PROFOR

WORKING PAPER

INFORMATION AND COMMUNICATION TECHNOLOGY FOR FOREST LAW ENFORCEMENT AND GOVERNANCE

CASE STUDY: LAO PEOPLE'S DEMOCRATIC REPUBLIC

OCTOBER 2014

Sepul Kanti Barua, Sami Jänne, Somphanh Phomma and Phathitmyxay Souphaphone

PROFOR
PROGRAM ON FORESTS

Acknowledgments

This study benefited from the contributions of a large number of forestry and ICT specialists both inside and outside the World Bank. The task team leader was Tuukka Castrén (Senior Forestry Specialist, AES) with support from Madhavi Pillai (Natural Resources Management Specialist, CPFPT). In the Lao People's Democratic Republic, the work was supported by the Country Manager, Keiko Miwa, and colleagues at the country team. Fieldwork was done with a team of consultants led by Sami Jänne and Phomma Samphanh from Indufor Oy. Work in Lao PDR was greatly helped by the wonderful collaboration with the DOFI team of experts led by Thongphanh Ratanalangsy, Director of Planning and Cooperation Division.

Disclaimer

All omissions and inaccuracies in this document are the responsibility of the authors. The views expressed do not necessarily represent those of the institutions involved, nor do they necessarily represent official policies of PROFOR or the World Bank Group.

Published in March 2015

For a full list of publications please contact:

Program on Forests (PROFOR)
1818 H Street, NW
Washington, DC 20433, USA
profor@worldbank.org
www.profor.info/knowledge

PROFOR is a multi-donor partnership supported by the European Commission, Finland, Germany, Italy, Japan, the Netherlands, Switzerland, the United Kingdom and the World Bank Group.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF BOXES

ABBREVIATIONS AND ACRONYMS

ASEAN	Association of Southeast Asian Nations
CliPAD	Climate Protection through Avoided Deforestation
DOFI	Department of Forest Inspection
DOF	Department of Forestry
FIP	Forest Investment Program
FLEG	Forest Law Enforcement and Governance
FLEGT	Forest Law Enforcement and Governance and Trade
FTP	file transfer protocol
GIS	geographic information system
GPS	Global Positioning System
ICT	information and communication technology
IT	Information technology
IUCN	International Union for Conservation of Nature
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
LAN	local area network
MAF	Ministry of Agriculture and Forestry
NA	National Assembly
NBCA	National Biodiversity Conservation Area
NGO	nongovernmental organization
PHRD	Policy and Human Resources Development Fund
POFI	Provincial Office of Forest Inspection
STEPP	Strategic and Tactical Enforcement Patrol Program
SUFORD	Sustainable Forestry and Rural Development Project
SUPSFM	Scaling-Up Participatory Sustainable Forest Management Project
WEN	Wildlife Enforcement Network
WWF	Worldwide Fund for Nature

Introduction

Background

The government of the Lao People's Democratic Republic has developed a Forest Strategy 2020 and Forest Law Enforcement Strategy, which both have provisions to combat illegal logging through increased community awareness and improved monitoring systems. The Department of Forest Inspection (DOFI), established in 2007 under the Ministry of Agriculture and Forestry (MAF), has been working on this task for several years. In general, DOFI is responsible for preventing, detecting, and suppressing forest crimes. It is empowered to conduct forestry control operations, investigate allegations of illegal logging, and collaborate with government and nongovernmental organizations (NGOs) as well as with the private sector and civil society.

A preliminary review of DOFI showed that the current system uses mostly conventional methods for information distribution and communication, such as official letters, phones, meetings, and so on, which makes inspection and investigation activities slow. Evidence collection and other field verifications are based on inaccurate information about the locations—for example, village or district name—or are not done systematically with appropriate case tracking. One reason for the slow system is the basic level of skills in information and communication technologies (ICT) in DOFI and its stakeholders. Several donors and projects have provided ICT hardware for DOFI, but the personnel are not using them efficiently.

Like many other countries, Lao PDR is implementing e-government policies and programs to support efficiency and effectiveness. A national ICT policy has been drafted but not yet approved by the National Assembly (NA).[1] In recent years, the Lao government has joined the worldwide ICT trend by first creating infrastructure for a national e-government system, with support from the Republic of Korea and recently with a soft loan from China.

Overview and Project Objectives

The Information and Communication Technology for Forest Law Enforcement and Governance Project (the project) was financed by a grant from the Korean Trust Fund on Information and Communication Technologies for Development (ICT4D) to the World Bank. Established in 2008, the Korean Trust Fund has funded a variety of different ICT innovation projects. It focuses on ICT projects that demonstrate cutting-edge solutions for economic and social growth and poverty reduction.

The overall objective of the project was to identify and apply ICT applications to improve forest governance and to identify the factors that strengthen the use of ICTs in the forest sector. The specific objectives were to (a) identify

1. Because of the organizational changes in administration in 2011, the development of the national ICT policy is on stand-by mode until further clarification of mandates and tasks of different departments.

ICT applications to improve forest governance, (b) apply those applications, (c) identify the factors that strengthen the use of ICTs in the forest sector, and (d) provide field-tested experience for further support by the World Bank and other development partners.

BOX 1.1 INFORMATION AND COMMUNICATION TECHNOLOGY FOR FOREST LAW ENFORCEMENT AND GOVERNANCE

The World Bank, with funding from the government of Korea, implemented in 2011–13 a technical assistance project on the use of ICTs to improve forest governance in Lao PDR and Moldova. ICTs are essential tools for development, transforming rural lives and livelihoods through computer use, mobile phones, and Internet applications. Many e-government and e-governance initiatives are making governments more efficient and responsive while improving service delivery. This applies to the forest sector as well.* The objectives of the project were to identify and apply ICT applications to improve forest governance and to identify the factors that strengthen the use of ICTs in the forest sector. It also provided field-tested experience for further support by the World Bank and other development partners. It is recognized that the current level of ICT is relatively low, particularly in the countryside; however, at the same time, expanding use of mobile phones has created opportunities for the introduction of new applications. A particular focus was on developing low-cost and simple-to-use technologies.

Project Structure

The project had four phases that ranged from capacity assessment through application development to studying the lessons learned:

i) **Brief capacity audit and identification of development opportunities:** This component assessed the current ICT capacity in the forest sector in and the potential for new applications. The main activities were (a) stakeholder consultations to identify forest governance challenges and how ICTs could be used to address those; (b) developing ICT applications to strengthen forest governance; and (c) building partnerships with potential local ICT innovators.

ii) **Development and use of ICT applications for forest governance and REDD+:** Based on the capacity audit, applications were developed in both participating countries. This component also included capacity building for information management development.

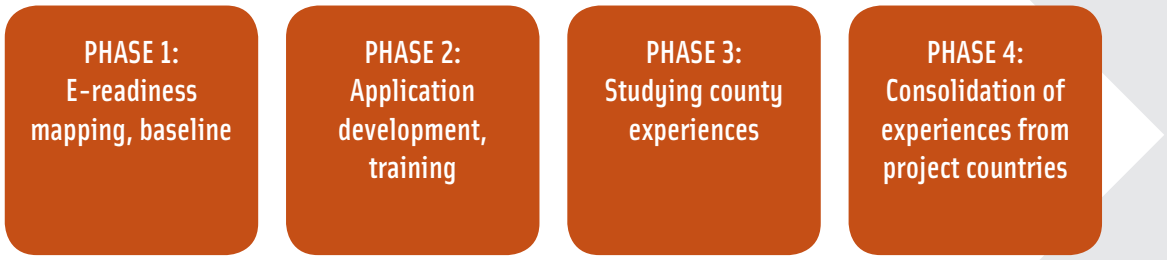
iii) **Ex post country analysis and in-country dissemination:** An assessment of the capacity change was prepared based on the capacity assessment done during the first component. This included identification of the main implementation issues and lessons learned. The report at hand is the output of this phase.

iv) **Lessons learned and global dissemination:** A cross-country comparison report analyzes the key success factors and how ICT-supported governance reforms can best be supported.

Implementation Arrangements

Consultant teams were selected in both countries to provide implementation support. The teams played a central part in the implementation and worked closely with local counterparts in implementing the project activities. The project worked in close collaboration with other ongoing development activities. In Lao PDR, close collaboration was established with the Sustainable Forestry and Rural Development Project (SUFORD), Strategic and Tactical Enforcement Patrol Program (STEPP), and various bilateral and REDD+-related projects and programs. In Moldova, the project interacted with the Improving Forest Law Enforcement and Governance in the European Neighbourhood Policy East Countries and Russia Project (ENPI-FLEG) and the e-transformation project on open data.

Figure B1.1 Overall Project Structure



*See, for example, Castrén, Tuukka, and Madhavi Pillai. 2011. Forest Governance 2.0: A Primer on ICTs and Governance. Washington, DC: Program on Forests (PROFOR). http://www.profor.info/profor/sites/profor.info/files/docs/Forest%20Governance_web.pdf.

The project was divided into four phases:

- Phase 1: Capacity audit (baseline) and identification of development opportunities
- Phase 1: Development and use of ICT applications for forest governance and REDD+
- Phases 3 and 4: Ex post country analysis, and lessons learned and global dissemination

The project was implemented by DOFI, which was supported by a technical consultant team. The project focused on the design of simple and easy-to-use ICT applications to combat illegal logging through developing forest sector ICT skills, community awareness, and improving the monitoring system in the field. The objectives of the project are explained below:

i) **Identification of opportunities:** The existing ICT system in DOFI was reviewed. It examined the tasks (mainly non-ICT) and procedures (investigation, inspection, and so on) conducted by DOFI. It reviewed the most important stakeholders and the communication channels used between them and DOFI. To achieve the first specific objective, the review included not only descriptions of the hardware, information technology (IT) infrastructure and personnel skills, but also existing challenges and potential solutions to them by applying ICT with the possible entry points for applications. It also reviewed national ICT policies and e-strategies of Lao PDR.

ii) **Using applications:** The second objective ensured that the applications were used for DOFI's internal activities, information distribution, and/or for data (for example, evidence collection). The applications were modified as much as possible according to user needs and feedback. This was an important aspect for the successful implementation of the project and for the sustainability of the applications.

iii) **Strengthening the use of ICT in the forest sector:** The third objective targeted an increased use of ICT and providing training for it.

iv) **Further actions:** The fourth objective reviewed the experiences in the field-testing of applications and created a plan for improvements, further development, and continuation. It also explored the possibilities of receiving additional support from the World Bank and other donors.

