requested for VLO Certificate, uploaded through the previous modules (Registration, Inventory, Felling, Bucking and Scaling, Transport) will be used for further validation. The System will verify uploaded documentary evidence as supporting papers of the logs harvested and being transported, in which the System will generate the VLO certificate. After system's verification of uploaded supporting documents, the System will is capable of producing a VLO Certificate certify that the said shipment is indeed legally harvested or sourced.

Supposedly, the VLO module should automatically compute for tax collected based on the tax rate which is equivalent to forest charges for natural growing trees harvested in both public and private lands. Fortunate, at the very start of Project implementation, the during the discussion on the Technical and Functional Specification, it was found out that we or in the Philippines, we are not into online issuance of Official Receipts (ORs) which is final proof of payment. Thus, this was not embedded in the System. Instead, the Official Receipt for payment for the forest charges is scanned and uploaded into the system. This is stored in the System which will be ready for access and verification anytime when the procedure reached the VLO certification process. The VLO process is a document verification procedure within NFSMS whose ultimate purpose is to verify the different parameters of timber legality anchored on the six (6) ASEAN Timber Legality Criteria. As member of ASEAN, we are under obligation to apply or adopt these timber legality criteria. At the ASEAN standard, this is the minimum requirements to Verify Legal Origin of timber, enumerated below.

1. Compliance with all relevant forestry laws and regulations
2. Payment of statutory charges
3. CITES compliance
4. Implementation of a system that allows tracking of logs to the forest of origin *(back-to-the-stump)*
5. Timber harvested by parties who have legal rights
6. Comply with social and environmental aspects laws

To have a clearer perspective on how the Philippines' had gone with the legality criteria anchored on the ASEAN Timber Legality Criteria. Below is the Summary Matrix based on documentary evidences.

Table 2. Showing the Philippines' compliance to the ASEAN Timber Legality Criteria.

ASEAN TIMBER LEGALITY CRITERIA	PHILIPPINE LEGAL COMPLIANCE *(documentary compliance)*
1. Compliance with all relevant forestry laws & regulations	All entities that harvest timber are in possession of valid permit or license issued by appropriate authorities (***Presidential Decree No. 705 – Revised Forestry Code in the Philippines***)
2. Payment of statutory fees & charges (some call it **Royalties**)	DENR Administrative Order No. 2000-21 (*Payment of forest charges for natural grown trees*); DENR Administrative Order No. 1999-53 (*Government share*); DENR Administrative Order No. 2000-63 (*Administrative fees*); Republic Act. No. 7161 (re *Forest Charges*)
3. CITES compliance	DENR Administrative Order No. 2007-01 (list of threatened species), Except specific provisions of the agreement or licenses. Bans cutting of *Agathis Philippinensis,* all mangrove species, etc
4. *Implementation of a system that allowing the tracking of logs to the forest of origin*	DENR Administrative Order No. 2007-31 (*Computer- Generated Certificate of Timber Origin-CTO / Certificate of Lumber Origin-CLO*) DENR Administrative Order No. 1997-04 (*Transport Certificate for Certificate of Minor Forest Products)*; DENR Administrative Order No. 1996-06 & 1996-11 (*Log Control Monitoring System-LCMS*)
5. Timber harvested by parties who have legal rights to carry out logging @ designated forest & based on approved plans.	Based on approved Comprehensive Development Management Plans, Five-Year Indicative Operations Plan, Multi-Year Indicative Operations Plan (*pursuant to numerous existing guidelines on the matter*)
6. Party who harvest the timber shall comply with laws governing social & environmental aspects.	Presidential Decree No. 1586 (*Philippine Environmental Impact Assessment System*) Republic Act No. 8371 (*Indigenous Peoples Rights Act Law for Free & Prior Informed Consent or FPIC*)

The System used these Criteria for Timber Legality by ASEAN as the Philippines is a member of ASEAN.

Furthermore, in terms of transport document i.e. the Certificate of Timber Origin (CTO) / Certificate of Lumber origin (CLO), the origin and destination of wood production is captured. Other transport documents such as the Self-Monitoring Form (SMF) for plantation species from private titled properties and registered with the Department of Environment and Natural Resources (DENR) and the Certificate of Verification (CoV) for planted timber species found in private titled properties.

The VLO system works by verifying uploaded documents for all permittees including those holders of tenure instruments (25-year agreements), based on the **ASEAN Timber Legality Criteria.**

Table 3. The VLO System

VERIFIED LEGAL ORIGIN (VLO) SYSTEM	
Criteria	**Result**
1. Copy of existing & relevant forestry laws & regulations (PD705) 2. Copy of Approved cutting permits based on legal rights to harvest & with approved management plans *(when applicable)* 3. Copy of ECC or CNC and FPIC or CNO *(whichever is applicable)* 4. Copy of Official Receipt as proof of Payments of forest charges *(when applicable)* 5. CITES alert *(system's default)* 6. QR coded Transport Certificate for Timber (with RFID) or Lumber (with QR) *(system's default)*	*System will generate document called VLO Certificate -- Certifying that this particular shipment of forest products is <u>VLO Certified</u>*

4.1.3 Online, Configurable, Multi-tiered and Integrated FSMS Environment with Field Entry Module

The NFSMS is an online management and monitoring system focusing on the wood production specifically logs and lumber sourced or harvested from tenured areas, private lands and passed through wood processing plants in the Philippines. It is an integration of web-based and mobile application having one central database. It can be accessed by multiple authorized users with different access roles in the CENRO, PENRO, Regional Offices and Central Office.

