INFORMATION AND COMMUNICATION TECHNOLOGY FOR FOREST LAW ENFORCEMENT AND GOVERNANCE

Lessons from a Two-Country Project in Lao PDR and Moldova

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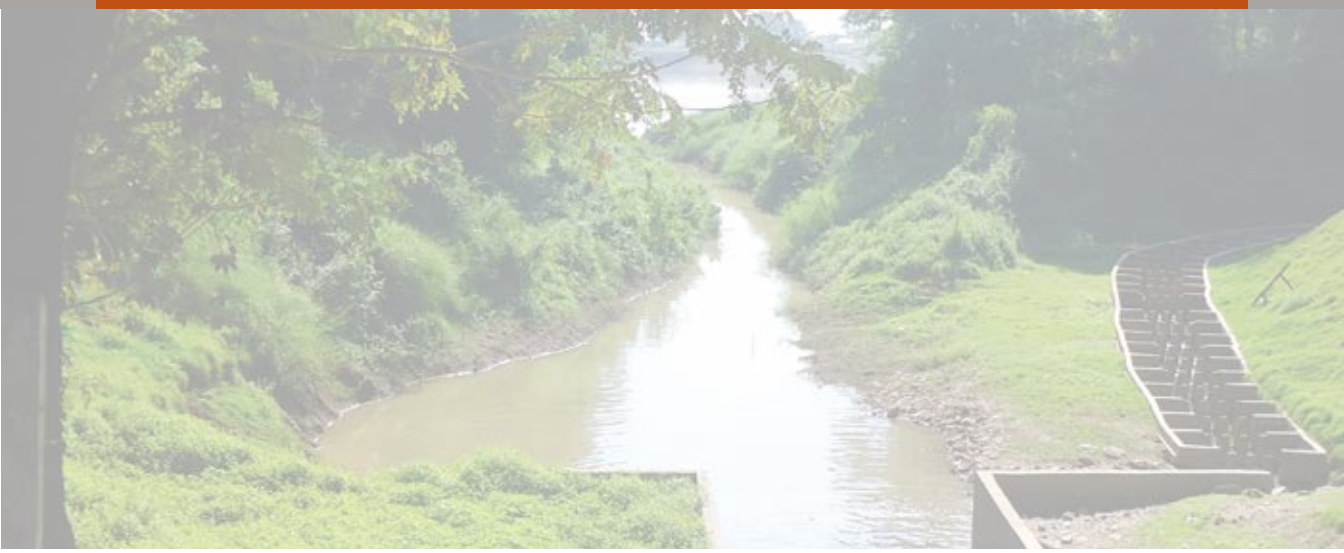

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Suggested citation:

Castrén, Tuukka and Madhavi Pillai. 2015. Information and Communication Technology for Forest Law Enforcement and Governance: Lessons from a Two-Country Projectin Lao PDR and Moldova. Washington DC: Program on Forests (PROFOR).

ISBN: 978-0-9910407-2-8

Photo credits: Agency Moldsilva, Republic of Moldova, and Ministry of Agriculture and Forestry, Lao PDR.

Published in February 2015

Printed on 100% Recycled paper

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

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Acknowledgments

This study has benefited from the contributions of a large number of forestry and ICT specialists both inside and outside the World Bank. The work was done under the overall guidance of Juergen Voegele, Director for the Agriculture and Environmental Services (AES) at the World Bank, and Valerie Hickey and Mark Cackler, Sector Managers at AES. This study was prepared under the supervision of World Bank Forest Advisers, Gerhard Dieterle and Peter Dewees. 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.

In Moldova, the work was supported by the Country Manager, Abdoulaye Seck, and colleagues at the country team. Fieldwork was done with a team of consultants comprising Varzari Alexandru, Caisin Valeriu, Sjoerd Vogelzang, Marina Cobernic, and Daria Spitoc from BLOM Consultants. Achieving the results would have been impossible without the active contribution of Moldsilva, and ICAS in particular. The counterpart team was led by Dimitri Galupa, Director. The country experiences were summarized and global lessons learned identified by Troy Etulain, a World Bank consultant.

The authors are grateful for the contributions of World Bank peer reviewers Naomi Halewood, Sandra Sargent, and Robert Davis. Additional comments were generously provided by Diji Chandrasekharan, Terhi Havimo, Tim Kelly, Nalin Kishor, and Andrew Mitchell, all at the World Bank. Flore de Preneuf and Nga Nguyen supported the preparation of the final publications, and Veronica Jarrin, project management.

Financing for the project was provided by the Korean Trust Fund on ICT4D (Information and Communication Technology for Development) managed by Valerie d'Costa. The publication and dissemination of the project results was supported by the Program on Forests (PROFOR) managed by Diji Chandrasekharan. PROFOR is a multidonor partnership managed by a secretariat at the World Bank.

Phil Cowling and Kenneth Rosenbaum wrote the body of the guide with the valuable assistance of Kristin DeValue. Kristin DeValue led the assembly of the case study, tools, and glossary annexes.

The guide was edited by Daria Steigman and designed by Studio Grafik.

James Cantrell provided editorial and publication support.

ACRONYMS AND ABBREVIATIONS

APVPROD	Standing Timber for Production Evaluation
Bank	World Bank
DOF	Department of Forestry of Lao DPR
DOFI	Department of Forest Inspection of Lao PDR
FAO	Food and Agriculture Organization of the United Nations
FOSS	free and open-source software
FTP	file transfer protocol
GIS	geographic information system
GPS	Global Positioning System
ICAS	Moldova Institutul de Cercetări şi Amenajări Silvice (Forest Research and Management Institute)
ICT	information and communication technology
ICT4D	information and communication technology for development
IT	information technology
IVR	interactive voice response
LBS	location-based service
M&E	monitoring and evaluation
MAF	Ministry of Agriculture and Forestry of Lao DPR
Moldsilva	Moldova's National Forest Management Agency
NGO	nongovernmental organization
ODK	Open Data Kit
OSS	open-source software
PCP	Polar Coordinates Plan
POFI	Provincial Office for Forest Inspection
PROFOR	Program on Forests
QGIS	Quantum GIS
SMS	Short Message Service
WWF	Worldwide Fund for Nature

All dollar amounts are U.S. dollars unless otherwise indicated.

EXECUTIVE SUMMARY

Introduction

Mobile phones, tablets, and access to the Internet have become ubiquitous in recent decades, and development practitioners have recognized the importance of using technology in achieving development outcomes in various fields, including in the forest sector. The use of information technology (IT) is not totally new in the sector: for example, forest inventories have been using computers for a long time and systems in this area are well advanced. There have been many interesting initiatives also in the forest sector promoting the use of information and communication technologies (ICTs). However, these have generally not led to notable scaling up, and pilot projects have remained small-scale activities.

The reasons why ICT has such a potential are well known and include the increasing prevalence of mobile devices; increasing speed and lower cost of mobile data; the spread of social media; the wider use of free and easy to use software for mapping, data collection, visualization, and satellite imagery. Yet, while this is promising, translating promise and potential into reliable tools that perform within the unique logistical constraints of forestry remains perniciously complex.

With the goal of deepening its understanding of how best to use ICTs for forest governance, the World Bank supported two pilot projects with funding from the government of Korea through its Trust Fund for ICT for Development. These pilot projects, implemented in the Lao People's Democratic Republic and Moldova, aimed to develop new tools, and also to cultivate insights into the best approaches for introducing new technologies while facilitating organizational change.[1] The project worked with two counterpart organizations: in Lao PDR, with the Department of Forest Inspection (DOFI); and in Moldova, with the Forest Research and Management Institute (Institutul de Cercetări şi Amenajări Silvice, or ICAS), which falls under the supervision of Moldsilva, Moldova's national forest management agency.