All the applications were developed in support of the five pillars of forest governance:[2]

1. Transparency, accountability, and public participation
2. Stability of forest institutions and conflict management
3. Quality of forest administration
4. Coherence of forest legislation and the rule of law
5. Economics, efficiency, equity, and incentives

The applications developed and tested in the project are mainly linked to the first and third pillars.

2. World Bank. 2009. *Roots for Good Forest Outcomes: An Analytical Framework for Governance Reforms*. Washington, DC: World Bank.

Department of Forest Inspection

The Department of Forest Inspection was established in 2007 and works directly under the surveillance of the Ministry of Agriculture and Forestry. It has more than 400 enforcement officers in the Provincial Offices for Forest Inspection (POFIs) based in 17 provinces of Lao PDR. Its main mandates and tasks are related to the prevention, detection, and suppression of forest- and wildlife-related crime over all forest landscapes, resources, and supply chains. It addresses challenges related to illegal logging, smuggling of timber, wildlife- and forestry-related corruption, and illegal encroachment. The organization has five divisions: Administrative, Planning and Cooperation, Forest Inspection, Aquatic, and Wildlife Investigation.

Tasks

Currently, DOFI has the following tasks:[3]

A. Inspection

- All forms of forest inspections, ranging from harvest production areas to production facilities
- Highway inspections of timber transportation
- Inspections of commercial sawmills and the detection of illegal sawmills
- Wildlife inspections of legal animal farms and patrols in threatened areas
- Inspecting and patrolling to prevent all unauthorized forestry activities, such as illegal logging and trading of forest products, conversion, and encroachment
- Cooperation with relevant domestic and foreign organizations
- Creating a database for forest inspection and forestland statistics. Coordinating with other relevant sectors and local authorities to collect data for the database for forest inspection, and also to create an inspection network down to the village level
- Prevention of illegal logging, trading, invasion, and destroying of forestland

3. These tasks are collected from different documents, which most notably include the following: Forestry Law 06/LNA, dated December 24, 2007; Aquatic and Wildlife Law 07/LNA, dated December 24, 2007; Criminal Law 01/LNA, dated May 15, 2004; Prime Minister Decree 148/PM, dated May 10, 2007, regarding the Organization and Implementation of MAF; and, Minister of Agriculture and Forestry Agreement 0410/MAF, dated April 10, 2009, concerning the Establishment of Department of Forest Inspection.

B. Investigations

- Develop and support the Strategic and Tactical Enforcement Patrol Program (STEPP) in all provinces.
- Provide advanced investigation training for DOFI headquarters' advanced investigation team.
- Provide equipment and technology to support professional investigations and provide workplace safety to all employees.
- Ensure that all investigations are professional and that investigators are guided by the Department of Code of Conduct.

C. National and International Cooperation[4]

Cooperation with other government ministries and law enforcement bodies (for example, Ministries of Industry and Commerce, Natural Resources and Environment and Justice, Customs, Army, Economic Police, Public Prosecutor)
International law enforcement collaboration (for example, Association of Southeast Asian Nations Wildlife Enforcement Network [ASEAN-WEN], International Criminal Police Organization [INTERPOL], Vietnam, China, and so on)
International forest governance partnerships (for example, FLEGT)

D. Capacity Building

- Design and deliver primary and advanced law enforcement training courses and workshops.
- Liaise with the Forestry Faculty at the National University of Lao PDR on curriculum development to their forestry program.
- Identify high-potential DOFI and POFI personnel for advanced training and exposure to greater responsibility.
- Strengthen training, investigative, and leadership opportunities for DOFI and POFI women to equalize their departmental responsibility and assist in their career advancement.

E. Administrative Tasks

- Manage human resources and collect personal statistics within the department and provincial offices.
- Manage assets, accounts, vehicles, and equipment.
- Manage incoming and outgoing documents systematically, ensuring that nothing goes missing and guiding them to correct (internal and external) destinations. Keep good filing systems, organizing notices, memos, agreements, and other relevant documents.
- Oversee, inspect, and direct the operations of provincial offices.
- Inspect and assess the performance of the forest officials.

4. See section 3.3.

External Support

DOFI receives support from several donors. Over the past four years, the main support has come from the following programs and funds (see also Box 2.1):

- **Sustainable Forestry and Rural Development Project (SUFORD),** a multilateral project funded by the government of Lao PDR, the World Bank, and the government of Finland. This program has provided overall facilitation of technical assistance and support to STEPP. It has also participated in the development of the online reporting system. STEPP aims to increase the administrative and operational capacity of DOFI by improving patrol activities and environmental crime inspections. It has just recently finished threat and risk assessments in all 17 provinces (143 districts). The assessment most notably covers the area under production, conservation and protection forests, sawmills, and plantations.

- **Policy and Human Resources Development Fund (PHRD),** funded by the government of Japan and managed by the World Bank. It has provided funds for capacity building.

- **Climate Protection through Avoided Deforestation (CliPAD),** funded by the German government. This support has included cars, computers (laptops), training, and, recently, GPS devices.

BOX 2.1 SOURCES OF RECENT SUPPORT FOR DOFI

Sustainable Forestry and Rural Development Project (SUFORD)

SUFORD is a multilateral project funded by the government of Lao PDR, the World Bank, and the government of Finland. The project started in 2003 with Phase I and continued with Phase II in 2009. The four main objectives of the project are (1) to improve policy, legal, and incentive frameworks to enable the expansion of Participatory Sustainable Forest Management (PSFM) throughout the country; (2) to bring the country's priority natural production forests under PSFM; (3) to improve villagers' well-being and livelihoods through benefits from sustainable forestry, community development, and the development of viable livelihood systems; and (4) support functioning sector monitoring and control systems. SUFORD has also supported the development of new and innovative methodologies for REDD monitoring. The project supported the establishment of DOFI and a follow-up project (Scaling-Up Participatory Sustainable Forest Management; SUPSFM in Lao PDR) will start soon.

Policy and Human Resources Development Fund (PHRD)

PHRD is a partnership between the government of Japan and the World Bank. The fund has supported technical assistance activities in more than 140 countries. The main objective of the fund is poverty reduction in developing countries through technical assistance and institutional strengthening. All activities support the design and implementation of World Bank-financed projects.

Climate Protection through Avoided Deforestation (CliPAD)

CliPAD is a German government–funded project that aims to identify opportunities to protect biodiversity and reduce greenhouse gas emissions through avoided deforestation and degradation in the national protected areas in Sayabouri, Houaphan, and Luang Prabang Provinces. Alongside the provision of advice at the national level, the project focuses on selected provinces and protected areas in cooperation with the financial cooperation module and partners.

Collaboration with Other Organizations

DOFI collaborates with a number of national and international organizations, NGOs, and donor-funded projects. All information system development in DOFI should take into consideration how collaboration with these partners could be improved and made more efficient. To understand and assess the possibilities of implementing ICT applications to improve DOFI communication between these organizations, a short review of the stakeholders (via interviews) was undertaken. Table 2.1 through Table 2.4 list DOFI's collaborators and the main activities with them.

Table 2.1 Cooperation with Government Organizations

Organization	Relationship with DOFI	Types of communication
Ministry of Finance/ Department of Customs	**Part of the inspection procedures:** export activities	Traditional methods: official letters, permissions, phone calls, meetings, and so on
Ministry of Industry and Commerce/ Department of Import-Export	**Part of the inspection procedures:** export licenses; providing information regarding annual timber quota allocation issued by the Department of Forestry (DOF) to the Ministry of Industry and Trade	Traditional methods: official letters, permissions, phone calls, meetings, and so on
Ministry of National Defense/Army. For example Battalion 941, which belongs to two ministries: Ministry of Defense, and Ministry of Natural Resources and Environment The National Phoukhaokhouay - Phouphanag Preservation Forest protection unit	**Joint inspection of illegal logging and transporting of illegal timber within the preserved forests:** gathering data of the shifting cultivation and the use of land within the preserved forests. Coordinating the publicizing of announcements, laws, and regulations in the surrounding villages of the preserved forests.	Coworking group in NBCA
Ministry of Public Security/ Environment Police Department	**Joint inspection of illegal logging and transporting of illegal timber cases:** coordinating the publicizing of announcements, laws, and regulations related with the environment issue	Regular meetings, workshops, official letters
Ministry of Justice/ Public Prosecutor's Office	**Part of the inspection procedures:** certificate of origin issued by MAF, the export stamp logbook, and a log list	Regular meetings, workshops, official letters
Ministry of Agriculture and Forestry (MAF)	**Part of the inspection procedures:** certificate of origin issued by MAF, the export stamp logbook, and a log list	Lead organization: regular meetings, workshops, official letters
MAF/ Department of Inspection	**Part of the inspection procedures:** responsible for tracking performance of all units within MAF; supporting oversight and accountability of MAF as a whole	Regular meetings, workshops, official letters
MAF/ Department of Forestry	**Management of production forest areas through the whole country:** support and coordinating the publicizing of announcements, forest laws, and regulations in the production forest areas	Regular meetings, official letters, permissions, and so on
Ministry of Natural Resources and Environment/ Department of Forest Management/ Conservation	**Protection and management of forestry resource in protection and conservation forest areas, including support and dissemination of forest law enforcement**	Traditional methods: official letters, permissions, and so on
Ministry of Natural Resources and Environment/ Department of Lands	**Land management and titling including forest areas:** land concession for any investment activities through the whole country; joint inspection of land concessions, support and coordinating the publicizing of announcements, laws, and regulations enforcement in national land and forest resources	Traditional methods: official letters, permissions, and so on