The outstanding features of the system is the flexibility to perform data collection offline and sync or mode to the DENR Server once internet connection becomes available. This allows inventory activities in sites that have no internet connection.

The documents submitted by the Service Provider are comprehensive. The screenshots provided in every document will greatly help visualize the system's flow.

4.1.4 The National Forest Stock Monitoring System (NFSMS) Processes or Steps.

1. Registration of Private Plantations, Tenure Holders and Wood Processing Plant
   A. Registration of Private Plantation
   B. Registration of Private Non-Plantation
   C. Tenure Holders
2. Request for RFID Nail Tags from CENRO, PENRO and Region to FMB
3. Issuance of RFID Request from CENRO, PENRO and Region to FMB
4. Acceptance of RFID
5. Creation of Inventory Team
6. Dispatch of Inventory Team
7. RFID Acceptance – Inventory Team
8. Generate Tally Sheet of Timber Inventory
9. Generate Stand and Stock Table
10. RFID Acceptance by Scaling Team
11. Download Log List of Felled Trees and Scaled of bucked logs
12. Request for Transport Document
13. Generation of Scale Report by NFSMS)
14. Download CTO Generated by NFSMS
15. Download SMF Generated by NFSMS
16. Receiving of Timber
17. Download CLO Generated by NFSMS
18. Download VLO Generated by NFSMS

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One can see the Screenshots of NFSMS processes and steps (Annex 6).

4.2 Significance of the Outputs

The significance of the project output can be measured by its adoption and application on a nationwide scale. The long-term impact to the Philippine forest is to have sustainable forest production of wood, supply of other forest goods and services for local consumption.

Supposedly, one of the key drivers for the project remains the ability for the DENR and the FMB to improve revenue collection or taxes in the form of forest charges, royalties and levies, as well as to demonstrably meet its commitments to actively combat illegal logging. Given the current minimal revenue collection from forest production, especially with regards to the collection of the "government share" from plantations by tenure holders of Industrial Forest Management program, it is expected that over time, increasing forest revenues will provide additional funds to support on-going system operations and maintenance. The automated recording and analysis volume of timber harvested in a particular area or location, will greatly help in determining the accurate amount of government tha the we are supposed to collect from a tenure holder.

Also, as part of the workshops and consultation process, alternative mechanisms were explored as means to insure the long-term viability and appropriation of the system by the forest administration. Such mechanisms could include:

(a) the possibility to sell barcodes to economic operators for a nominal fee in order to generate extra revenues;

(b) linking the FSMS to other national initiatives such as the *Monitoring, Reporting and Verifications* (MRV) system required under the national REDD+ strategy, thus providing continued support for the development and extension of the application;

(c) linking the FSMS to systems from other administrative departments (such as customs, finance, etc…) in order to maximize the benefits of the system and thus entrench its usage.

Given the present international requirement for increased transparency and improved governance in the forestry sector (*as demonstrated by the adoption of the Lacey Act in the US, the FLEGT process in Europe and the REDD+ framework at the Climate Change area, etc)*, it appears that national forest information management system with "back to stump" traceability and VLO capabilities are quickly becoming required tools to engage in the international wood trade, and that pressure on producer countries to put in place such systems shall be maintained in the future.

4.3 Progress of the Project

The NFSMS is intended for roll-out and nationwide adoption in the Philippines in mid-2018. But, we need to improve the system by covering all planted trees (registered tree plantations in private titled lands) as well as standing trees (not described as tree plantations). We also intend to include imported logs coming into the country, provided these logs are covered with a valid import authority issued by the Department of Environment and Natural Resources (DENR). Hope, these logs when used as raw material can be captured by the system and the corresponding Verified Legal Origin (VLO) Certificate can be issued and generated by the System.

For planning purposes, the Forest Administration in the Philippines should be able to make realistic projections of timber demands, market prices and even knowing the prices of different timber species that are or will be available in the market. The roles of tree plantations from private lands or private properties will be measured and hopefully accounted for. With records and data of private tree plantations already available electronically, forest industry will surely benefit from this knowing where and who to contact to when they need raw materials of timber to feed their mills.

5. CONCLUSIONS

- The FMB, as the Executing Agency (EA), had exerted all efforts. and committed personnel for the completion and successful implementation of the project. We completed the project after several extensions granted to us by ITTO. We have faced and hurdled almost impossible challenges and still complete the project.

- The FMB sought assistance from the DENR Central Office by requesting substantial additional emergency fund to continue funding the development of the System when the project funding support was suspended by ITTO. We are indeed committed to completing this project and eventually adopt the system as our national timber tracking system for the Philippines.

- The completion of the project boosted the confidence to present this system to the top management of the Department and eventually prepare for its adoption on the national scale to ensure that timber and other timber products are indeed legally sourced and/or legally harvested/cut, transported, processed and marketed. At this time, the required tax on harvested trees in every tree cut in the form of forest charges are exactly, accurately collected and recorded.