1. Detailed country reports on Lao PDR and Moldova are available in a separate volume on the PROFOR website (http://www.profor.info). These reports describe e-readiness in the counterpart organizations, project implementation, and technological choices made in more detail.

PART I: EXPERIENCE FROM LAO PDR AND MOLDOVA

Forest Governance

Forest governance has many dimensions and illegal logging is one—yet much-discussed—element in the wider forest governance space. The issues in forest governance are diverse, but, at the same time, it has been recognized that ICT and modern technology could have the potential to promote the rule of law as well as socially and environmentally sustainable development in the sector.

The World Bank (2009) has identified five key pillars of forest governance:

Pillar I: Transparency, accountability, and public participation
Pillar II: Stability of forest institutions and conflict management
Pillar III: Quality of forest administration
Pillar IV: Coherence of forest legislation and rule of law
Pillar V: Economic efficiency, equity, and incentives

Illegal logging is often considered as a visible symptom of poor sector governance and it is often linked to other governance challenges as well. It should be recognized that even legal actions may lead to unsustainable management of forests: good governance and legality do not always deliver sustainability. Also the opposite holds true: not all technically illegal activities are unsustainable.

Both Lao PDR and Moldova are transition economies and the state has played a large role in the economy and still dominates the forest sector. In Lao PDR, forests are all state owned and management activities are separated from forest law enforcement. Management is done by the Department of Forestry (DOF) under the Ministry of Agriculture and Forestry (MAF) for production forestry and by the Ministry for Natural Resources and Environment (MONRE) for other forest categories. The unit in charge of forest law enforcement is DOFI under MAF. In Moldova, the main agency in charge of forest management is Moldsilva, which manages most of the forests in the country. ICAS is a semi-independent agency affiliated with Moldsilva in charge of national forest policy development and various other development activities.

The different value of illegally harvested wood in the two countries leads also to different forms of market behavior and creates different challenges for e-governance. In Moldova, illegally harvested wood is consumed domestically for heating and is mainly harvested for subsistence purposes. By contrast, in Lao PDR the trade of illegal timber often deals with high-value commercial species. The pattern of unregulated logging has a fundamental impact on what kind of solutions—including e-solutions—can be proposed to address the challenges and what role forest authorities should play. In Moldova, there are fewer options for technical solutions because of the high level of independent action. In comparison, the comparatively larger size of transactions and logistics in the supply chains of commercial illegal logging in Lao PDR give forest agencies more opportunities to focus e-governance activities on transport, financial transactions, and market activities.

Project Implementation: Lao PDR

The Department of Forest Inspection in Lao PDR had limited capacity and experience in ICT and e-governance and in the project chose a cautious approach with the way it introduced technology. DOFI is still developing its approach to ICT, with a lot of discussion about its challenges and what could be accomplished with the effective application of technology. DOFI and its field organizations, Provincial Offices of Forest Inspection (POFIs), face diverse forest governance challenges. These are often linked to limited technical, institutional, and financial capacity.

The diversity of challenges indicates a dire need for well-designed ICT development, including coordination between national and local levels, and between government and citizens.

This project identified what were described as basic, medium-level, and high-level ICT applications. Basic applications were meant to improve the use of the existing internal DOFI systems. These applications were focused on building the capacity of DOFI staff in the use of their existing options, in particular for file sharing and transfer via file transfer protocol (FTP). The medium-level applications focused on more effective use of Web-based tools and geospatial information. These included adding task management functionalities to the new online reporting system, encouraging the use of mobile data collection and geographic information systems. High-level applications included a focus on tools designed for remote data collection.

There are a wide variety of options for employing technology for improved forest governance. For example, it is possible to observe the loss of individual trees using object-based analysis software. POFIs employ some interesting non-ICT tactics for catching illegal logging, including a network of paid informants located in each village and town. Informants' identities are secret, enabling them to quietly monitor illegal activity. These complex structures would benefit immensely from modern communication technology. For example, it should be possible to introduce a mobile phone–based reporting system so that POFI reports could be easily sent from local to national level. The idea would be to not compromise individuals' identities and circumvent any inappropriate control occurring at the local level. These interlinked systems would be able to share case information between agencies, allowing smooth collaboration.

Project Implementation: Moldova

ICAS developed two Web-based applications that will have long-term usefulness for Moldsilva's management of forests. In order to choose which applications it would develop and to get baseline data, ICAS conducted a survey among Moldsilva managers, forest engineers, foresters, and administrative staff. In this case, the patient diagnosed himself and prescribed his own medicine. An alternative option would have been, for example, to have surveyed how Moldsilva staff members spent their time and what their perceived needs were, and then to apply expert knowledge to identify, cater, and deploy specific technologies to meet those needs.

ICAS could have been more ambitious with technology, yet their choices were also realistic. Technology choices are based on trade-offs: technology leaps allow bypassing several intermediate steps in technology development and applying the latest available systems. Often this is linked to fundamental reengineering administrative structures and processes. This is also a risky option as there may be notable resistance among staff and such reforms mean navigating unchartered waters. More incremental gradual reforms do not allow necessarily institutional restructuring and using the latest, most advanced technology. On the other hand, this lowers resistance among staff, as they can relate their new tools to existing tasks.

The first of two tools developed by ICAS, a timber volume calculator (APVPROD), is an online reporting interface that automatically calculates tree volume according to official volume calculation formulas that are specific to the major tree species found in Moldova. It replaces currently applied manual methods. The online calculation tool saves staff time and reduces error. The other tool produced by ICAS, the Polar Coordinates Plan (PCP), is an online database of all forest plots managed by Moldsilva. The tool uses Google Maps, which automatically calculates the surface area and provides basic information about the borders of a parcel or sub-parcel dimensions and the composition and type of species found in a parcel.

Lessons from the Case Studies

Forest agencies designing their own strategies for e-transformation have many cost and capacity factors to consider. Ultimately they need to find their own path and make their own decisions about what they want to accomplish. This is necessary because there is no one predefined road map, no step-by-step process for pursuing advanced use of ICTs or the requisite organizational transformation—only some guiding principles. The experiences from Lao PDR and Moldova offer good insights on some success factors and lessons learned on how to introduce ICT in forest administration and how to use it to improve the state of sector governance.

Plans for using ICTs to improve forest governance need to be part of a wider, national-level e-government and open government development, which highlights a need for long-term strategic thinking. The initial introduction of technology for core functions, while still internal, increases the ease and efficiency of sharing information. There is an inherent pressure on government to be open with its activities and information, though state institutions usually want to improve their own internal information sharing and management before they move to providing the public with information and services.

The long-term character of this has implications for technology choice. For example, agencies' must choose between free and open-source software (FOSS) and proprietary platforms; if they are thinking several years into the future, agencies should from the beginning invest in tools that will provide them with the best combination of flexibility and reliability. The choice may also be based on the resources available. Additionally, there is the question of choosing between locally developed solutions and ready-made or off-the-Internet/shelf products. When making the choice, issues like local capacity, budget, and longer-term e-development strategy need to be considered.

A related point to plans for increasing transparency is the need for forestry agencies to communicate with their stakeholders. Agencies may want to hone their use of ICTs for internal purposes, but failing to communicate with the public leaves them vulnerable to having their programs and activities misunderstood or underappreciated. Forest agencies work nationally, but citizens observe the result of programs locally. It is probably not immediately apparent to an average citizen that a local situation is not necessarily representative of the state of forest management nationally.