Table 2.2 International Cooperation and Agreements

Organization	Relationship with DOFI	Types of communication
ASEAN-WEN	**Supporting Lao PDR to become compliant with ASEAN-WEN**	E-mail, meetings
ASEAN-FLEG	**Supporting Lao PDR to become compliant with ASEAN-FLEG**	E-mail, meetings
EU-FLEGT	**Lao PDR has launched the Voluntary Partnership Agreement negotiation process with the EU.**	E-mail, meetings
Neighboring countries (Vietnam, Cambodia, China, and Thailand)	**Cooperation to stop illegal imports and exports of illegal timber**	E-mail, official letters; bilateral agreements between Lao PDR and neighbors (these agreements specify responsibilities of both countries)
Lao PDR National REDD+ Taskforce	**Readiness preparation for formational REDD-plus strategy development and core capacity building:** supported on the basis of needs; supporting and disseminating forestry law enforcement in project areas	Traditional methods, official letters
Embassy of the United States	**Frequent offers of support**	Traditional methods, official letters

Table 2.3 Nongovernmental Organizations

NGO	Relationship with DOFI	Type of communication
IUCN	**Works on their project areas to actively support the strengthening of law enforcement and improving forest governance.** Cooperation with DOFI helps the government to develop the systems, capacities, and coordination mechanisms it needs to establish a strong enforcement regime at all levels.	Traditional methods, official letters, to some extent e-mail
WWF	**Coordinates with DOFI in two projects.** XePian National Protection Area and in CarBi-project; sharing information with DOFI; actively working with POFIs.	E-mail, Skype, mobile phones

Table 2.4 Projects and Other Entities

Name	Relationship with DOFI	Type of communication
World Bank	**Provides support through several projects, including SUFORD, SUPSFM, and ICT for FLEG project:** Preparing for Forest Investment Program (FIP; include components related to DOFI).	Regular meetings with DOFI
SUFORD/ SUPSFM (financed by government of Finland)	**Provides technical assistance to DOFI:** Parts of the project components support DOFI (for example, STEPP activities).	Regular meetings, reporting on technical assistance
CliPAD	**Parts of the activities support FLEG:** Project has provided DOFI IT hardware and GPS devices; extending relationship to work with DOFI in two northern provinces.	Regular meetings
CarBi (WWF)	**Component for measuring the reduction of illegal logging and the control of transboundary timber trade:** Currently cooperating with DOFI and POFIs in the south.	Regular meetings, official letters, e-mail, and so on.

Provincial Offices for Forest Inspection (POFIs)

DOFI itself oversees the work of POFIs. The organizational structures are also characterized by the extensive decentralization policy launched in 1986 with the New Economic Mechanism. Effectively, it means that provincial technical agencies are closely linked to and influenced by local, provincial administration, even if they ultimately report to the central agency in the capital, Vientiane.

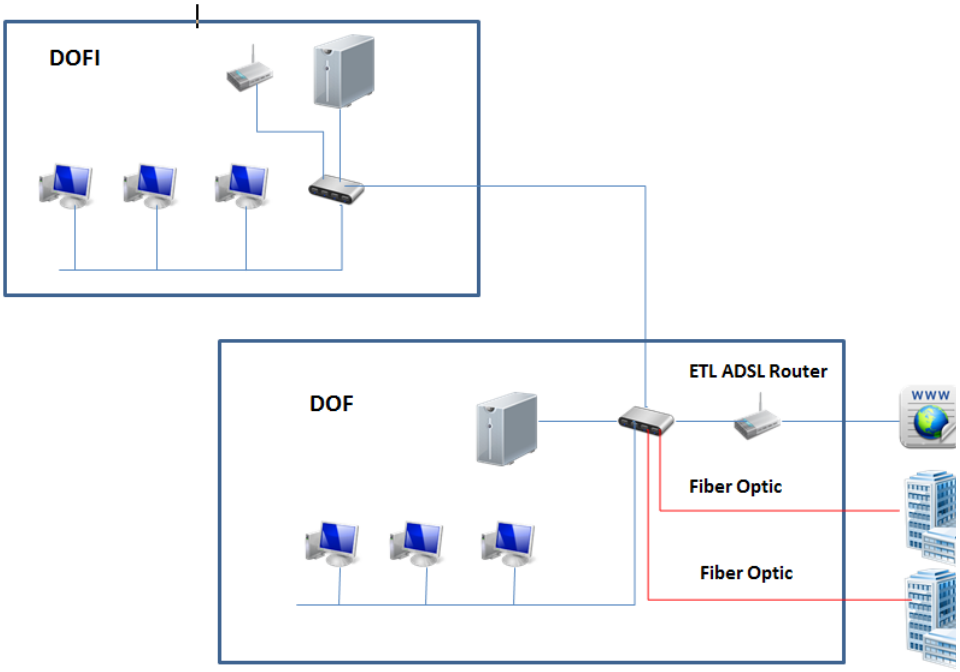
POFIs are local focal points for implementing forest investigations and inspections. POFIs are not directly responsible to DOFI but rather to the provincial governor. DOFI supervises the provincial offices, but in a decentralized manner—for example, reporting from the POFI goes first to the province vice-governor responsible for economic matters. This affects the reporting, especially in cases where, for example, logging is already approved by the provincial governor.

E-Readiness Audit

Current Situation with ICT Resources in DOFI

Before starting the application development, the use of ICT in DOFI and in Lao PDR was assessed. The review included the current ICT setup in DOFI and how the forest sectors are linked to one another. It also reviewed the e-readiness of DOFI. The current IT infrastructure of DOFI and connections to other forest-related institutions are demonstrated in Figure 3.1.

Figure 3.1 DOFI Internal ICT Network and Connection to Forest Sector



DOFI's ICT hardware consists of a server and network with 24 desktop computers and 8 laptops, most of which are provided by different donors (for example, SUFORD, CliPAD). DOFI's server is located in the Department of Forestry (DOF) server room and connected to the DOF network.

DOFI once shared a local area network (LAN) with DOF, which provided Internet access to both organizations, making it very slow and practically unusable. Later, the Lao government announced that it would withdraw central support for the Internet. This meant that each department would need to establish their own connection, which DOFI implemented in autumn 2012.

Most of the personnel in DOFI use computers for reporting and other nontechnical tasks. There are three people with forestry backgrounds who have limited capabilities in ICT. Most of the personnel are familiar with using the Internet, e-mail, basic office tools, and even social media such as Facebook. The first internal workshop for DOFI staff showed that the overall maturity level in ICT is low. Comparisons between DOFI and DOF also showed remarkable differences in using ICT. Below are a few examples:

- DOF uses a server to store data. The DOFI server is not used (empty disks).
- DOF produces reports that are available in digital format. DOFI uses a conventional paper-based system, although incoming and outgoing letters are recorded (reference number, date, and title) in a database (actual documents are not scanned). The software for this is provided by MAF.
- DOF uses remote sensing and GPS/GIS data actively. DOFI lacks basic skills in handling geospatial data.

Challenges and Possible Solutions

Currently DOFI has limited ICT capacity and, as discussed in section 2.3 above, many processes and most communication is done manually using paper. In order to understand where the best entry points for reform could be found, the project concentrated on examining challenges in current procedures and how they can be made more efficient by using ICT. During the inception phase, the DOFI Internet connection was too slow to be considered usable. Therefore some applications were planned and developed based on the use of a LAN. Still, if needed, these applications could be transformed and made available on the Internet.

Table 3.1 shows the existing challenges and possible ICT solutions. The solutions with the most potential are shown in the right column.

Table 3.1 Challenges and Solutions with ICT

Existing ICT challenges in DOFI	Existing ICT challenges in DOFI
1. Server-network connecting personal computers	
The capacity of staff to use ICT efficiently is basic.	Applications should target development of the skills of DOFI personnel to increase their capacity and confidence to use the existing server network system.
The existing server-network system is open access; it should be secured.	A file server should be used for storing important documents and secured by login password.
There is no central document repository.	An improved and better-arranged ICT-based document storage and distribution system should be established.
USB memory sticks, CDs, and e-mail are some of the methods for transferring files from one user to another, which makes it, without centralized protection, vulnerable to data loss, viruses, and so on.	A system for document download/upload from server should be created.

Existing ICT challenges in DOFI	Existing ICT challenges in DOFI
Documents are not available, for example, for fieldwork and when staff are abroad.	Applications should target development of the skills of DOFI personnel to increase their capacity and confidence to use the existing server network system.
2. Internet connection	
Shared Internet connection with DOF was very slow.	Internet connection should be established to DOFI to ensure that it can distribute information to other stakeholders and the wider public.
3. Online reporting	
Existing online reporting is not used; it does not include any kind of tasking or follow-up system.	Increase the confidence of the organization to better use the existing online reporting system, making it easier to use.
	Take the online reporting system to the next level, making it usable in the provinces and adding functions such as tasking and follow-up.
4. Geospatial information	
The location is normally reported using inaccurate village and district names, which makes the system inaccurate and inefficient.	Build up capacity in using GPS, especially for field verification.
	Introduce open-source Quantum GIS, free GPS and Google Earth software to DOFI; online global tools (for example, Global Forest Watch*).
	Create applications that use all available ICT equipment, for example, mobile phones.
5. Communication	
Existing communication with other forest-related organizations and stakeholders is based on traditional methods (official letters, phone calls, and meetings; see Tables 2.1-2.4).	ICT-based communication channels should be established using applications that use existing capacity of these offices (for example, mobile phone–based quick reporting).
6. Visibility	
DOFI activities/procedures are not understood by stakeholders or the public, which makes voluntary participation difficult if not impossible.	Use social media and website to distribute information about DOFI and its activities; social media can also be the "meeting place" for DOFI and other stakeholders.
Information about DOFI and its activities are not visible to the wider audience.	Identify applications related to the website to make it more usable to stakeholders, the wider audience, and the public while at the same time increasing communication between DOFI and other organizations.
Stakeholders (especially NGOs) have problems in understanding DOFI's procedures for investigation and inspection. Participation of these organizations is limited.	
7. E-Governance program	
DOFI is not connected to the government's e-governance initiative.	A government portal exists, but it does not have links to DOFI. As a starting point, a link from this portal to DOFI should be added.