- The NFSMS was successfully pilot tested and had demonstrated to be feasible. It can be used to trace wood products – currently logs and lumbers, by going back to their origin. The system can be use as Chain of Custody system with traceability feature. Verification of Legal Origin (VLO) has been integrated to ensure that shipment of timber and lumber that were subjected to the System can be ultimate issued with a certificate called VLO Certificate certifying that such shipment of timber or lumber are legally sourced harvested or from verifiable sources.

- The System is an online and available over the web, we though that it will be critical to have reliable and stable internet connection that must always be present at all the DENR Field Offices nationwide i.e. the DENR Central Office, Forest Management Bureau, Regional Offices, Provincial and Community Offices, which will not be at the control of the DENR, since this is Service Provider dependent.

- Forest governance will be enhanced and practiced when the System becomes operational. All transaction in the System will be transparent, accountability of forest officers is fully established, procedures are well documented, recorded and known. This enhances responsible forest officers in the use and adoption of the System. Finally, the movement of timber and lumber products can be closely monitored. This will require capacitating DENR personnel who will use the system.

6. RECOMMENDATIONS

The current scope or coverage of NFSMS is the harvest and transport of timber (round logs) and lumber from the cutting area going to the wood processing plants and to retail local market or even to ready for export. This is already a stand-alone System that could satisfy the requirement for legality of timber and lumber using the six ASEAN Criteria for Timber Legality. This is a widely accepted criteria in ASEAN for almost a decade now. This system is developed by the government and likewise implemented by the government as a second level of verification. The system has feature for check and balances to ensure the ASEAN timber legality criteria is strictly observed, fully checked and carefully verified. Though the coverage is only logs and lumber, we intend the system soonest.

The System has very stringent verification process and leaves no rooms form manipulation. We are grateful, confident and thankful that we had developed a System that could stand alone yet come with a VLO certificate proving that such shipment of timber or lumber covered b the System's generated CTO or CLO, are indeeed legally sourced or harvested.

Thus, the System can still be improved by adding several features or functionalities that will include other timber associated products e.g. plywood, veneer, pulpwood, imported logs, imported lumber, to increase its coverage and effective use of the System as a reliable tracking system for timber and associated wood products.

There is need for an improved internet performance, internet speed and availability nationwide so that DENR field offices can be reached anytime and on real time. The NFSMS as a web-based system requires stable and usable internet connection.

There should be several dedicated and well-trained personnel at the DENR field offices (i.e. CENR Offices, PENR Offices and Regional Offices to fully operationalized the NFSMS. This simply means that field personnel from these offices must undergo training and familiarization on NFSMS.

The integration of the Frontline Services and Transaction System (FSTS) of the DENR whereby supporting documents of DENR clients will be uploaded under FSTS which will also be and made available to NFSMS. This will reduce document redundancy, save server/database space for the files and avoid duplication of works by DENR personnel in uploading the documents separately in the two different systems.

The interface to FMB's central information system i.e. the Forest Information System (FIS) for pulling updated data like species, wood processors, tenure holders, private land owners, etc, will truly compliment the usage of other systems that the DENR is already implementing or planned to implement.

Individual labeling of logs is feasible, practical and economic. But labeling each lumber will tedious process, time consuming and the resulting downtime in processing of logs into lumber can lead to increase in prices of lumber in the market. Hence, the other possibility of labeling lumbers on a per bundle scheme is can be considered. This will ease up downtime of attaching or putting label for each lumber. The downside of this scheme is that each lumber will no longer be traceable. The notion of tracking back the lumber to the specific tree stump of origin will be compromised. In both approaches, the segregation of the lumber produced for each log into lumber is already simplified. Further simplification of this process will render the System in effective. Thus, segregation process is inevitable in the wood processing plant.

The mapping of the inventoried standing trees using GPS device can posed possible limitation on the accuracy of the data captured by the RFID device reader. This is just a suspicious that has not been validated. Nonetheless, here are the following equipment that are expected to be available in the different DENR field offices and locations.

Equipment	Region	PENRO	CENRO	Forest Products Monitoring Stations	Wood Processor
Workstations	✔	✔	✔	O	✔
WiFi Access Points	✔	✔	✔	✔	✔
RFID Device Reader	O	O	✔	✔	✔
RFID Nail Tags	✔	✔	✔	X	X
Android Mobile phone	X	X	X	✔	X
Cordless Hand drill	X	X	✔	X	X
Drill bits	X	X	✔	X	X

Rubber hammer	X	X	✔	X	X
Barcode Printer	✔	X	X	X	X
Label Stickers	✔	X	X	X	X
Printer Ribbon	✔	X	X	X	X

Legend: ✔ – Required
X – Not Required
O – Optional

In order for the system to run efficiently, and to guide the end-user what are the requirements necessary to run the system, it is recommended to include 'NFSMS Minimum Server Requirement' in the final deliverable documents.

7. IMPLICATIONS FOR PRACTICE

The present project will provide the DENR and FMB with a transparent and efficient Forest Stock Monitoring System, which shall be translated into policy through various Department Administrative Orders (DAO), Department Memorandum Circular (DMC) and Department Memorandum Order (DMO), many of which are already drafted and under review, but not yet operational. With improved CoC management also explicitly targeted in the pending Sustainable Forest Ecosystem Management Act and thus endorsed at the highest political level, the FMB has a clear mandate to mainstream the adoption of the system throughout the forest administration. The guidelines for adoption in NFSMS is already in progress. The draft guidelines will be subject for review and further consultation by the Departments Policy Technical Working Group (PTWG).