The desire for "scaling up" use of ICTs by forest agencies is a predominant focus for donors. In the cases of Moldova and Lao PDR, this appears more likely for Moldsilva, which is in the position of testing two new useful programs and training its staff nationwide in their use. It is taking something that was successful at the local level and is now attempting to reproduce it on a large scale.

The emphasis should be on the most useful process so that agencies have all of the capacities in place when they need them. Forest agencies should focus on determining the full set of skills and tools that would be useful for their work, and then proceed meticulously in acquiring them. The best way for an agency to move forward will depend on a large number of factors. Most critical to understand, however, is that it may entail altering what a forest agency considers to be its core competencies. This could mean that certain positions and activities become redundant, while other new skills and competencies must be brought in. And with new skills come corresponding new technologies, which could be as diverse as social media for strategic communications or complex mapping software.

The focus on the forest agencies' role appears to be missing the potential for outside entrepreneurs to help agencies. The private sector could, for example, be engaged in developing custom

mobile phone apps for catching illegal logging or in to performing tasks like data analysis and visualization, training, and website maintenance. While these may appear like traditional cost-saving outsourcing activities, modern communications technologies induce a great measure of hype and a "silver bullet" mentality, as though their introduction can easily solve complex problems. The monetary and personnel resources demands are usually more than governments estimate. It could be more efficient to encourage for-profit companies to invest their own time and money into solutions that the government may want to develop.

Engaging with innovative private sector operators, research institutions, civil society organizations as well as individual "hackers" can be useful and bring innovation to forest agencies. At the same time, this needs to be built into existing and foreseen institutional realities to be sustainable. For example, the structure and sources of budget funding matter. Many agencies may be cash poor but staff rich or there may be (donor) resources available for investment but no recurrent budget. Decisions have to consider if investment and recurrent budgets can substitute for each other or if cash and noncash resources can do that. This has an impact on technology choice as well; an agency may have staff for in-house implementation and support, but not for payment for external services and licenses, or vice versa.

One key element for successful reform processes is finding the right entry points for reforms; even good initiatives can fail if introduced too early, too late, or at wrong levels. In wider ICT4D-discussion there often is discussion on gradual approaches versus leapfrogging (introducing extensive reforms at one go). Often these two approaches are seen as mutually exclusive and operators should choose one or the other. However, the experience from the two countries does not necessarily support the conclusion that only one option would be feasible. This project used the introduction of small improvements to engage with the agencies and to introduce the possibilities of ICT in forest administrations. The tools developed were closely linked to the agencies' activities with the objective of making routine processes more efficient and less prone to error. The objective was to allow staff and management to familiarize themselves with ICT.

Even small gradual reforms can be useful as they introduce the benefits of ICT in a familiar context to forest agencies and their staff. This stepwise approach can serve as a starting point for reform when ICTs are first introduced to improve efficiency of operations by changing existing processes (gradual approach) and wider, more fundamental reforms (leapfrogging) can be introduced at a later stage when e-skills and readiness have improved. The decision between gradual approach and leapfrogging is not necessarily mutually exclusive but a matter of sequence. Small gradual reforms can act as preludes for larger, agency-wide changes.

One important aspect of information management is data security. Forestry institutions need to be mindful of information security in order to avoid having their systems taken down, their data stolen, or their communications hijacked. They should also be careful to protect the privacy of persons who may have anonymously reported illegal logging or corruption. Security vulnerabilities are an unavoidable reality for all types of ICTs, particularly mobile phones and the Internet, with new threats discovered on almost a daily basis. All information management systems have their risks and no perfectly safe systems exist. Therefore, the key issues are recognizing and managing risks. Additionally, it is essential to focus on preventing attacks and mitigating their effects and planning for postattack recovery.

Often in e-development projects, donors and program administrators do not know whether to expect technology to yield quick or gradual results. These and other unknowns often lead to cautious project approaches. The solution to the cautious

project manager's dilemma is a pilot project. The field of ICT for development (ICT4D) is rife with pilots. Experts refer to this ongoing phenomenon as "pilotitis," a negative characterization of the tendency for donors and implementers to support no more than short-term experiments aimed at demonstrating proofs of concept.

Despite a large number of pilot projects in e-governance in several sectors, there is relatively little information on the costs of these projects and what would be the resource needs. ICT projects are often cumbersome and all countries have had experiences with projects that have had serious cost and time overruns. These may have been caused by either inadequate planning or changing needs during the implementation. Good cost estimates are essential, as is monitoring of costs. It is also essential to recognize that some cost elements may be difficult to estimate and are not always well budgeted for.

One oft-repeated mistake is to assume that, if an organization creates or builds a new tool, then people will use it. This "build it and they will come" assumption has led to the creation of countless websites and resource centers. Even if ICT tools are often free or low cost, it does not necessarily mean organizations should create, for example, whole new information platforms from scratch, especially if a preexisting tool could essentially perform the same tasks. Any ICT4D strategy should not be driven by the belief that modern equipment alone solves the agency's computation or communications problems. This assumption has been a common problem in many different contexts. ICT and e-governance reforms need to be based on a genuine commitment to improve governance outcomes and the quality of public administration and services. Political will is a necessary condition for any reforms.

ICT is about managing data, making it more accessible and easier to process to become information that is relevant and valuable. However, it does not help if the underlying data is not available. Improving use of information and information technology requires also investments in a number of areas. In order to achieve genuine change to the development outcomes, there needs to be changes in the institutional readiness and structures, in data availability, and, finally, in the technology itself. None of the three will lead to major changes by themselves.

PART II: GUIDANCE FOR COMMUNICATION TOOLS

The reality is that introduction of ICT tools is as much about organizational change as it is about the technology itself. The set of technological tools available to forest institutions and stakeholders is evolving and expanding. New software and hardware innovations seem to embody the very word "innovation"; many of the most useful innovations actually involve creative and practical applications of existing tools. While it is almost impossible to keep abreast of all these developments, it is important to understand that the costs of ICT tools have gone down and many software tools and data sets are free, they are ready to be used creatively, users can contribute to the evolution of tools and that the paradigm shifts they affect require open minds and flexible approaches. On the other hand, it is also critical to recognize that these tools cannot be expected to magically solve all of a forest agency's problems. But they can, if applied strategically, increase the speed, professionalism, efficiency, and effectiveness.

The relative ease of collecting and producing more data and information presents agencies with unavoidable questions, particularly in relation to its human and financial resources: what types of information and data should it collect and distribute? Should lowered transaction costs of information

collection and distribution change the very character of forest institution? Should an agency use technology to involve the public in governance processes? As agencies begin to grapple with these and other questions, it becomes obvious that the change character of communications technology requires a new self-conception for forest agencies. Understanding the specific capabilities of the main technologies helps move this reconceptualization process along. With these principles in mind, this report provides practical explanations of some common and useful applications of ICT tools for five main areas of activity: (1) data acquisition and use, (2) communications, (3) engagement, (4) organizational coordination, and (5) measurement, monitoring, and evaluation.

Data Acquisition and Use

Forest data is the essential element of many ICT activities. Precise information about the state of a country's forests enables better policy design and implementation. Forest managers planning for an ICT activity should think through the life cycle of data, from collection to storage and integrity, to analysis, to mapping and visualization, to remote access and sharing with the public, other state and local administration, parliamentarians, the private sector and other interested parties.