* http://www.globalforestwatch.org/.

In summary, DOFI and the project team identified several opportunities to make the internal and external processes more efficient by using ICT. However, the capacities of the personnel in ICT as well as infrastructure were still at a level that should be upgraded. The applications and solutions in Table 3.1 showed that in order for this to happen, three issues should be addressed:

- The applications that were to be developed, even though fairly simple, should strengthen competence of DOFI staff to use the existing ICT setup. These simple applications will prepare the personnel for more complex and sophisticated applications.

- Information channels to and communication with stakeholders and the wider audience should be enhanced. Most government organizations still use traditional methods for communication and information distribution. If DOFI's parts of the communication channels are improved by ICT, this will not guarantee improvement of the overall system. Information distribution should be made more efficient so as to also reach the wider public by using means such as social media.

- Case verification and investigation is not done in a timely manner, making the system nonresponsive for prosecution and for many participating organizations. Applications for GPS and other mobile collection devices should be developed. Instead of full reporting and investigation, participation (especially by NGOs) should be based on reporting that targets the identification of hot spots and areas vulnerable to illegal forestry activities.

Application Development for DOFI

Application Groups

The short list of potential applications was divided into three groups: (1) basic, (2) medium level, and (3) high level and end user. This would ensure that applications are built and users are trained in an order that gradually raises DOFI's capacity toward high-level end-user applications. This ranking also indicates the level of required user experience: It is essential to be able to understand and use basic applications before moving to the more complex and advanced medium- and high-level applications.

Basic Applications

Basic applications are those related to the use of the existing server-network-personal computer environment:

- Applications that strengthen the capacity of DOFI personnel to use existing ICT more efficiently
- Applications that target a buildup of the capacity of DOFI to use the network more efficiently
- Applications that target more secure and speedy file/document transfer

Medium-Level Applications

These applications include those related to the efficient use of the Internet for faster distribution of DOFI-based information to stakeholders and the public. They also improve on the current online reporting system by adding functions such as tasking and follow-up.

Geospatial information plays an important role in verifying forest-related information. The locations of legal and illegal logging should be known by the authorities. Combined uses of GPS/GIS (Quantum GIS) and Google Earth (and later on point of interest mapping) are powerful applications to collect, analyze, and distribute data.

Medium-level applications include the following:

- Applications that actively use the Internet
- Applications utilizing social media for distribution of evidence of illegal forest-related activities. This evidence (uploaded pictures, coordinates, and so on) is provided not only by DOFI but also by other sources, such as other government organizations, NGOs, private companies, or the public.
- Applications that involve basic GPS/GIS skills. The spatial information is crucial when drawing the line between legal and illegal activities. Spatial locations can be imported to GIS and displayed to a wider audience by providing Google Earth (KML) files.

The requirement for moving to medium-level applications is the complete understanding of basic applications and confidence in using them. Again, medium-level applications provide better preparedness for the high-level and end-user applications by giving DOFI a basic understanding of social media, Web applications, and the use of geospatial information.

High-Level and End-User Applications

High-level and end-user applications use mobile phones for data collection to obtain information about logging and other potentially illegal forest-related activities.

Selected Applications and Links to Current DOFI Tasks

The main objective of each application was that it would contribute to the efficiency of DOFI. As seen in Table 3.1, some were more likely to become test beds for new applications. There were several areas of focus:

- Improvements to the document storage and distribution system
- Improvements to field verification and evidence collection
- Improvements on using the Internet as a communication channel
- Improvements to the existing reporting system

In the following sections, each application is briefly explained, as envisaged in the inception phase, then a description of the development of and progress made in each application is given. This will show how other activities, cooperation, and even feedback have formulated the applications to better fit organizational needs.

Basic Applications

These applications were targeted to improve the quality of the forest administration by increasing the confidence and capacity of DOFI personnel to use the existing ICT setup.

File exchange application

A file exchange application (file server; folder) is a computer responsible for the central storage, distribution, and management of data files internally so that other computers on the same network can access the files. The simplest file exchange application can be an external hard disk with folders (for example, people's names, reports) connected to the network that users can access. A file server allows users to share information (such as documents, audio files, movies, images, databases, and so on) over a network. Furthermore, this widely used simple office application can be upgraded so that it can be used over the Internet and through different cloud-based services (for example, Dropbox; see Figure 4.1).

The use of the application will result in better file sharing inside DOFI (no need for USB sticks and so on) and increased use of the network infrastructure.

Figure 4.1 Simple Description of the File Exchange Application

DOFI will later decide and regulate which documents, reports, and so on that will be served through the file exchange application (Table 4.1).

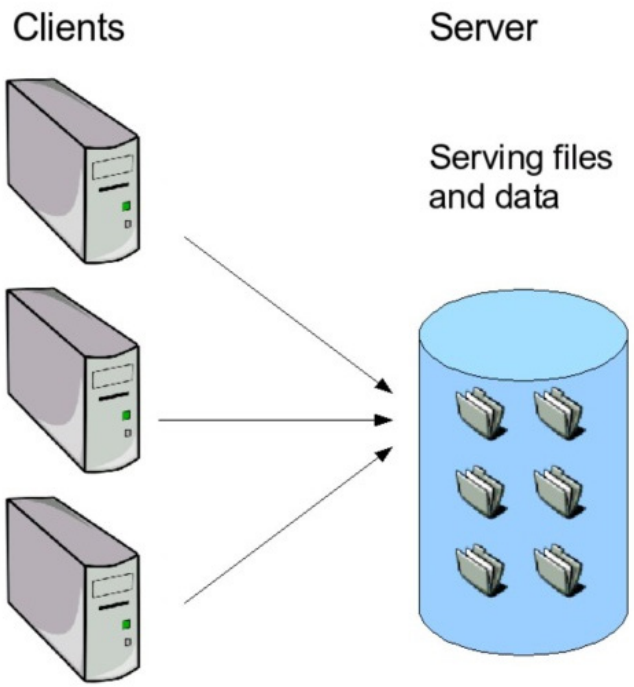


Table 4.1 Application Summary: Basic Applications

Application	Application usage	Application users	Further actions
File exchange	Access documents inside DOFI: for example, annual reports, for commenting, editing.	DOFI personnel in general; different divisions should have their own folders in the application.	Training for DOFI in general; upgrade to Internet base, for example, free (up to 2 Gb) external service (for example, Dropbox, Google, or Skydrive)
FTP server	Access and upload documents from the field, abroad, etc.; external access to other stakeholders (own password and dedicated folders).	Field teams, DOFI staff who need access to server	Training for DOFI in general; upgrade to free FTP applications (for example, FileZilla)
KnowledgeTree	Store and manage important DOFI documents, providing access, for example, via web pages.	Field teams, DOFI staff who need access to server	Regulate which documents should be stored; guidelines and training for its use (DOFI in general)

FTP server application

An FTP (file transfer protocol) server is an application used for transferring files between machines on networks, such as LANs and/or the Internet. Access can be established by using the host address. There are also several free FTP software applications for more organized work (for example, FileZilla FTP client). The use of the application will enable DOFI staff to access their files and documents from remote locations—in the provinces, abroad, or anywhere there is access to the Internet.

KnowledgeTree application

One of the core activities of all DOFI divisions is to manage documents systematically, ensuring that nothing goes missing and guiding them to their correct destinations. Basic applications were developed to support this activity. KnowledgeTree's document management system is an open-source/free application to store, manage, and track digital documents and images.

Basic applications have been developed and are fully functional; however, there are not many users because DOFI has been slow to adopt them. Nevertheless, DOFI will implement their use, and in the future we hope to see technology transfer from the trained DOFI personnel team to others. It has been expected that staff would start using the applications based on the example set by other, more experienced users.

As planned, basic applications have increased the confidence of DOFI personnel to use their own file server and network. It has also added to the quality of forest administration to handle and better distribute existing reports and documents. IT staff selected by DOFI were able to follow up the training relatively well and are also capable of independent work using these applications. The field tests performed by STEPP showed that these applications can be used, for example, to secure the collected information to DOFI's server. Figure 4.2 and Figure 4.3 show the FTP access established to the DOFI's server and KnowledgeTree, respectively.