The main innovations introduced through the project are however a lot more technically than policy driven. The field data collection module, for example, will provide opportunity to introduce barcode tagging processed, facilitate field law enforcement as well as enable participatory mapping as a means of actively involving local communities in sustainable forest management.

The online interface, making the platform accessible to a much wider audience, will also prove an ideal vehicle to disseminate project learning and stimulate exchanges on the institutional framework necessary for the efficient deployment of such systems.

The eventual adoption of the System will enable to the Philippines to have a functioning and working Timber Tracking system.

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Outputs and Activities	UWM	Schedule (in months)																	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Output 1: Forest Stock Monitoring System (FSMS) module to support 100% "Back to Stump Traceability" for wood production developed																			
Activity 1.1: "Functional & Technical Specification" of traceability module	Functional and Technical Specification identified	X	X	X															
Activity 1.2: Traceability module configuration	Traceability module Configured				X	X	X	X	X	X									
Activity 1.3: Traceability module deployment & testing	Traceability module deployed & tested										X	X							
Activity 1.4: Field testing of traceability module	Traceability module tested													X	X	X	X	X	X
Output 2: Forest Stock Monitoring System (FSMS) module to support Verification of Legal Origin (VLO) developed																			
Activity 2.1: "Functional & Technical Specification" of VLO module	Functional and Technical Specification identified	X	X	X															
Activity 2.2: VLO module configuration	VLO module configured				X	X	X	X	X	X									
Activity 2.3: VLO module deployment and testing	VLO module deployed& tested										X	X							
Activity 2.4: Field testing of traceability module	Traceability module tested													X	X	X	X	X	X
Output 3: Online, multi-tiered & integrated FMS environment with field data entry module configured																			
Activity 3.1: "Functional & Technical Specification "of online, multi-tiered environment & field module	Functional & Technical Specification identified	X	X	X															
Activity 3.2: Field module & FSMS environment configuration	Field module configured				X	X	X	X	X	X									
Activity 3.3: Field module & FSMS environment deployment & testing	Field module deployed & tested										X	X							
Activity 3.4: Field Testing of field data entry & law enforcement module	Field module tested													X	X	X	X	X	X

ANNEX 2. Project Logical Framework Matrix *(based on the Approved Project document)*

Strategy of Intervention	Measurable Indicators	Means of Verification	Key Assumptions
Development Objective: *To improve forestry governance, institutional law enforcement capacity, stakeholder coordination and forest sector competitiveness through improved data management*	*The Philippines FSMS is deployed nationally by 2015; The FSMS meets the* **FLEGT TLAS standard and Lacey Act VLO** *requirements by 2015; The FSMS supports a Philippines Timber Certifications Standard by 2016.*	*Regulations and Department Administrative Orders (DAO) are enacted to support the deployment of the system nationally; The FSMS issues Philippines' internationally recognized "Timber Certifications Licenses".*	*There is maintained political will at the DENR to deploy the FSMS nationally; The Philippines proceeds with the definition and implementation of a Certification Standard; Further modules of the system are developed/ improved to bridge potential remaining gaps with the TLAS standard.*
Specific Objective: *Development and testing of an integrated, real-time, multi-tiered, configurable, online national Forest Stock Monitoring System (FSMS) with improved governance capabilities at all levels of the Forest Administration.*	*The FSMS meets the "Functional and technical Specifications of the project;* **Selected staff of DENR Field Operations and FMB are trained according to the System Users Procedures;** **The System is now available online to project stakeholders including ITTO**	*The FSMS goes through a documented "Acceptance Testing" process by the DENR and FMB to ensure the system meets the "Functional and Technical Specifications"; Training course attendance list and system usage logs; Pilot data and reports can be viewed online.*	*No major technical difficulties are encountered at project deployment; All the stakeholders agree on a set of "Functional and Technical Specifications" for the project; All the required stakeholders agree to participate to the pilot phase of the project.*
Output 1: *Forest Stock Monitoring System (FSMS) module to support 100% "Back to Stump" traceability for wood production developed.*	**Output indicators:** **The FSMS supports timber tracking and traceability management from pre-harvest inventory to production, transport, wood product transformation and residual inventory; Field controls are facilitated through handheld computer;**	***Review of management plan, database and evidence of pertinent system generated documents; Interviews with DENR field personnel on investigation of log movements on pilot CoC; Enforcement and reconciliation of pre-harvest and residual inventory monitoring with production data;*** *For all logs and timber along the pilot*	*On-going political will to configure and test the feature; Private sector participation to the field testing; Capacity requirements at both government & private sector level to ensure data entry at each control point are met.*