Mobile data collection tools help with entering forest monitoring data into mobile devices and sending these data to a central location. This increases the overall speed of data collection, improves accuracy of the data, increases its manipulability, and allows agencies to react more quickly to trends that analysis of the data identify. Recent technical development has dramatically changed mobile data collection, making it a cost-efficient and easy option.

Mapping and data visualization helps data to be presented in a clear and visually attractive way when disseminated to the public. Nonprofessional audiences, in particular, need to have access to data that is easy to read and does not require extensive background knowledge. Extracting insights from data can be difficult if the data is, for example, organized in spreadsheets or complex tables. Often presentation of data in maps and other visual tools is needed.

Community or participatory mapping has been used in rural development projects for a long time. Technological change allows a vast expansion of the model from the previously applied mapping for participatory local planning purposes to more widely applied models that share many characteristics of crowdsourcing. Unlike in traditional mapping methods, with computerized mapping tools this can be done on several occasions and over a longer time period with increasing accuracy. With constant updates, the map becomes a community resource, empowering previously unknown community members and stakeholders.

Sometimes forestry institutions choose to build software tools specifically suited to their data storage or computational needs. One example is the tools developed in Moldova for automated tree volume calculation and graphical display of forest parcel records in this project. Before starting application development only for the unique use of one institution, it is essential that project developers survey existing software packages.

Communications

Improving transparency and accountability requires active communication with all stakeholders. Engaging through media is also a way of ensuring buy-in to policy decisions among the general public. Social media and other new tools provide forestry institutions opportunities to enhance their communications activities, engage the public, and to get feedback on their work. Most of the common tools are free and Web-based, and available both for institutions and individuals. Effective communication needs to use all kinds of media and, in most cases, traditional ways of communication cannot simply be replaced by new media. However, on many occasions they may complement each other. When planning communication, it is also essential that no stakeholder group becomes excluded as a result of the choice of the media. For example, groups like the elderly, speakers of minority languages, and people with disabilities or the illiterate need special consideration and easily can be excluded by new media.

It is common for a forestry agency to maintain an institutional website. It is less common that these websites take full advantage of all features that a well-designed website offers in terms of communications, audience engagement, and e-government services. They are also often updated inadequately and populated with outdated and somewhat random information. Designing a website is a trade-off between its usability and resources needed to develop and maintain the site. Social networks offer forest agencies venues for communicating with the public in forums where they are already active. Given the massive level of global users, there is a good chance that much of any target audience in a country will have a Facebook or other, locally popular social network account. Typically, governmental organizations use social media to increase the reach of their communications activities and to engage with audiences. A forest agency could post maps or pictures to convey information such as the location of forest fires, of available recreation zones, or where dangerous animals had been sighted. As it usage continues to grow, the potential of social media as a tool for strategic communication also increases. Twitter is the world's most popular microblogging site, offering a large range of creative applications. These are examples of some globally recognized social media services. There are also many others and in some specific countries, other services are also well known and sometimes more widely use. When developing a social media strategy, it is essential that local market conditions are analyzed first and that the selected tools are widely used or expanding in the target areas.

Broadcast media and community radio remain primary sources for people to access news, information, and entertainment. In particular, community radio is often grounded in the communities where stations are physically located, engaging people with local information. Establishing partnerships with these stations could enable both communication of messages to communities and community dialogue around forest issues.

Engagement with the Public

Forest agencies that adopt strategies for using ICTs for public engagement increase the chances of succeeding in their more traditional roles. The tools can be used to inform and educate the public about a forest agency's role and current activities. Reaching out to the public for its opinion can give a country's citizens a sense of ownership over the management of their forests.

In simple terms, crowdsourcing is requesting help or participation for completing an activity or solving a problem. It is important to consider the

possible length of a crowdsourcing activity. Both temporary and open-ended appeals to the public make sense in different circumstances. While a campaign with a limited time frame might increase participation because of a sense of urgency, a forestry institution might also want to maintain, for example, an illegal logging hotline operating with an open-ended mandate.

The data possessed by a government is a public resource. The potential insights from analysis of this data could in some way provide unprecedented benefits to society if made publicly available (open data). The more people with access to the data, the greater the chances are that more insights could be found, and the more benefit to a society. Forestry institutions have always stood to benefit from providing as much data as possible to the public. The work and resources outside organizations might invest in processing and visualizing the data provide great added value to both a forest agency's communications and its analytical work. However, despite the benefits of sharing data with the public, in many forest administrations the tradition has been to keep information classified. Additionally, many agencies are poorly equipped to share information widely.

Monitoring and Evaluating ICT Investments

All information systems require investments and financing of recurrent costs. In principle, as messages become less time-sensitive, the larger the audience and the larger the cost. The graphic is applicable to both Short Message Service (SMS) and interactive voice response (IVR) because for both tools, the recurring costs are directly associated with the size of the audience and the frequency of engagement with that audience. Thus, when considering technology options, it is important for forest agencies to frame their communication strategy within their budget.

It is necessary to think about monitoring from the project conception phase. Forest agencies should start by developing a results framework with both performance and impact indicators. One essential, yet often ignored, element is analyzing the pre-project situation to establish the baseline. To determine the impact of an ICT forestry project, many of the usual approaches to monitoring and evaluation (M&E) apply, including randomized control trials, control groups, baselines, and so on.

RELATIONSHIP BETWEEN TYPE OF COMMUNICATIONS AND RELATIVE COST

Looking Forward

Forest administrations in both Lao PDR and Moldova have started their e-development from a modest level but they have shown that if having right approaches, ICT can be introduced and "low-hanging fruits" picked to improve agencies' operations. At the same time, it is clear that this cannot be done in isolation from wider institutional development in the organizations. ICT alone does not fundamentally change the agencies if their underlying processes are not addressed adequately. Information is an essential element in all public administration and the forest sector is no different. Therefore, information and knowledge management should be one of the core functions of these agencies.

Some general lessons on how to promote e-transformation can be drawn from these two study cases. These observations provide guidance and tentative checklists for other countries and organizations when they design and implement their e-reforms:

- First, the experiences from these two countries indicate that the introduction of ICT should always be designed in a way that is aligned with existing capacity and e-readiness among the staff.

- Second, technology choice is essential, yet it should not be the dominant driver; the starting point should be the needs and processes in the organization and the technology should be adjusted to match that, not the other way round.

- Third, the whole value chain of information management needs to be considered. ICT is only a tool to manage information, but it requires that the data used is adequate, relevant, and reliable. If the underlying input data does not match the needs of the organization, then the output hardly meets its needs. It is also essential that legislation allows sharing information with other agencies and with general public. The value of information can be maximized if it is shared.

The examples in this report show that e-reforms can be initiated and progress made even with relatively small resources and in forest organizations that have limited previous experience from e-governance. They also show that understanding local contexts and capacities is an essential precondition and, in some cases, the gradual introduction of new topics and approaches will open opportunities for larger reforms. These smaller steps can appear time-consuming, but building local capacity from the bottom up builds the foundation for capacity that is needed if and when larger, leapfrogging reforms are implemented. These bigger reforms need to look at all dimensions of information use and management, ranging from the right technology choices to underlying processes and functions of the forest agencies.