Figure 4.2 FTP Access Established to Server Folders

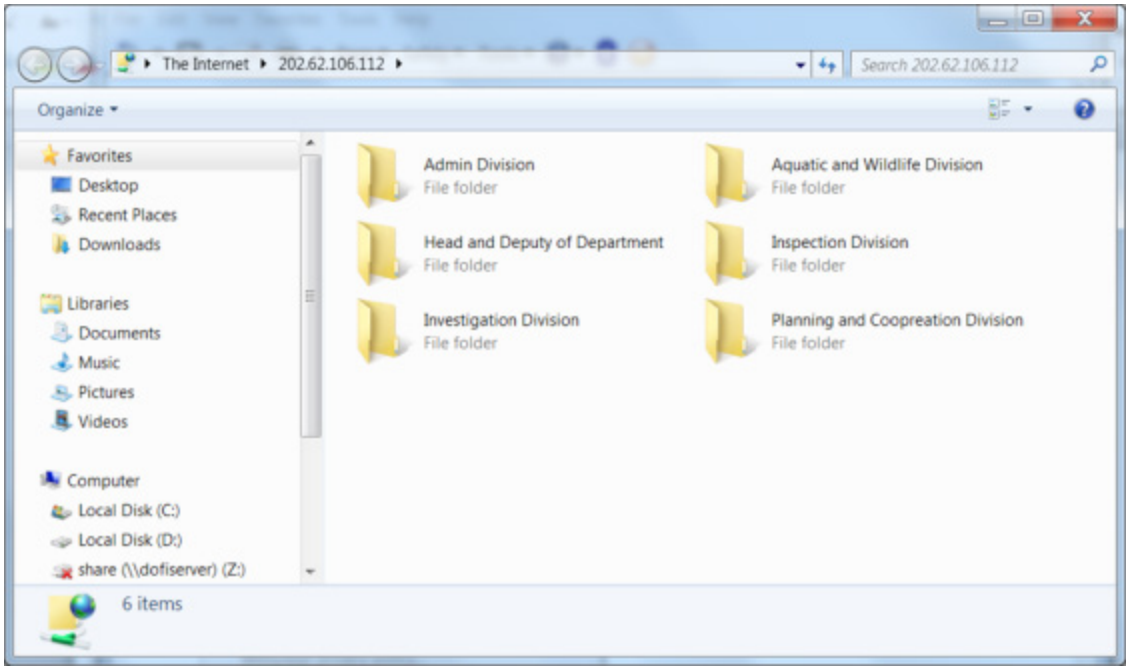
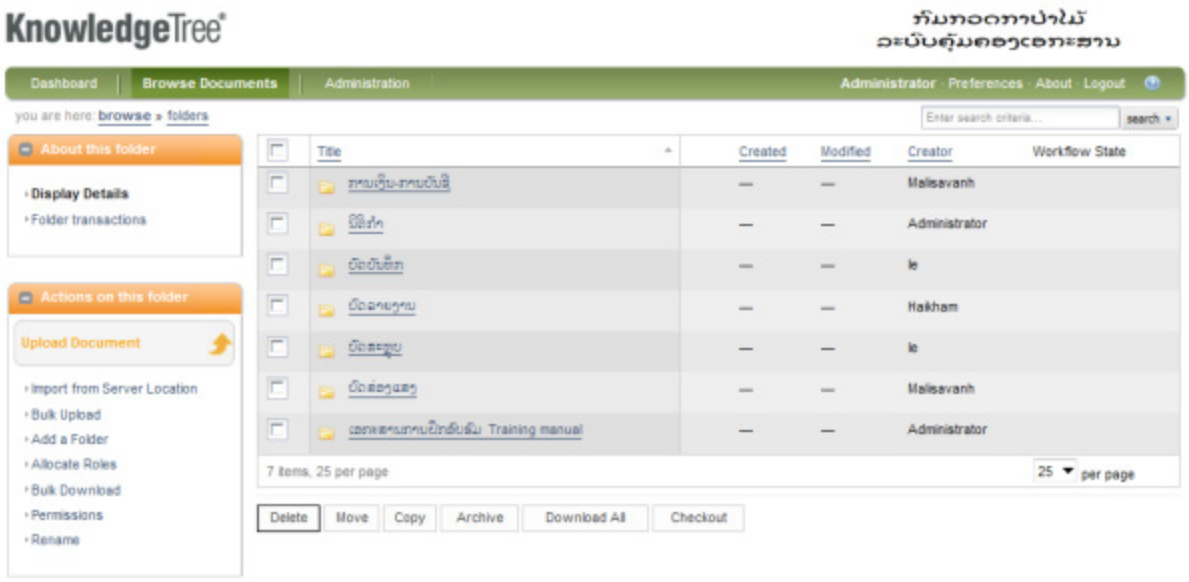


Figure 4.3 Access to KnowledgeTree Application



Medium-level Applications

These applications will increase the visibility of DOFI by using the Internet. They also build up DOFI capacity to collect and handle geospatial data. They are mainly based on and encourage the use of the Internet and free/open-source software such as Quantum GIS and Google Earth.

Online reporting application

During the previous phases of SUFORD, online reporting and a follow-up system (Lao-English) were developed. Nevertheless, it was never used in daily operations and a new system (only Lao) has been developed based on feedback from DOFI. Both systems include online forms and reports related to investigation and inspection. Differences between the old and new reporting systems are shown in Table 4.2.

Table 4.2 Online Reporting System: Old Version versus New Version

Old online reporting	New online reporting
Reporting based on activities, not cases	System based on cases, which leads to activities
Draft online reporting based on expert proposals	Online reporting based on user requirements (DOFI)
Three modules: (1) Inspection, (2) Investigation, and (3) Case tracking	Four modules: (1) Forest; (2) Logging; (3) NTFP, aquatic and wildlife; and (4) Equipment, weapons and machines
Difficult to track the case status	Easy access to the status of individual cases
Only three process steps	More process steps available: Inspect, Investigate, Suspend, Store, Operating, Prosecutor, Indict, Judge, Take action, and so on.
Reporting system in English and Lao	Reporting system only in Lao

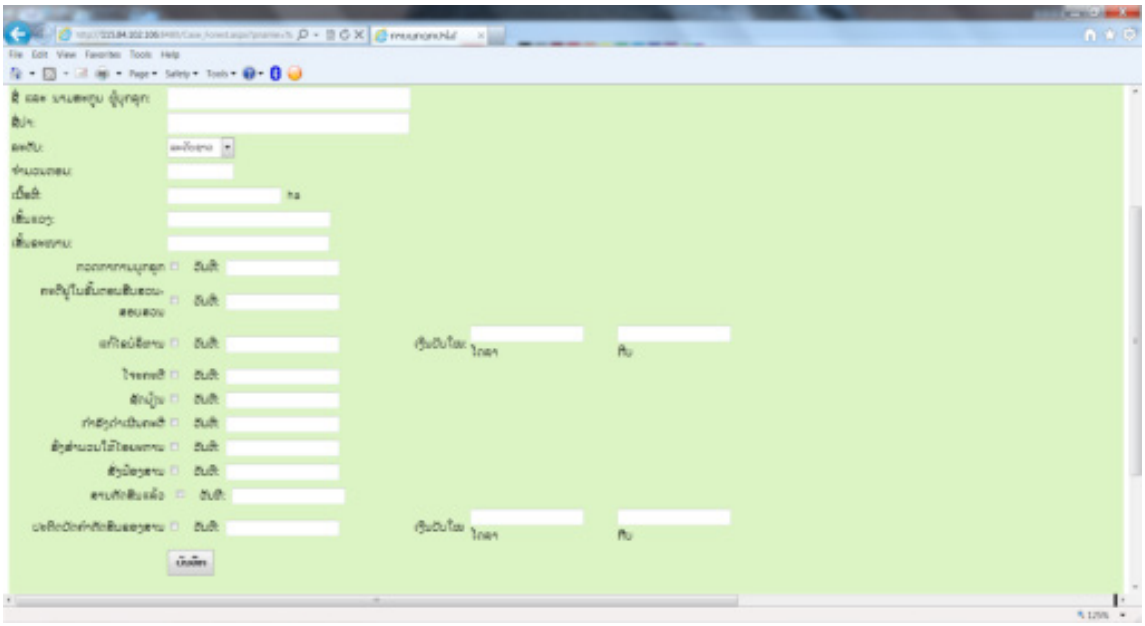
The project supported the redesign of the reporting system by adding tools for follow-up and job tracking. The Logging and Locations application supports online reporting by providing the coordinates needed for reporting. Proposed improvements have been collected during the training sessions arranged for the provincial offices.

Currently, online reporting is planned for use by POFIs to report illegal activities. The role of DOFI is to finalize these reports and forward them to the prosecutor's office. The following activities are included in the reports:

- Information about forest intruders
- Illegal logging
- Reports on non-timber forest products and wildlife-related illegal activities
- Reports on vehicles, weapons, and other equipment used for illegal activities

Figure 4.4 shows the basic interface for online reporting (this is only a Lao-language application). The form can be used for reporting any illegal activity online.

Figure 4.4 Online Reporting Interface



The existing online reporting system was introduced to the POFI personnel. During training sessions, several comments and ideas to improve the reporting system were gathered:

- A document reference should be added to every step of the reporting process.
- The location of the illegal logging or other illegal forestry activities, along with the names of persons involved, should be added. Also, the possibility of adding images to support the report should be incorporated.
- A summary report should be created for each province on cases that have been transferred from that province to the public prosecutor. The report may include, among other things, the number of cases transferred and the time and date of transfer.
- Access to the summary report should be limited only to the provincial staff concerned, but DOFI should be able to view all reports.

The reporting system was modified according to the feedback received from the provinces and made ready for wider use. Online reporting is now a stand-alone application, which means that it is accessible through the LAN/Internet using a certain IP address. In the future, online reporting should become part of the web pages, with login/password access. Currently, the online reporting system has only been developed in the Lao language.

Facebook page

The Facebook page content was planned by DOFI and the project team supported the implementation. The page works as an information distribution channel for DOFI. Later on, if needed, the page could serve as a forum to publish images provided by the public, stakeholders, and so on. Establishment of the Facebook page increases the visibility of DOFI to a wider audience. Activities shown on the page could include information about new projects, seminars, workshops, social events, and so on.

The Facebook page is now online,[5] complete with images from the field, including illegal logging, confiscated timber, and so on. The page is a good start to make DOFI better known among its counterparts and the wider public (Figure 4.5); however, its updating has remained a challenge.

5. https://www.facebook.com/pages/DOFI-Lao/274323392685101.

Figure 4.5 Recent Update of DOFI Facebook Page

Logging and Locations application

Satellite imagery change detection has been used to provide information about logging for STEPP. Detected changes need to be verified in the field and additional evidence collected. Originally, two ideas were introduced to DOFI and STEPP to improve the fieldwork: (1) the basic and conventional use of GPS and GIS software and (2) a point of interest mapping application. The application has mainly emphasized the use of conventional GPS.