		supply chain, a report providing a CoC history and "Back to Stump" traceability can be issued by the system.	
Output 2: *Forest Stock Monitoring System (FSMS) module to support Verification of Legal Origin (VLO) developed.*	**Output indicators:** ***Data on production volumes, species and tax rate configured in the FSMS; FSMS automatically calculates applicable tax, forest charges and fees; Origin and destination of wood production captured and monitored through CLO/CTO;***	***Review of management plan, database and evidence of pertinent system generated documents such as production and tax reports and CLO/CTO; Interviews with DENR field personnel;***	*Stakeholders agree to the implementation of a forest tax verification module;* *Integration of the CLO/CTO module into the FSMS does not present unforeseen technical difficulties.*
Output 3: *Online, multi-tiered and integrated FSMS environment with field data entry module configured.*	**Output indicators:** *The system environment is configured and supports online, multi-tiered access;* *The system environment features post-processing and detailed automated reporting capabilities;* ***Users are trained on the online environment.***	***Training manual and online system user guide;*** ***Review of database and evidence of pertinent system generated documents;*** *The FSMS goes through a documented "Acceptance Testing" process by the FMB;* *The "Online" system contains verifiable information from field control points and entered by stakeholders at the end of the pilot;*	*No major technical difficulties are encountered at project deployment;* *All the stakeholders agree on a set of "Functional and Technical Specifications" for the project;* *All the required stakeholders agree to participate to the pilot phase of the project.*

ANNEX 3: FIRST PILOT SITE - NFSMS Pilot Testing Schedule and Photo Documentation

Private Forest Development Agreement (PFDA) area of Rose Industries, Inc.
Barangay Pagsangahan, Municipality of San Francisco
Province of Quezon
DENR Regional Office 4A
October 10-14, 2016

SITE INFORMATION

Private Forest covers around 2,000 Hectares with a Wood Processing Plant (sawmill) within the property. The private forest is covered with a Private Forest Development Agreement (PFDA) issued in 1992 with a validity of 25 years which then expired last 2017.

SCHEDULE OF ACTIVITIES OF THE FIRST PILOT TESTING

DATE	ACTIVITY
October 10, 2016 *(Day 1)*	**Travel from MetroManila going to the Pilot Site and coordination with the different DENR Field Offices** First Stop – DENR PENRO Quezon in Lucena City *(Courtesy call and short briefing with DENR Technical Personnel)* Second Stop – DENR CENRO Catanauan *(Courtesy call and short briefing with DENR Technical Personnel)* Third Stop - Rose Industries Sawmill, San Francisco, Quezon *(Courtesy call and another round of briefing with the personnel of PFDA holder)*
October 11, 2016 *(Day 2)*	**Inventory of RFID** - RFID Distribution - Briefing on the different roles to be performed by the Pilot Testing Team - Conduct of Timber Inventory and Tree Marking *(Timber Identification, Measurement of Merchantable height, Total tree height and recording them using the Handheld Device)*
October 12, 2016 *(Day 3)*	**Continuation of the Timber Inventory and Tree marking** - Tree inventory and marking (continuation) **Felling and Bucking** - Felling of inventoried and marked trees
October 13, 2016 *(Day 4)*	**Bucking and Scaling** - Continue Bucking - Scaling of felled timber *(measurement of bucked logs and recording in the Handheld Device)* **Log Transport and Wood Processing Plant (WPP)** - Request for transport of logs *(Certificate of Timber Origin-CTO)* - CTO issued by NFSMS, and transport of scaled logs to the WPP - Simulation of Law Enforcement Function at Forest Products Monitoring Stations - Clearing and receiving of log shipment in the WPP - Slicing of logs into lumber, segregation and labelling
October 14, 2016 *(Day 5)*	**Lumber Production and Labelling** - Labelling of Lumber production - Association of Lumber produced with the Timber RFIDs - Recording in the Handheld Device - Request for transport of lumber *(Certificate of Lumber Origin-CLO)* - CLO issued by the NFSMS & lumber shipment ready for transport - Departure from Quezon Province

PHOTOS: October 10, 2016 *(Day 1)* **– Coordination with different DENR Field Office.**

Fig. 1. NFSMS Pilot Testing Team composed of personnel from FMB, DENR CENRO-Catanauan, Quezon and the Service Provider / Sub-Contractor (CAI-STA)

October 11, 2016 (Day 2) – INVENTORY

Fig. 2. FMB Personnel demonstrate the proper conduct of Timber Inventory using appropriate instruments i.e. tree caliper & diameter tape, laser range finder, & GPS.
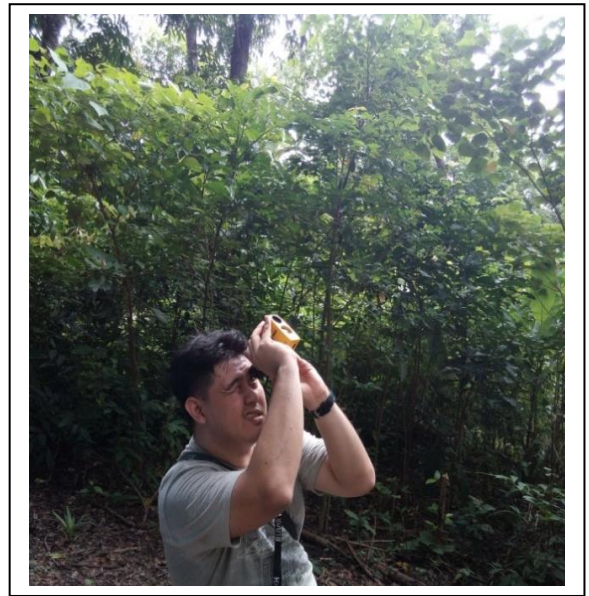
STANDING TIMBER INVENTORY

Fig. 3. Measuring Tree Diameter using diameter tape and Merchantable and Total Tree Height using Laser Range Finder.