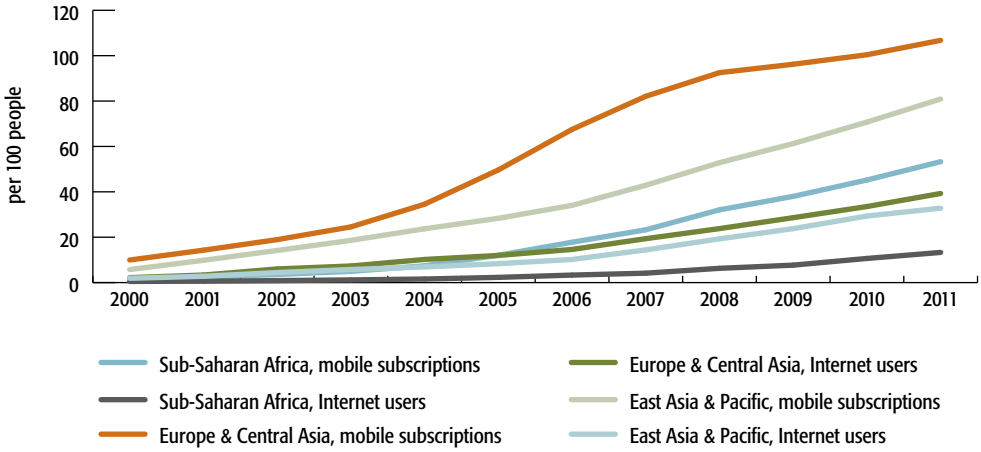
1 INTRODUCTION

1.1 Background

Development institutions like the World Bank have recognized the importance and potential for using technology to achieve development outcomes in various fields, including in the forest sector and in forest governance in particular. The use of technology is not totally new in the forest sector: for example, computation-heavy forest inventories have been using computers for a long time and systems in this area are well advanced. There have been many interesting initiatives in the forest sector promoting the use of information and communication technologies (ICTs). However, these have generally not led to notable scale-up and pilot projects have remained small-scale activities.[1]

Why do we think that ICTs could change the way we work in forest governance? The reason is simple: technology and communication devices have become ubiquitous. This can be seen, for example, in the exponential growth in access to information networks in all regions of the developing world. Now, everyone—or at least someone in their communities—has access to modern communication technology and information networks. At the same time, it should be recognized that there are always some areas (for example, remote and sparsely populated areas) and social groups (for example, older people, those with disabilities, speakers of minority languages, or the poorest) who are not using modern technology. Therefore, it is essential that public services in particular are available through diverse media. However, as can be seen from Figure 1.1, in the past decade access to information networks has changed fundamentally and that has also

FIGURE 1.1 MOBILE PHONE AND INTERNET PENETRATION IN SELECTED REGIONS (2000–2011, PER 100 PEOPLE)



Note: Data includes only developing countries in the regions.
Source: International Telecommunications Union (ITU).

transformed the way we can communicate with forest users and other stakeholders about forests and forest governance. In Europe and Central Asia, for instance, mobile phone penetration already exceeds 100 percent.

The elements which bring about these changes are well known and include the increasing prevalence of mobile phones, particularly smartphones; the increasing speed and lower cost of mobile data; the spread of social media; and the wider use of free and easy-to-use software for mapping, data collection, visualization, and satellite imagery. The possibilities they offer promise to change the meaning and character of forest governance.

Yet, while this is promising, translating promise and potential into reliable tools that perform within the unique logistical constraints of forestry remains perniciously complex. Developing economies also face difficult challenges. These include poor infrastructure, varying levels of literacy, corruption, and limited access to ICTs, to name a few.

With the goal of deepening its understanding of how best to use ICTs for forest governance, the World Bank supported two pilot projects with funding from the government of Korea through its Trust Fund for ICT for Development. These pilot projects, implemented in Lao PDR and Moldova, aimed to develop and deploy new tools, and also to cultivate insights into the best approaches for introducing new technologies while facilitating organizational change. The experiences from the project are captured in this report, which comprises two sections: the first part introduces the issues and challenges in forest governance, draws on the practical experiences from the two country cases, and draws lessons from the case studies; the second part provides additional guidance on ICTs in the forest sector and in particular on communication between forest agencies and the public.

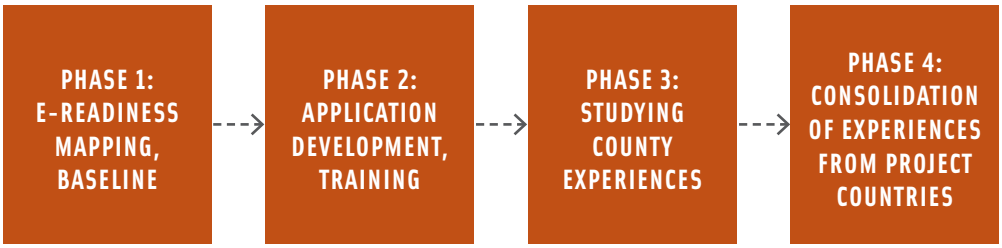
Detailed country reports on Lao PDR and Moldova are available in a separate volume on the PROFOR website.[2] These reports describe e-readiness in the counterpart organizations, project implementation, and technological choices made in more detail.

1.2 The Forest Governance and ICT Project

In June 2012, the World Bank launched the Information and Communication Technology (ICT) for Forest Law Enforcement and Governance Project, which aimed to examine the essential question of how modern ICTs could improve the quality, professionalism, and effectiveness of forest governance in Lao PDR and Moldova. The project was implemented in both Lao PDR and Moldova by consultant teams consisting of internationally and locally recruited experts. The teams worked with primary local counterparts: in Lao PDR, with the Department of Forest Inspection (DOFI); and in Moldova, with the Forest Research and Management Institute (Institutul de Cercetări şi Amenajări Silvice, or ICAS), which falls under the supervision of Moldsilva, Moldova's national forest management agency. The project, which was implemented in both countries simultaneously and was less than one year in length, showed that, while ICTs offer undeniable benefits for forest governance, challenges remain for making the maximum use of technology because of the technical capacity of beneficiary organizations.

The project proceeded through four phases (Figure 1.2). First, the implementers worked with their government counterparts to conduct baseline evaluations and mapping of the existing capacity and readiness to use ICT

FIGURE 1.2 ICT FOR FOREST LAW ENFORCEMENT AND GOVERNANCE PROJECT STRUCTURE



in forest administration (e-readiness). These assessments, in particular, were looking for opportunities to address organizational needs with technological solutions. Based upon what they learned, and in consultations with their government counterparts, in the second phase the project teams chose what they considered to be appropriate technological solutions for the counterparts' forest management activities. Following these decisions, the teams and partners pursued development of new ICT applications as well as the customization of existing computer programs. After that, a select group of the forest management staff was trained in the use of these tools before they were distributed more widely and presented to the agencies' management. In the third phase, the country team prepared assessments of the process and progress made.

This report constitutes the fourth and final phase of the project. It includes assessments of project activities and a broad set of lessons learned that are both specific to Moldova and Lao PDR and more universal in character.

The report consists of two parts: the first part (chapters 2-5) describes the project and its operating environment. Following this introduction, chapter 2 discusses the challenges of forest governance in these two countries, Lao PDR and Moldova. In chapter 3, the experiences in project implementation are summarized based on the two country reports and the project team's analysis of the project are made. In chapters 4 and 5, the key recommendations are given—first specific to these two sub-projects, and then more broadly to all practitioners interested in wider application of ICT in forest governance work.

The second part (chapters 6-12) is more forward-looking and presents some approaches to be used when developing ICT applications for forest governance. Forest agencies and the wider community of practice have experiences in using ICT in technical forest management (for example, mapping, resource inventories, and building forest management information systems for internal use).[3] On the other hand, there is less experience and guidance on how to use ICT in strengthening communication with forest users and the general public. This is linked to the perception that forest agencies tend to be inward-looking technical agencies rather than open public service agencies. Chapter 6 discusses the general principles of e-development in forest agencies. Subsequent chapters present some themes for e-development: chapter 7 is about data management; chapter 8 is concerned with communication; chapter 9 focuses on engaging with the public; and chapter 10 discusses information coordination in forest agencies. The report concludes by highlighting the importance of monitoring and evaluation.