This application has built up DOFI capacity to better understand geospatial information in general. The idea was to use GPS (first basic and then more advanced) to collect logging-related data and import coordinates to GIS (free GPS software; Quantum GIS), convert them to KML (Keyhole Markup Language), and then distribute data to the stakeholders for display in Google Earth as forest-related hot spots (that is, areas with most forest-related activities). The package has so far included and introduced the following procedures:

- Procedure 1: Collect data with GPS à import data to Quantum GIS à export them as Google Earth points.
- Procedure 2: Download/upload points from/to GPS device à navigate to the areas of interest à collect data using advanced GPS.
- Procedure 3: Secure data to server using basic application (FTP).
- Procedure 4: Use smartphone-based point of interest mapping application (or other appropriate data collection software) to collect data à upload data to the map portal (high-level and end-user application).

Basic handheld GPS, Quantum GIS, and Google Earth were used for training. This was successful, but it only covered basic use and in an environment not prone to errors or other challenges (for example, remote forest areas). Advanced training included the use of advanced GPS equipped with digital camera, related GPS software, and training for field verification.

Medium-level applications are summarized in Table 4.3.

Table 4.3 Application Summary: Medium-Level Applications

Application	Application usage	Application users	Recommendations
Online reporting	To enable case reporting. Reporting can be done at the province level and saved for finalization at the central level. In the future, this should replace the traditional and manual system. The reporting follows the same procedures as the traditional system.	DOFI central and provinces	Finalize the system and start to implement it in parallel with the manual system. Enable access from the website, making it easier to access (IP address based login still difficult for some users).
Facebook	This application shows updated information about DOFI and its activities.	DOFI and other stakeholders, NGOs, public, and so on.	Regulate the updating of the page.
Logging and Locations	Application is mainly used to collect information about illegal activities in the field. The coordinates and related information can be used as evidence in prosecution (part of online reporting system, see above).	DOFI ICT/STEPP team; people responsible for field verification, for example, based on satellite image interpretation	Prepare clear guidelines and process descriptions of how to collect data and how to back it up during field verification (FTP application). Basic use of geospatial data should be followed by advanced training, including geospatial analysis.

High-Level and End-User Applications

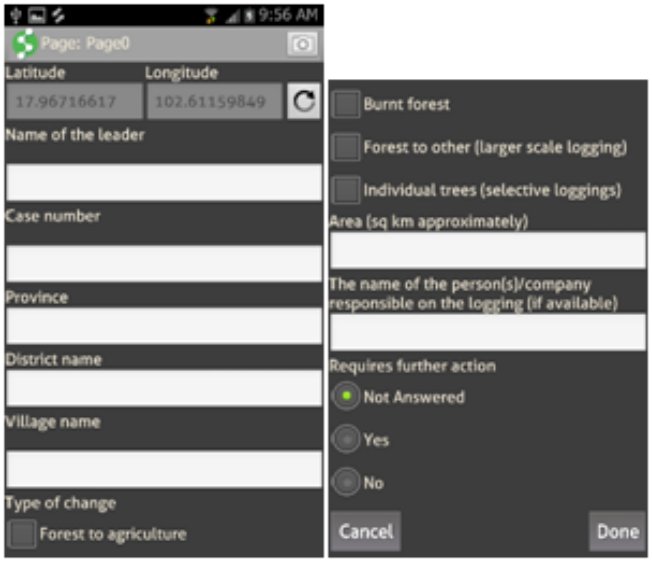
This category has only one application, which aims to provide a tool to the personnel working in the field to collect data and report on forest-related activities. The application is designed not just for DOFI or Provincial Agriculture and Forestry Offices but also for other stakeholders, such as NGOs.

Mobile data collection

Mobile data collection covers applications that can be designed for use with mobile phones. Applications can vary from simple SMS-based mobile collection systems (for example, for disease control) to more complex smartphone-based applications with enabled design of forms, use of GPS, and visualization in an external Internet-based map portal (generally referred to as mapping points of interests). These applications are widely used to collect data related to, for example, wildlife, forestry, agriculture, health, disease control, and so on. The project applied a proprietary application, Poimapper.

Predesigned forms for mobile phones were used for data and information collection in the field. During the project, forms were designed and tested in the field. Normally, point of interest mapping applications require high-end mobile phones with a GPS utility. The project downloaded the database for Poimapper for testing. Figure 4.6 shows the first form developed for the project.

Figure 4.6 Poimapper Form Designed for Smartphones



The first part of the form captures information about the location. Coordinates are displayed automatically and the camera is enabled for detailed documentation. The second part of the form collects attribute information about the actual change (that is, type of change, size, and, if known, who is responsible for it). The last part of the form asks if further action is needed. Finally, the user accepts or cancels the data entry.

The application was field-tested during the extended and combined training with DOFI's STEPP team. The application worked well, even in the dense forest areas where GPS signals are known to be weak. Data collected from the field were uploaded to a Web-based map portal.

The feedback given was that the form was too complex and therefore too slow to use, especially in difficult conditions. The new form design is much simpler and concentrates only on collecting the most important information. There is also a possibility to translate the form into the Lao language using a local ICT company specializing in mobile phone development.

The application has shown to DOFI that mobile devices can be used for field data collection. It has also shown the future possibilities related to mobile field collection (Table 4.4).

Table 4.4 Application Summary: Point of Interest Mapping

Application usage	Application users	Further actions
Application is mainly used to collect information about illegal activities in the field. This application has been mainly tested as a potential application for future fieldwork.	DOFI ICT/STEPP team; people responsible for field verification (for example, based on satellite image interpretation); it can also be extended to be used with other organizations to collect information about forest hot spots.	Study of the availability of GPS equipped mobile phones is needed (existing and future needs); cooperate with other organizations (for example, NGOs) to use this application for their fieldwork.

Status of All Applications

The status of the applications is summarized in Table 4.5. All applications have been finalized and technical documentation has been provided.

Table 4.5 Status of Application Development

Application group	Application name	Remarks
Basic applications	File exchange, FTP, KnowledgeTree	Additional field tests were done during the field verification exercise.
Medium-level applications	Facebook	Procedures for updating need to be established.
	Logging and Locations	Additional training in advanced GIS were conducted and related field tests were done.
	Online reporting	All user feedback was received—improvements to the application added.
High-level and end-user applications	Poimapper	Additional form for data entry was created; field tests were completed; based on feedback from field tests, a new form has been created.

Application Links to DOFI

In DOFI, activities and related applications are divided into two major areas. The first covers the confidential investigations and inspections done by DOFI (secure and closed area of activities). These activities aim to gather evidence for possible prosecution. Neither the results nor data are available to others because of their sensitivity and ongoing investigation. Data are released to the wider public after investigations have concluded.

The visible side of DOFI covers public relationships and information distribution to other forest- and environment-related entities. Social media (Facebook) is used to distribute information on DOFI-related matters, social events, donor support, and so on. In addition, there are other public awareness activities, which can also involve other government organizations and NGOs.

As planned in the preliminary phases of the project, the applications should not be separate developments, but rather be linked to everyday activities of DOFI as listed above. Table 4.6 shows how applications link to the actual tasks of DOFI.

Table 4.6 Links Between DOFI Activities and the Application

DOFI Task	Application
1. Manage Incoming and Outgoing Documents Systematically	
Ensure that nothing goes missing and guide them to correct (internal and external) destinations. Keep good filing system, organize draft notices, meeting memos, agreements, and other relevant documents.	**Basic applications** are all developed to improve the filing system, which organizes and archives final documents (KnowledgeTree). **Dropbox** ensures the distribution of draft memos, documents, and so on, inside and between different divisions. **FTP** application enables the movement of files and data outside the office.
2. Continue to Develop and Support STEPP In All Provinces	
Provide equipment and technology to support professional investigations.	**Logging and Locations application** enables accurate measurements of coordinates and visualization of the data **Point of interest mapping application** training was provided and its was use tested during the field verification exercise
3. Find Measures for Forest and Land Inspections to Prevent Illegal Logging, Trading, Invading, and Destroying of Forest Land	
Take active role in inspecting, preventing, patrolling to prevent illegal logging, trading, invading and destroying of forestland.	**Facebook application** provides information about DOFI and emphasizes how the organization is preventing illegal logging; it also encourages open discussion and public participation.
4. Create Database for Forest Inspection and Forestland Statistics	
Coordinate with all other relevant sectors, local authorities to collect data and create a database for forest inspection data and create inspection network down to the village level.	**Online reporting serves as data entry point for the database.** All information entered into the reporting system is saved into a database; in the future, other forest-related data sets—for example, forest class (production, protection, and conservation forests) boundaries—should be incorporated into the database.

All applications were tested during the field exercises. GPS and uploaded points were used to navigate to the area of interest. Data (waypoints, tracks, and pictures) were collected using GPS and uploaded regularly using 3G Internet connections to the DOFI server. The point of interest mapper was also tested and all relevant data were uploaded to the map portal during the field exercises. Facebook was used to show the results and experience from the field to a wider audience.

Training and Dissemination in Counterpart Organizations

Workshops: Two workshops were arranged during Phase I. The first was held to assess the organization's readiness for e-governance and introduce initial application selection. The workshop brought in valuable information about the level of ICT skills in DOFI.

The second workshop introduced the project and inception report to other stakeholders. This workshop included participants from different organizations (government and NGOs). The workshop brought in information about concerns and requests from other organizations.

Training: Project-related training started at the beginning of Phase II. Owing to limited resources, the first training sessions gave basic information about the applications. These were followed by advanced and combined training, where all applications were used and tested. Afterward, there were field exercises, where the applications were tested in the real environment.

DOFI assigned four people to first receive training. Subsequently, these people were promoted and four new staff members were assigned to the project. This did not affect the progress much because training had covered only the basic applications. Some review training had to be done, but this was completed among other training.