STANDING TIMBER INVENTORY

Fig. 4. Drilling a guide hole and hammering an RFID nail tag during timber inventory.

Fig. 5. Scanning, Associating, Recording, and Storing RFID Nail Tag implanted at the Base of a Standing Tree using an RFID Handheld Device/Reader.
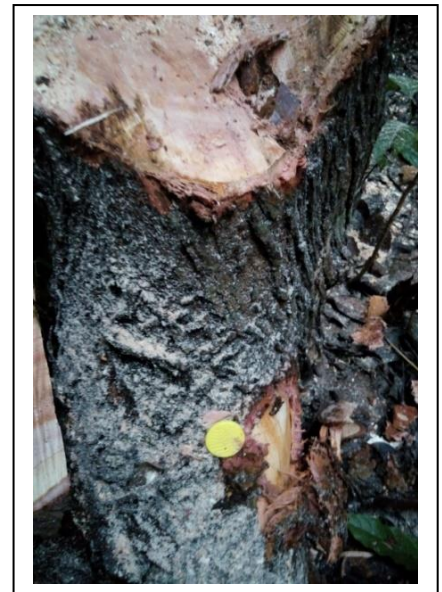
October 12, 2016 (Day 3) – FELLING, BUCKING AND SCALING

Felling of trees   RFID at the base of the Tree Stump

Drilling Guide Hole on one Log End

Inserting an RFID nail tag

RFIDs Inserted on a Tree Stump and the Log Derived from the Tree Stump

FELLING, BUCKING AND SCALING

Scanning and Associating Felled Log RFID with the Tree Stump RFID prior to Scaling.

SCALING

Scaling of Felled Timber before Marking with RFID

October 13, 2016 (Day 4) – LOG TRANSPORT AND WOOD PROCESSING

Tractor is Used for Hauling Logs to the Sawmill.

Tractor is Used for Hauling of Logs to the Sawmill

Checking the Condition of the RFID on arrival at the Gates of the Wood Processing Plant (Sawmill) which also served as a Dummy Forest Product Monitoring Station to test Law Enforcement Function.
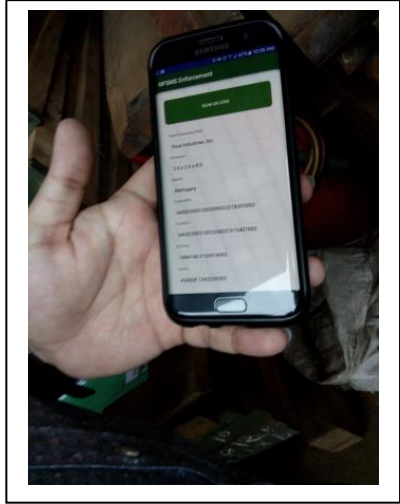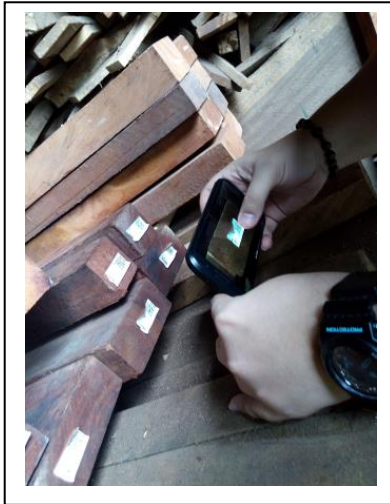
October 14, 2016 (Day 5) – LOG TRANSPORT AND WOOD PROCESSING

Printing of lumber label

Printed lumber labels are stuck at the end of each lumber

Verification of QR codes at point of destination using smart phone

ANNEX 4: SECOND PILOT SITE - NFSMS Pilot Testing Schedule and Photo Documentation
Private Land Timber Permit (PLTP) Holder
Barangay Osmena, Municipality of La Paz
Province of Agusan del Sur
DENR Regional Office No. 13 (CARAGA Region)
November 26 to December 01, 2019

SITE INFORMATION

Private Land or a Titled Property with an area of about 10.0 Hectares. It has tree cutting permit called Private Land Timber Permit (PLTP) valid for six (6) months with an authorized cut of Four Hundred Forty One and 70/100 (441.70) Cubic Meters involving Four Hundred Twelve (412) natural growing timber trees of various species of endemic and native trees.