PART I: EXPERIENCE FROM LAO PDR AND MOLDOVA

2 FOREST GOVERNANCE: ISSUES AND CHALLENGES

2.1 Components of Forest Governance

Forest governance has many dimensions and illegal logging is only one, much-discussed element. The World Bank (2009) has identified five key pillars of forest governance (Table 2.1). The issues in forest governance are diverse, but it has been widely recognized that ICT and modern technology have the potential to promote the rule of law and socially and environmentally sustainable development in the sector. However, while interesting pilot projects have been developed in many countries, ICT development has not yet led to wide-scale application of technology and e-transformation in the sector has not taken place.[4]

The pilot activities in Lao PDR and Moldova looked particularly at two dimensions of forest governance: (1) law enforcement and prevention and detection of illegal logging (a particular focus in Lao PDR), and (2) improving operations and efficiency of forest administration (a particular focus in Moldova[5]).

Illegal logging is often considered as a visible symptom of poor sector governance and it is often linked to other governance challenged as well. Illegal logging is not a pure law enforcement issue: there is, for example, ample evidence[6] that when forest users have direct management rights and responsibilities for a given forest area,

TABLE 2.1 THE BUILDING BLOCKS OF FOREST GOVERNANCE AND THEIR PRINCIPAL COMPONENTS

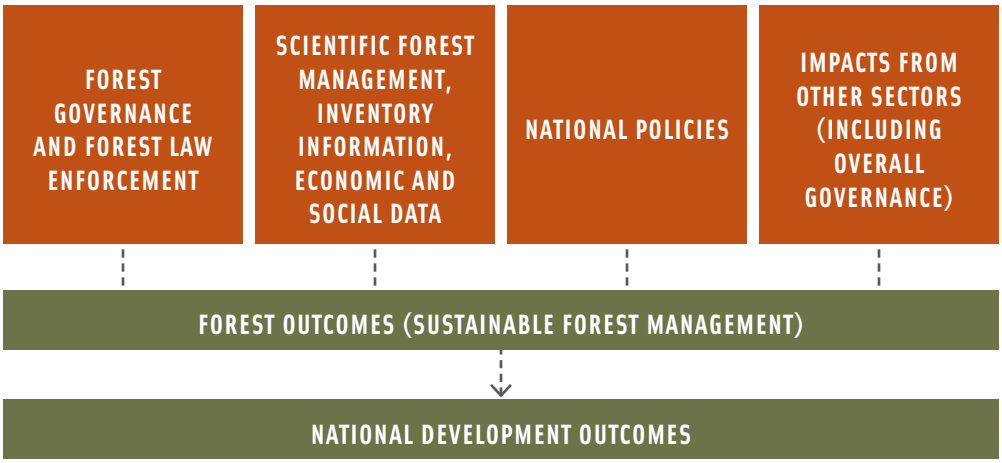
Pillar I:	• Transparency, accountability, and public participation • Transparency in the forest sector • Decentralization, devolution, and public participation in forest management • Accountability of forest officials to stakeholders • Accountability within the forest agencies
Pillar II:	• Stability of forest institutions and conflict management • General stability of forest institutions • Management of conflict over forest resources
Pillar III:	• Quality of forest administration • Willingness to address forest sector issues • Capacity and effectiveness of forest agencies • Corruption control within the forest sector • Forest monitoring and evaluation (M&E)
Pillar IV:	• Coherence of forest legislation and rule of law • Quality of domestic forest legislation • Quality of forest law enforcement • Quality of forest adjudication • Property rights recognized/honored/enforced
Pillar V:	• Economic efficiency, equity, and incentives • Maintenance of ecosystem integrity—sustainable forest use • Incentives for sustainable use and penalties for violations • Forest products pricing • Commercial timber trade and forest businesses • Equitable allocation of forest benefits • Market institutions • Forest revenues and expenditures

Source: World Bank 2009.

not only does that lead to better socioeconomic outcomes, but it also reduces the risk for illegal logging. In addition, the quality and legitimacy of forest administration can be linked to illegal and informal logging: an inefficient forest authority that lacks legitimacy in the eyes of the rural population is not likely to be capable of preventing either crime-driven commercial illegal logging or informal—and often technically illegal—forest use by the local population.

It should be recognized that even formal legal actions may lead to unsustainable management of the resources: *good governance and legality* do not always deliver *sustainability*. The opposite also holds true: not all technically illegal activities are unsustainable. Forests are often used in many diverse ways and there may be overlapping and competing claims over the resource. Development outcomes in forestry depend on many factors both inside and outside the sector (Figure 2.1). However, by improving the efficiency, effectiveness, and technical competence of forest administration by the introduction of ICT and modern technology, the achievement of national development outcomes is more likely.

FIGURE 2.1 KEY FACTORS IN SUSTAINABLE FOREST MANAGEMENT



Source: Castrén and Pillai 2011.

2.2 Nature of Illegal Logging in Lao PDR and Moldova

The different value of illegally harvested wood between the two countries leads to different forms of market behavior and creates different challenges for e-governance. In Moldova, illegally harvested wood is consumed domestically for heating and is mainly done for subsistence purposes. By contrast, in Lao PDR the trade of illegal timber mostly takes the form of high-value international trade. The pattern of unregulated logging has a fundamental impact on what kind of solutions—including e-solutions—can be proposed to resolve the challenges and what role forest authorities should play. In Moldova, arguably there are fewer options for technical solutions because of the high level of independent action, but random spot checks and remote sensing could be employed. At the same time, it would be essential to engage with local forest users to ensure that the response—which may be justified from a sustainable forest management perspective—does not lead to socially adverse impacts.

In comparison, the comparatively larger size of transactions and logistics in the supply chains of commercial illegal logging in Lao PDR give forest agencies an opportunity to focus e-governance activities on longer-range transport, financial transactions, and market offerings of both illegal timber and even processed products.

A comparison of wood prices also demonstrates the differing opportunities for monitoring tools to catching illegal logging. While it is possible to buy one cubic meter of oak (one of the two most commonly harvested woods) for about MDL 400 (about $33) in Moldova, Lao rosewood can sell for up to $5,600 per cubic meter online.[7] The smaller transactions in Moldova leave much less of a footprint, limiting the potential use of technology to curb the illegality. Indeed, when an individual cuts down a small stand of trees for their family's firewood, there is no business transaction whatsoever. The industrialized illegal logging in Lao PDR, however, involves many different actors playing varying roles in the transfer of trees from the forest to the market.

Both agencies offer rewards for whistleblowers. In Moldova, 15 percent of the assessed penalty goes to the person who discovers the illegal cutting. Informants in Lao PDR receive money for calls and fuel, and KN 300,000 (almost $40) for every truck they report. Neither country reported the use of technical advanced communication tools to hide the identities of the people submitting the tip-offs to protect whistleblowers through technical means.

There is a clear need to address the domestic demand for wood in Moldova—both for heating and other purposes such as construction. The current official wood volume limit for harvesting is less than half of the estimated annual consumption: the official annual maximum authorized logging amount is 450,000 cubic meters while estimated actual removals are 1,200,000 cubic meters per year.[8] Further complicating the matter, wood that is imported with the intention of further export is included in the calculation, and imported wood is sometimes measured in weight, sometimes in volume, making its measurement challenging.