At the end of Phase II, a wrap-up workshop introduced the applications to the management level of DOFI. The workshop combined demonstrations (in the field), presentations (classroom), and teamwork. As a conclusion to the workshop, several ideas were presented:

- Management agreed that knowledge in the use of the applications should be transferred to other employees of DOFI/PAFO. It was proposed that the ICT/STEPP team of DOFI would arrange training in the applications for DOFI.

- All applications were recognized as important tools for DOFI and should be used by other divisions as well. Especially, training in the use of basic applications—file exchange, KnowledgeTree, and FTP—should be given and then used in DOFI.

- DOFI management requested that the project team seek additional funding to further build the capacities of DOFI to use ICT.

- It was noted that this kind of project was useful because of its open scope. In other words, it is not restricted to one or several provinces; it can facilitate activities (such as cooperation, training, and fieldwork) that cover any area.

Conclusions and Recommendations

Lessons Learned: Key Success Factors and Risks for Sustainability

The project has been a success considering its duration and the resources available. Several factors contributed to the successful implementation of the project:

- **Institutional commitment to use ICT:** Senior management and personnel have recognized the importance of moving toward e-governance. Internal resources have been allocated and made available for training, field exercises, and so on. The role of technical assistance has been recognized and DOFI management gave full support to the pilot project.

- **Cooperation with other projects and programs:** The project began with STEPP and then cooperated with CliPAD. Working with other projects has increased the visibility of DOFI. It has also attracted other organizations to cooperate and share information and ideas with DOFI.

- **Repeated training activities:** Training sessions have been arranged, beginning with a short basic introduction to the applications and followed by field exercises. In these sessions, individual applications and/or combination of applications were used. This has increased the confidence of the personnel in using the applications.

- **Staying simple and responding to demand:** In application development, the project did not try to create anything complex, rather it concentrated on the idea of using existing infrastructure, hardware, and skills. This has further led to a steady growth in overall capacity in ICT. The project also responded to the demand from STEPP to provide applications that would improve its capability to conduct field surveys.

The project team anticipated several risks for this kind of project.[6] Even though ICT solutions have become more sustainable—mainly because of the reduced costs, especially in hardware—there are still some risks that can pose a threat to sustainability. Table 5.1 describes the risks along with possible mitigation measures.

6. Some of these risks are typical also to any ICT-related projects.

Table 5.1 Anticipated Risks and Mitigation Measures

Risk	Risk level	Mitigation
Applications are not used for a long period and the users forget the procedures.	**Medium**	**Cooperate with other organizations that are able to continue the use of these applications.** This also shows how important the applications are for the organizations and other related projects. For example, CliPAD is cooperating with POFIs in northern provinces. They need DOFI to provide training.
Applications use is not a common practice.	**High**	**Prepare guidelines and regulations for how, when, where to use the applications.** In some cases the best solution is mandatory use of an application (for example, online reporting).
Lack of funds to run operations that are based on the applications	**Medium**	**The importance of ICT to support forest inspection and investigation activities should be explained to the ministry or even at the government level.** The government should provide funds to sustain the activities. This is based on communication and demonstrating, for example, that the fight against illegal logging requires accurate knowledge and information about the locations of the irregularities.
Software used is expensive and maintenance, updates, and so on become too costly for the counterpart organization.	**Low**	**Use open-source and free software.** More time and resources for training is needed because of scattered information sources.
Applications are not routinely used.	**Medium**	**Tasks should always be done using the application(s).** The applications are already used in STEPP; to ensure continuation, applications should support other activities and their objectives. Skipping the use of applications—for example, because of problems or lack of understanding—easily leads to the situation where traditional methods are used again and might replace the applications. There should not be an option to use the old system anymore.
Slow Internet connection	**Medium**	**Some measures should be established to restrict the use for work purposes only or limit personal use to out-of-office hours.** Medium-level applications particularly depend on a stable Internet connection. In the beginning of the project, the connection was shared with DOF, making the Internet connection unusable. DOFI has had its own Internet connection since autumn 2012. In the future, the possible increase in the number of users may make the connection slow again. Restrictions could include sites that require high bandwidth (for example, YouTube).

Institutional Uptake

Project activities included frequent and mostly informal meetings with DOFI, arranged sometimes at short notice. These meetings included updates on project progress, discussions about training and field exercises, and other project-related issues. The project activities were carried out as planned. Support from the management level for using e-applications has played an important role.

The timing for the additional ICT project was ideal. Larger projects (for example, FIP) have not yet been initiated, leaving space and resources for a smaller project. In addition, DOFI is now receiving information about ICT and related applications that could, in the future, be advantageous, especially when planning the IT-related project components and procurement of equipment.

The issue of financing was a concern at the beginning of the project. This is not a surprise, because Lao PDR, and especially its government organizations, is still heavily dependent on support from other countries and donors. Nevertheless, close cooperation with DOFI and particularly with STEPP has improved the attitude toward the project. The management has understood the usefulness of ICT to support patrol activities.

The second challenge was the limited familiarity with ICT and e-government in DOFI, which made visible progress and implementation slow. Nevertheless, the level of knowledge increased gradually during the project. The conceptual ideas have created technical innovations proposed by the organization and its provincial offices.

The final concern was related to the institutionalization and sustainability of the applications. This was mainly because of the short duration of the project. It was difficult to foresee if the applications had really been adopted. Actual implementation and subsequent institutionalization were not part of the project, but they have to be carried out by DOFI. The use of the applications should be regulated and clear guidelines should be prepared for their use. Moreover, the applications must be used actively.

Nevertheless, the project has initialized technical innovation in the organization and made the management aware that certain activities can be supported by ICT. The applications show that small ICT-based additions to everyday routines can increase the organization's capability to handle and better understand them. To increase sustainability, DOFI management has to step forward and fully implement the applications. Here are recommended actions that will increase the sustainability of the project applications:

- **Knowledge transfer:** Basic applications are useful for everyday tasks and should be used more often. Training that first covers the management and then the wider audience will increase the probability that applications are used. The basic applications created in this project are only examples. There are several other options available for free on the Internet that could be considered in the future.

- **Mandatory use of the applications:** Some applications are not currently used (for example, online reporting). The reason given for this is that the applications are modified repeatedly, and so it is not worthwhile to start using them. Moving to a digital system might be easier for trained staff, especially the younger members, while it is difficult for those who are not that familiar with new technologies (typically older personnel). Management should also go through extensive training to understand the advantages of this kind of application. Management should mandate adoption of the application. It should replace the current paper-based system.

- **Core team:** The DOFI core team, including those trained in this project, should supervise and train staff in the provincial offices. DOFI should have a maintenance plan to upgrade the skills of this core team. It also would be beneficial if new people could be recruited to the core team outside DOFI (for example, forest GIS graduates with an IT/GIS background from the National University of Lao PDR).

- **Free applications:** For example, one free alternative option for mobile data collection is EpiCollect.[7] This application provides functionalities available in the commercial version, such as form builder for data collection. Other options for mobile data collection are presented in the World Bank report "ICT for Data Collection and Monitoring and Evaluation."[8]

- Depending on the organization, **basic applications** can be used as they are anywhere within the LAN. However they could be upgraded to Web-based applications that use cloud services (for example, for data storage and transfer).

- Online reporting could be replicated taking into account the different legal and practical requirements of other countries. Modifications to SQL server-based data entry are relatively easy.

7. http://www.epicollect.net.
8. World Bank. 2013. "ICT for Data Collection and Monitoring & Evaluation: Opportunities and Guidance on Mobile Applications for Forest and Agricultural Sectors." Agriculture and Environmental Services Technical Assistance, report 01. World Bank, Washington, DC.

- The Logging and Locations application uses basic GPS devices and free GPS software. Other free GPS uploading/downloading software may be found on the Internet (for example, EasyGPS). This software supports most commercial devices.

- The mobile phone–based data collection was tested with a simplified data entry form suitable for Lao conditions. The form could be modified to better fit with the needs of other countries. Fieldwork is often done in dense canopy forest areas, making even the conventional use of GPS (for example, Garmin 60cs) inaccurate. Still, smartphones can be used to collect additional information, for example, about the target area.[9] This could easily replace the commonly used paper forms. Free mobile collection applications are available from the Internet.

Current Situation Compared to the Baseline

To understand the progress achieved during the project period, the baseline and the current situation are compared in Table 5.2. The baseline is the situation that prevailed at DOFI during the inception phase of the project.

Table 5.2 Comparison Between Baseline and Current Situation

Baseline situation	Current situation
DOFI management	
Based on the first workshop results, the management was skeptical toward ICT.	The wrap-up workshop showed that the attitude had changed to being more supportive; management was now more confident about using ICT and gave full support to it.
DOFI personnel	
Among 26 technicians, only 3 had more advanced knowledge of ICT; these 3 were from the IT section of the investigation division.	All together, 7 people were trained in basic applications and 4 more were trained in medium- and high-level applications; the personnel are now familiar with mobile data collection methods; all applications have been introduced to the management.
DOFI server	
DOFI server and related hard disks were empty and not used.	DOFI's server and related hard disk are now used; different divisions have their own folders for file sharing; KnowledgeTree application includes reports; FTP has been used to support data transfer from the field.
Field verification	
Field inspection locations were based on inaccurate use of district and village names; investigation lacked accurate information (e.g., x and y coordinates); no one in DOFI is skilled in using GPS.	GPS is used to collect location-based information more accurately; so far 3 areas and 10 points have been checked using GPS; the use of GPS has been taken as a standard tool for field verification; 4 people are able to use GPS and 3 are familiar with the use of GPS.
Mobile data collection	
Management and staff were unfamiliar with mobile data collection.	Mobile data collection application was used to check several areas related to investigations of illegal logging.
Online reporting	
Online reporting system was not used; no report has been done using the online reporting system; DOFI still uses conventional system to report investigations and inspections.	Test reports have been produced; the Forest Resources Inspection Strategy Action Plan of DOFI now includes the implementation of online reporting.
Awareness about DOFI	
DOFI did not have any Internet-based channel to spread information about their activities; web pages have been designed but not published.	**The Facebook** page has been established as a preliminary solution for awareness raising; since joining Facebook in September 2012, DOFI has made 18 updates to the pages, including information about meetings, news, and seminars.