SCHEDULE OF ACTIVITIES OF THE SECOND PILOT TESTING

Date	Activity
November 26, 2018 *(Day 1)*	**Travel from MetroManila going to Butuan City (Caraga Region), Pilot Site and coordination with different DENR Field Offices** First Stop – DENR Regional Office in Butuan City *(Courtesy call and short briefing with DENR Technical Personnel i.e. DENR Regional Enforcement Division)* Second Stop – DENR CENRO Talacogon *(Courtesy call and full briefing & presentation of NFSMS and how it works or functions to DENR Technical Personnel)*
November 27, 2018 *(Day 2)*	**Inventory of RFID** - RFID Distribution - Briefing on the different roles to be performed by the Pilot Testing Team **Timber Inventory, Felling, Bucking and Scaling** - Conduct of Timber Inventory and Tree Marking *(Timber Identification, Measurement of Merchantable height, Total tree height and recording them using the Handheld Device)* - Felling of selected inventoried and marked trees - Bucking of felled timber inserting of RFID nail tags *(measurement of bucked logs and recording in the Handheld Device)* - Scaling of timbers & submission of scaled report
November 28, 2018 *(Day 3)*	**Visitation of Wood Processing Plants (sawmills)** Elmo Wood Corp. (EWC) under the jurisdiction of DENR CENRO Bayugan City, and Talacogon Woodworks, Inc. (TWI) under the jurisdiction of DENR CENRO Talacogon
November 29, 2018 *(Day 4)*	**Log Transport and Wood Processing Plant (WPP)** - Request for transport of logs *(Certificate of Timber Origin-CTO)* - CTO issued by NFSMS and scaled logs ready for transport to the WPP - Simulation of Law Enforcement Function at Forest Products Monitoring Stations was not carried out one full day of heavy rains rendering the road not passable to hauling trucks - Clearing and receiving of log shipment in the WPP was not tested **HAULING OF LOGS** - (Unfortunately, the permittee was not allowed to transport the logs because the road is still muddy due to heavy rains in the area. And according to them, they have a local ordinance wherein they need to wait at least three (3) days after the rain for the road to dry before the trucks are allowed to enter.)
November 30, 2018 *(Day 5)*	**WPP Visitation** Coronet Wood Industries, Inc – CENRO-Bislig City
December 1, 2018 *(Day 6)*	**TRAVEL TO CAGAYAN DE ORO CITY (Third Pilot Site)**

PHOTOS: **Nov. 26, to Dec. 01, 2018** (Caraga Region) *(Day 1)*

Coordination meeting & briefing with the Enforcement Division Chief Modesto U. Lagumbay, Jr., DENR, Region X.

Briefing at DENR CENRO-Talacogon, Agusan Del Sur, with the Pilot Testing Team and technical personnel from the DENR Regional Office, PENRO-Agusan del Sur and CENRO-Talacogon.

Briefing at DENR CENRO-Talacogon with the Pilot Test Team before proceeding to the inventory area.

Briefing on-site of the Pilot Testing Team together with other DENR personnel and the permittee.

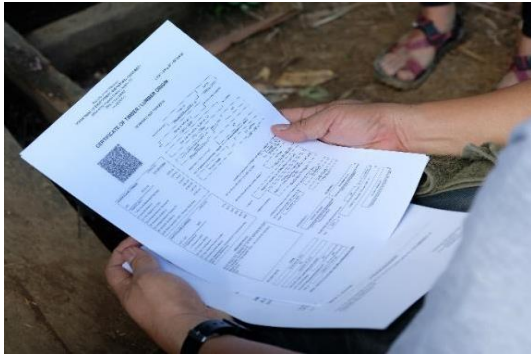Sample of an inventoried tree with nail tag

The conduct of timber inventory and tree tagging

Felling, bucking, stump-RFID association and scaling

Bucked logs with RFID nail tags at the log end.

NFSMS issued Certificate of Timber Origin (CTO). Verifying the CTO using a smart phone.

Interview with the Assistant Vice Manager of the Coronet Wood Industries, Inc.

The Members of the Pilot Testing Team testing at Brgy. Osmena Sr., La Paz, Agusan del Sur, Caraga Region.

ANNEX 5: THIRD PILOT SITE - NFSMS Pilot Testing Schedule and Photo Documentation
Industrial Forest Management Agreement (IFMA) Holder
Barangay Abyawan, Municipality of Malitbog
Province of Bukidnon
DENR Regional Office No. 10
December 02-07, 2019

SITE INFORMATION

The Pilot Site is covered by a tenure instruments called Industrial Forest Management Agreement (IFMA) in the name of Bukidnon Forest Inc. (BFI). The specific pilot site is at Barangay Abyawan, Malitbog, Bukidnon. The instrument holder is the Bukidnon Forest Inc. (BFI).

DAILY ACTIVITIES OF THE THIRD PILOT TESTING IN REGION 10

Date	Activity
December 2, 2018 *(Day 1)*	**DATA CONSOLIDATION**
December 3, 2018 *(Day 2)*	**COORDINATION WITH RESPECTIVE OFFICES** CENRO-Manolo Fortich, Bukidnon **INVENTORY PROCEDURE** Creation of Inventory Team RFID Distribution Tree inventory and marking
December 4, 2018 *(Day 3)*	**FELLING, BUCKING AND SCALING** Felling of inventoried and marked trees Bucking of felled logs Scaling of bucked logs/timbers **TRANSPORT** (Request for transport documents i.e. Certificate of Timber Origin or CTO, for transport to Wood Processing Plants or WPP) Log transport to WPP Forest Products Monitoring Stations (previously called Checkpoint) Shipment cleared and received by WPP
December 5, 2018 *(Day 4)*	**WOOD PROCESSING** Processing of logs into lumber Labelling of lumber Associating of labeled lumber with log RFID
December 6, 2018 *(Day 5)*	**WOOD PROCESSING** Association of Timber to Lumbers Request for CLO to transport (The team was not able to upload the Log-Lumber Association data and the CLO request because the DENR server where the NFSMS is hosted was experiencing a network problem due to "fiber cut".)
December 7, 2018 *(Day 6)*	**ARRIVAL AT THE DENR REGION X OFFICE** DENR Regional Executive Director requested for an Exit Conference team. Attended by Assistant Regional Director for Technical Services, Paquito Melicor, Jr.; Enforcement Division Chief, For. Luzviminda Legara; License, including some personnel of the Patents and Deeds Division and representatives from the other division.