Estimating the extent of illegal and unregulated logging in Lao PDR is difficult and no comprehensive mapping has been done. One particular concern is that legality of logging is often unclear and exceptions are often issued on ad hoc basis on unclear legal basis.[9] A particular characteristic is that, when illegal tree harvesting occurs, a document is always produced, meaning that the tree harvesters go about obtaining a document if only to add an artifice of formality. Logging is not a series of fly-by-night operations. Rather, everyone on the ground thinks the logging is sanctioned. There are also cases of confiscated timber reentering local supply chains through formal or informal sales of confiscated timber.[10]

In Moldova, ICAS described locals committing crimes of opportunity, cutting down several co-located trees when no one was looking. In Lao PDR, discussions focused more on large companies engaging in coordinated, selective cutting. Often the operators are well connected; a typical story would involve foresters detaining what it believed to be a truck full of illegal timber, only to receive a phone call from a highly placed official with instructions to release the shipment.

The more commercialized nature of illegal logging in Lao PDR compared to Moldova makes it necessary to have more planning and information. There is anecdotal evidence of companies hiring locals to scout entire forests for individual high-value trees. There is also a high degree of damage to the remaining forest, and POFI foresters said that illegal harvesters do not bother removing trees if, once they are cut down, they turn out to have low-quality internal wood.

3 DEVELOPING ICT READINESS IN FOREST ADMINISTRATION: PRACTICAL EXPERIENCE FROM THE PROJECT

3.1 Country Context: Lao PDR and Moldova

Lao PDR and Moldova are both relatively small countries. At 237,000 square kilometers and with 6.5 million people, Lao PDR has seven times more surface area and is less densely populated than Moldova, which is 34,000 square kilometers and home to 3.5 million people. On average, Moldova's citizens attain a $2,136 per capita income, significantly higher than the $1,320 per capita income earned in Lao PDR. According to the Food and Agriculture Organization (FAO) of the United Nations' *Global Forest Resource Assessment 2010* (FAO 2010), 12 percent of the land area, or 386,000 hectares, in Moldova is covered by forest. In Lao PDR, forests cover 40 percent of the land area,[11] but this has been declining over the past few decades. During the 1990s, the annual loss of forest cover was about 1.4 percent annually, giving an average annual loss of forest cover of about 134,000 hectares.[12]

Both Lao PDR and Moldova are transition economies and the state has traditionally played a large role in the economy and still dominates the forest sector. In Lao PDR, forests are all state owned and management activities are separated from forest law enforcement. Management is done by the Department of Forestry (DOF) under the Ministry of Agriculture and Forestry (MAF) for production forestry and by the Ministry for Natural Resources and Environment for other forest categories. The unit in charge of forest law enforcement is the Department of Forest Inspection (DOFI) under MAF.

In Moldova, the main agency in charge of forest management is Moldsilva, which manages most of the forests in the country. Forest management is implemented by 24 forest enterprises. The Forest Research and Management Institute (ICAS) is a semi-independent agency affiliated with Moldsilva in charge of national forest policy development and various other development activities.

The main counterparts for the e-development project were DOFI in Lao PDR and ICAS in Moldova. The organizations have somewhat different roles in the national forest sector in the two countries and they do not have exactly the same responsibilities, structures, or authority. Moreover, the forest governance challenges in the Moldova and Lao PDR differ significantly, particularly in relation to the basic characteristics of illegal logging. Both the problems and the root causes DOFI and Moldsilva are trying to address differ fundamentally: illegally harvested timber in Lao PDR is primarily exported to neighboring countries and logging companies are the dominant perpetrators; in Moldova, most unregulated and illegal harvesting is done by private citizens

FIGURE 3.1 LAO PDR MAP

FIGURE 3.2 MOLDOVA MAP

for household consumption. The two forestry agencies subsequently face strikingly different enforcement challenges.

Both partners are national-level agencies that fall under larger administrative bodies. Both countries have forest organizations and responsibilities spread between multiple agencies, complicating authorities. In Lao PDR, DOFI, established only in 2009, is responsible for forest governance and law enforcement. The agency is also mandated to cooperate with Vietnam's Forest Protection Department to curb the illegal trading of wood along the 2,000-kilometer Lao PDR-Vietnam border. DOFI itself oversees the work of the Provincial Offices of Forest Inspection (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.

POFI heads officially report to DOFI and its personnel but in practice also have to take local provincial governors into consideration. According to DOFI staff, if a POFI inspector knows there is a problem with the forest that cannot be solved locally, in particular if local high-level collusion is involved, a DOFI inspector may be requested to visit a site because that official will be able to operate with more independence. The Lao PDR forest sector administration is devolving and there are also proposals to revise, reorganize, and consolidate forest management bodies, responsibilities, and authorities within the next few years.

Vietnam, Thailand, and China are the primary consumers of Lao wood. According to DOFI, 10 to 15 species are most commonly targeted for illegal logging in Lao PDR. There is anecdotal evidence that illegal loggers are slowly shifting to other species because priority species they used to target are becoming depleted. On some specific species, illegal—as well as legal—logging has, in fact, come to an end because they have effectively run out of specific tree species.

FIELD OBSERVATION:

RESOURCES FOR FOREST INSPECTION

The Deputy Chief of Inspectorate for flora and fauna at the Moldovan Ministry of Environment, who has been in the job for 12 years and has always been responsible for forests, thinks that the available sustainable timber supply from forests is able to meet demand if properly managed. His inspectorate includes 256 inspectors (for all departments), which includes 45 specifically for flora and fauna in the field and 8 in the ministry. Yet, each year they reduce their staff levels as the ministry's budget gets reduced. Six years ago they had 400 inspectors.

In Moldova, 24 regional forest enterprises implement national forest policy. Moldsilva manages most of the state-owned forests (about 81 percent of forest area). Local public authorities own 18 percent, and the remaining 1 percent is private property (World Bank 2014). Forest enterprises have the authority to manage timber sales in the forests under their control, either by auction, when a winning buyer cuts down the trees themselves, or by harvesting and selling the trees themselves. Moldsilva's official annual limit for tree harvesting nationwide is 450,000 cubic meters per year. All auctions are placed online.

According to Kobernik-Gurkovskaya (2011), in 2009 about 1,305,000 cubic meters of wood was consumed nationally for household purposes. Meanwhile, only 74,650 cubic meters of wood was consumed by wood-processing industries. Half of all species consumed were oak and ash. The study found that, of the amount consumed by households, nearly all of it (up to 98 percent) was used for heating, with the remainder used for construction. About two-thirds of Moldovan households use wood for heating and their wood consumption equates to 87 percent of the annual increment in the forests. Moldova meets about 27 percent of its annual wood consumption with imports from other countries, such as Russia and Belarus.

One major challenge for Moldsilva is that the majority of unregulated forest activities occur in communal/municipal forests. These cover 56,000 hectares and where the national agency lacks jurisdiction. Only a small proportion (estimated at less than 1 percent) of these forests have management plans. There is no national agency or authority that specifically regulates the activities of community forests, though they do fall under the jurisdiction of the Ministry of Environment that would be ready to assist with the development of such plans.