9. For more information on mobile data collection, see "ICT for Data Collection and Monitoring & Evaluation" (World Bank 2013).

Interaction with Other Programs and Outside Service Providers

The project explored the possibilities for cooperation with other projects, programs, donors, and the private sector. The closest cooperation was established with DOFI's STEPP program, which has covered satellite image–based change detection and related field verification of areas in the southern part of Lao PDR. SUFORD contributed by supporting the project-related training activities.

KfW-funded CliPAD mainly works in the northern provinces (Sayabouri, Houaphan, and Luang Prabang). The project has provided funds for verification equipment, such as GPS (equipped with digital camera) and laptops.

In addition, the project has been in contact with local ICT companies for possible cooperation in the future.

Recommendations

The recommendations can be divided into three groups:

- General recommendations: issues and further tasks for the management and the role of other development agencies as well as the private sector and how to engage them in the work
- Application-specific recommendations: technical issues and further implementation of all applications
- Recommendations on how to scale up the project's achievements

General recommendations

These recommendations cover issues and further tasks for the management and the role of other development agencies and the private sector and how to engage them in the work:

- **There should be a more comprehensive review of the institutional frameworks and administrative processes on forest law enforcement** to understand how the traditional system works as a whole. Old, slow, and inefficient reporting systems should be replaced by online reporting. It would also be useful to review how other organizations (Environment Police, MAF/Inspection) are involved in the overall inspection and investigation processes.
- **There should be a separate division in DOFI that concentrates on issues related to GIS/remote sensing, IT, and information management in general.** In the future, GIS/remote sensing and IT-based tools will eventually replace the conventional methods currently used by DOFI. To keep up with development, DOFI should establish a geospatial team to provide support to other divisions. This should include nominating a senior level chief information officer. DOFI's work is very much based on gathering and analyzing information and data. Therefore, there should be a designated official overseeing information and knowledge management.
- **Cooperation with other organizations should be encouraged.** This does not mean that DOFI compromises the important procedures related to the prosecution of illegal activities, but it should create a network that can be used to better monitor activities in the forests. Involvement of international organizations, for example, will also increase transparency and trust of the government organization.

Application-specific recommendations

The application-specific recommendations relate to the implementation and institutionalization of the applications. Currently they are being used on a test basis, but they have been found to be useful for other purposes as well—for example, in different divisions of DOFI:

- **Training should be arranged to cover all users in DOFI and other personnel.** The basic applications introduced during the workshop were found to be useful for all divisions. Further training should be arranged by DOFI's STEPP team.

- **The use of applications should be regulated and guidelines should be prepared.** A working team should be established to prepare guidelines to decide how, when, and where the applications should be used. This could cover, for example, DOFI reporting and how to distribute reports for reviewing and commenting. The guidelines should be approved by the management.

- **Easier access to the applications should be provided.** This could be, for example, access to KnowledgeTree from the website. The original plan included better access to the applications from web pages but, because of the slow development of web pages, it was not possible to implement this.

- **Possibilities for continue training and field exercises with other projects should be explored and encouraged.** It is recommended that cooperation be established with other government organizations and NGOs. DOFI has already made an agreement with CliPAD (Planning Division/Department of Forestry).

- **The capacity-building activities for DOFI personnel should concentrate on advanced GIS.** Staff have already been trained in the basic collection and display of geospatial data. They need more advanced training on the subject so as to be able to better analyze the data they have collected.

- **Use of the Logging and Locations application should be taken forward toward distributing and sharing data.** This could be done by establishing a map portal (for example, a geoportal; see Box 5.1), which could be used to provide access to DOFI data. It can be established by using open-source and free software, such as GeoServer or MapServer.

- **Start to use the online reporting system.** This application has been under development for several years and the project team made final modifications. Its use should be made mandatory and the application should be used actively by POFIs.

- **Application upgrades. Some applications can be upgraded relatively easily.** Now that stable Internet is available in DOFI, for example, the file exchange application could be upgraded to the Web-based free Dropbox application or another well-established third-party service. Cloud-based Dropbox could be used to share files with other organizations as well.

- **Involve the local private sector in the development of ICT.** Especially if mobile applications are used, it is important that the development includes Lao-language application interfaces.

BOX 5.1 GEOPORTALS

Geoportals are Web portals that offer access to geospatial data. Similar to GIS software, they offer an interface and tools for data viewing. Access to the geoportal could be a part of DOFI's website or a stand-alone portal. Geoportals are available as commercial versions as well as open-source, free versions. The most used open-source geoportals are GeoServer and MapServer. Geoportals are widely used to visualize and distribute organization, country, or even worldwide data sets.

Recommendation for Scaling Up the Project's Achievements

The project concentrated on building up the capacity of DOFI to use ICT applications for their everyday routines. The applications were categorized into three levels, depending on their usage: basic, medium, and high. While basic applications concentrated on improving the everyday tasks at the central level by providing tools to use the server more efficiently, the medium- and high-level applications improved DOFI's capabilities to investigate, gather evidence, and report what had been seen and done in the field.

Now that these applications have been field-tested, it is essential to take steps toward more advanced and organized handling of geospatial data and piloting mobile applications. DOFI has shown increasing interest, mainly because of patrolling activities, in using geospatial data for their everyday activities. The use of geospatial data could play an important role in improving the forest law enforcement and governance in Lao PDR and thus could be the main theme for any future scaling-up activities.

Geospatial data related to forests are collected using various methods by various organizations. DOFI has also started to collect information related to illegal logging and forest-related hot spots. Currently, DOFI data sets are basic, isolated, and do not have any link or reference to other data sets. Furthermore, all DOFI data cannot be made visible to a wider audience while litigation is still ongoing.

Below are the specific recommendations and related activities to scale up ICT in DOFI. The piloting of the data collection could cover patrols and related data collection in one province (coverage of one POFI). This piloting could test the whole law enforcement process, from detection of suspected illegal logging (using satellite images from outside sources, such as NGOs) to prosecution. There are several different steps of this activity:

- Handling and preprocessing information related to possible illegal activities by DOFI
- Providing data as waypoints/tracks to the POFIs by DOFI
- Launching a patrol team with mobile data collection units (based on smartphones or conventional GPS with digital camera) by POFIs
- Investigating areas of interest, preparation of online reports on the findings, and making online reports available for DOFI by POFIs
- Analyzing the results based on reporting and, if necessary, the collection of additional information from areas that have been left out of the investigation by DOFI

- Finalizing reports, preparing summaries, and forwarding them to the prosecutor's office by DOFI
- Storing the data in a GIS database (PostGIS) by DOFI
- Visualizing the data sets using GIS software by DOFI
- Preparing a case and transferring it to the prosecution

Advance distribution of geospatial data would include the establishment of a geoportal and related database (PostGIS; establishment of a database is mentioned as one of the activities of DOFI) would be the first and the main step toward DOFI becoming more transparent and with a public-service orientation (Box 5.1 above).

The establishment of a geoportal would enable the visualization of all DOFI-related data collected from the field (field verification, inspection, and investigation) as well as other forest-related data provided by other organizations. The advanced distribution of geospatial data would include the following steps:

- Incorporating the data sets into GeoServer and the PostGIS database. PostGIS, as any other geo-database, collects and organizes data.
- Creating data directories for different data sets (for example, forest boundaries, hot spots, field verification results, and so on). Data sets (individual works done by DOFI and hot spots provided by other organizations, projects, and individuals) would be clearly separated (for example, by using different colors and symbols).
- Publishing the data (for example, on the Internet).

Establishing a geoportal would need to be accompanied by extensive training. The DOFI personnel would need to be trained to use mobile data collection to ensure accurate measurements. This training would also cover uploading and downloading GPS data and using the online reporting system. At the central level, the personnel would be trained to receive online reports and analyze them in relation to actual points collected. They would also need to be trained to give feedback for the fieldwork done in the pilot province—for example, questioning why certain areas were not investigated. Finally, they would need to be trained to import field verification data to the geoportal.

The use of a geoportal would have several advantages:

- A geoportal would institutionalize the use of geospatial data. DOFI would be able to set targets to populate the geoportal with its own data and data provided by other organizations. The production of geospatial data would be a priority and its collection would always be linked to investigation.
- The geoportal could be established using open-source and free software, such as GeoServer or MapServer. In principle, using open-source tools would lower the initial investment cost.
- The geoportal would combine the data sets from different sources into one layer that could be visualized and distributed with minimal effort. The users of the geoportal could also be divided into groups (for example, internal and external users). Internal users would be provided with full access to all data, while public access would be restricted to data sets that had been approved for publication.

- DOFI would become better linked to other government plans on e-applications and services. Once established, the DOFI geoportal could easily be added as a link in the national portal. It could also be linked to the DOFI web pages.

- STEPP activities would be more visible to the wider public (in cases that have been carried out and finalized). This would bring more positive publicity to DOFI. Donors would also be able to follow the progress in DOFI.

- The geoportal would increase the cooperation between other organizations (government or nongovernment) and DOFI. As the use of the data provided by other organizations requires cooperation and data/knowledge sharing agreements, this would bring organizations closer to one another and enable better cooperation. The establishment of the geoportal would be done to support continuing cooperation with key partners, such as STEPP, CliPAD, and WWF. The cooperation with CliPAD would provide data sets for field verification from the project provinces, Xaignabouli and Houaphan.

Additional resources would be required for successful implementation of the geoportal. Even though it would be based on open-source and free solutions, it would require more resources than basic handling of geospatial data. In addition, further training in handling and analyzing geospatial data would be needed. One should note here that these portals are often documented by the users and more advanced information is only available, for example, in discussion forums and articles. Moreover, the training for the establishment and use of geoportals is more time consuming than with other GIS/GPS-based applications.