Coordination & briefing with CENRO Virgilio Batocail together with four (4) personnel of CENRO-Manolo Fortich.

Arrival of the Pilot Testing Team at the inventory site (Barangay Abyawan, Municipality of Malitbog, Province of Bukidnon) and giving another round of short briefing on the conduct of timber inventory with technical staff of the Bukidnon Forest Inc. (BFI), a holder of a tenure instruments called Industrial Forest Management Agreement (IFMA).

Diameter measurement using a Tree Caliper, drilling guide holes, implanting RFID Nail Tags and encoding of the trees inventoried in the Handheld Device.

Felled logs to be buck into smaller log sizes at the Cutting Area

Tree/Stump

Bucked logs. The logs were numbered according to the tree/stump's number and the number of bucked logs. All logs from tree/stump number 1 were marked 1-1, 1-2, 1-3 and 1-4.

Inspection of a shipment of logs and verification of the transport document (Certificate of Timber Origin) as part of the Law Enforcement Function, at a dummy Forest Products Monitoring Stations.

At the premises of the Wood Processing Plant (mini-sawmill). And unloading of logs inside at the sawmill (JCJM Trading) after being cleared for processing.

Log RFIDs and lumbers produced with the assigned log number label using lumber crayon
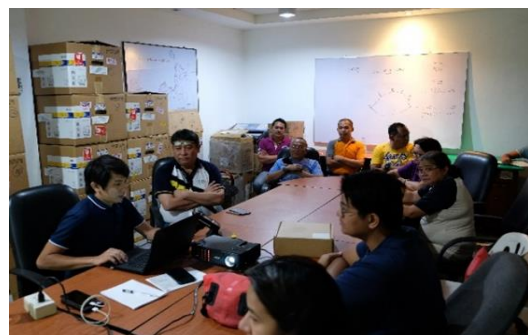

Freshly milled lumber and labeled with QR code labels

QR code labels attached to end of each lumber is secured with staple wire.

Scanning and association of log RFID with the lumber labels. And request for transport document (Certificate of Lumber Origin-CLO).

Exit Conference at the DENR Regional Office No. X with the Regional Executive Director, Assistant Regional Director, Regional Chiefs of the Enforcement Division and Chief of the Lands, Patents & Permits Division.

The Pilot Testing Team at Barangay Abyawan, Municipality of Malitbog, Province of Bukidnon. The tam posed for posterity at the third or last Pilot Testing site of NFSMS.

ANNEX 6. Equipment Used in Developing the NFSMS and during NFSMS Pilot Testing

Below are the actual list of equipment used in the project until Pilot Testing of NFSMS.

Equipment	Description
Workstations	Used personal laptops in field and existing computers of DENR offices (CENRO Catanauan, PENRO Quezon and DENR Region IV-B), FMB Office. At WPP – used PC of Rose Industries. For accessing web-based application and installing desktop applications
WiFi Access Points	Pocket WiFi in the field and existing internet connection in the DENR offices. For accessing web-based application
RFID Device Reader	Chainway C4000. Scanning RFID nail tags and data entry
RFID nail tags	Customized UHF Nail tags. For tree and log tagging
Android Cell phone	Personal Cell phone with at least KitKat OS version installed. For checkpoint inspection of transport document and lumber qr code verification
Cordless Drill	BOSCH Cordless Drill GSR 1800-LI. Used to drill a hole to guide the RFID nail tag. Ideally drill a hole, diameter 5.8mm or 6mm, depth about 35mm
Drill bit	3/16″. Used to drill a hole to guide the RFID nail tag.
Rubber hammer	For hammering in the RFID nail tag after drilling a hole
Barcode Printer	Intermec EasyCoder PD43 Direct/Thermal Transfer Barcode Printer
Label Stickers	Thermal Transfer with customize size 1.8″ x .8″
Printer Ribbon	
Web/Application/Data base Server	Applications and Database is deployed in DENR development server

Photos of Project Equipment

Barcode Printer Intermec EasyCoder PD43 Model	Label Stickers Thermal Transfer with customize size 1.8″ x .8″ (Actual)	RFID Device Reader (Chainway C4000 Model)	RFID Nail Tags (Actual size of a customized UHF Nail Tags)
	BOSCH Cordless Drill GSR 1800-LI Model	Drill bit 3/16″ (Actual)	Rubber hammer (Actual)

Approval Information

By signing this document you agree to this as the formal Project Closure Report.

Date	Role/Title	Name	Signature
	Project. Designation: Assistant Project Coordinator Position : Supervising Forest Management Specialist Chief, Forest Protection Section Forest Resources Conservation Division (FRCD) Forest Management Bureau	Raul M. Briz	

BIBLIOGRAPHY

The authors

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(NOTE: We intend to write scientific paper on the study of NFSMS)