3.2 Identifying Entry Points and Level of Engagement

In most forested countries, public forest agencies have been in existence for decades and in many developing countries, which used to be colonized by European states, their origins are in pre-independence colonial administrations. This is often reflected in a certain level of inertia and lack of reform. Often agencies see their role through a "command and control" lens rather than a more service-oriented angle. Introduction of new technologies often also means introduction of new ways of working in the agency. Therefore, finding the right entry point and level of engagement with the counterpart organizations is essential. In the project, countries chose to work at the national level with ministry departments despite the decentralized forest

management structures in both countries. This was justified by the small project size, with the intention of rolling out systems once they had been mastered and centrally located employees could become the change agents for regionally located employees. An alternative option would have been to work with just a select group of field offices (for example, one POFI in Lao PDR or one forest enterprise in Moldova) as a pilot in order to introduce a set of technologies and move them well beyond the pilot phase. Both approaches have their benefits.

One distinct difference in the entry points between the two countries is that the Moldovan government has an ongoing e-government project financed by the World Bank.[13] This embodies official commitment, laws, and budgetary resources for e-development in the country and across the public sector. Despite its cross-sectoral nature, forest authorities have not engaged with the e-government project to any large extent, even if the basic concepts are highly relevant for forest governance as well. For one, the forests are innately public resources. Second, other areas of law and economic activity also affect them. People working at the various governmental bodies with forest management responsibilities are public servants. Both individual citizens and legitimate economic actors should have a right to know how their governments are managing their national resources.

3.3 Case Study: Lao PDR[14]

The introduction of ICT and e-development to improve forest governance in Lao PDR needs to recognize the special characteristics of the sector. For example, much of the illegal logging in the country is organized and industrialized, operating at a level that is beyond the capacity of responsible state agencies to control. Large, organized companies with good political connections often carry out these operations.

The Department of Forest Inspection in Lao PDR had limited capacity and experience in ICT and e-governance and in the project chose a cautious approach with the way it introduced technology. DOFI is still developing its approach to ICT, with a lot of discussion about its challenges and what could be accomplished with the effective application of technology.

DOFI and its field organizations, POFIs, face diverse forest governance challenges. These are often linked to limited technical, institutional, and financial capacity. Some challenges are country specific while others are common in other countries as well and in the Mekong region in particular. Some cannot be solved by one country alone but require regional collaboration (PROFOR 2011). The diversity of challenges indicates a dire need for ICT projects, including coordination between national and local levels, and between government and citizens.

Application Selection

DOFI and the project team adopted more of a top-down approach because of the perception of DOFI's technical abilities. "Because of the low level of ICT skills and e-preparedness [in DOFI]," its report reads, "the [consultant] ICT team generated the concept ideas and introduced them to the counterpart organization, [the] Department of Forest Investigation." The idea was to build up capacity at the center and then push it out to the regions.

The consultants identified and pursued what were described as basic, medium-level, and high-level ICT applications that would improve DOFI's work. Their work on training and developing basic applications were meant to improve the use of the existing internal DOFI network. These applications were focused on building the

capacity of DOFI staff in the use of their existing options, in particular for file sharing and transfer via FTP.[15] The team also established an account on the KnowledgeTree website to provide access to documents via the Internet. By the end of the project, though, the project had only trained a small percentage of the staff. Despite training activities, there remain some concerns about the effectiveness of the training: for example, online reporting on inspection cases had been developed earlier, but it is not in use despite training. One option would be to make its use mandatory, which would be an incentive for staff to get trained.

Training in the use of existing systems can also lead to further development in applications. For example, once DOFI staff went through training for the online reporting system, the participants had good technical suggestions for the platform, such as: "There should be additional counter or summary report indicating how many cases have been sent to the public prosecutor." At this stage it would be essential that (a) existing systems are really put in to use (for example, making them mandatory) and (b) options are left open for further development based on practical experience.

The medium-level applications focused on more effective use of Web-based tools and geospatial information. These included adding task management functionalities to the new (and still not widely adopted) online reporting system, encouraging the use of such tools as Quantum GIS (open source), Google Earth, Poimapper (proprietary), and GeoPortal (supported by the European Space Agency and the FAO). This emphasis on the use of mapping tools meant that the project team worked with key DOFI staff to improve their understanding of the data formats used by mapping applications.

Consultants also encouraged DOFI's use of its Facebook page, including for posting photos of illegal logging submitted anonymously by members of the public. By the time of the project's final workshop,[16] however, the DOFI Facebook page had not been updated since DOFI's previous workshop.

High-level applications included a focus on tools designed for remote data collection. In particular, the consultants trained a limited number of DOFI staff in the use of one particular Global Positioning System (GPS) device, the Garmin 62sc, which, in addition to its geolocation capabilities, features a native digital camera.[17] All of the GPS points collected were uploaded and secured in the DOFI server by using Basecamp and Google Earth. However, even though some DOFI and POFI staff learned to use GPS devices both for geolocation and photography, the information they collected was not actionable. Often, information was only stored in a database and not used to initiate any enforcement actions. This—like the lack of uptake in the online reporting system—demonstrates that training alone does not necessarily lead to changes in behavior. Also the administrative processes have to be reviewed to create demand for training and incentives for trainees to apply their new skills.

Remote sensing has proven to be a useful application of technology in Lao PDR in support of law enforcement. Working in partnership with the Forest Inventory and Planning Division (FIPD), a local consultant company ran RapidEye[18] high-resolution satellite imagery through eCognition[19] image analysis software. In particular, they were trying to observe selective logging in order to identify cases of illegal logging. The system was effective and the software was able to identify even the removal of individual trees. This was done separately from the current project.

DOFI currently has three IT staff members. In addition to managing the department's ICT activities, they are expected to provide training both at headquarters and to provincial staff. However, staff retention is a problem and once they receive training, specialist staff often leave DOFI.

At first the consultant team was planning to implement an SMS-to-server application for collecting georeferenced information. Later a decision was made to use a proprietary mobile data collection platform, Poimapper.[20] The supplier provided the system free of charge for pilot use; it also helped to develop forms for Poimapper and provided space on their GeoServer account. In retrospect, the consultant team stated that they should have developed DOFI expertise in using SMS-based reporting systems: SMS was previously used for avian flu testing implemented by the FAO and the then Prime Minister's Office on Science and Technology. This is possible because about 90 percent of the geographic area of Lao PDR has mobile coverage. While most phones in use do not have Lao script, people can text in closely related Thai and still communicate with each other.

Project Implementation

By the end of the project, the team was able to produce a long list of technical challenges faced by DOFI, with possible solutions involving the use of ICTs, but also requiring institutional commitment and investment. One development partner told the mission that DOFI is still of the mindset of wanting to control the data and that a major cultural shift will be necessary to move it toward engaging in open data or e-government activities.

For all of the application levels, the team's intention was to expose DOFI and POFI staff to the applications and their usefulness, with the hope that the counterparts would, understanding their benefits, include the applications in their forest governance work. To this end, the project team made significant efforts to leave the host partner with guides and manuals both in English and Lao on how to use all of the tools introduced under the project. There are grounds, however, for doubting the uptake of technology; as the consultants noted in their report, "these applications have been developed and are fully functional. However, there are not many users because of the slow adoption of them by DOFI."

The government of Lao PDR initiated an e-government program over three years ago, an effort which evolved away from creative use of potential public access to Web-based information and tools to a fiber-optic cable infrastructure project in the capital, Vientiane. Initially, the program was a road map that the government of the Republic of Korea helped to establish, but later it evolved to a project and was finally financed by the

FIELD OBSERVATION:

DIFFICULTIES IN MOVING FROM DEVELOPMENT TO USE

DOFI had an online reporting mechanism for illegal logging that was under development for six years but then never deployed. The system was first developed under SUFORD (a separate Bank–supported forest project). After that, a new and revised version of the application was developed, but it, too, has not been deployed. The system is available and is fully functional, but it is just not being used. DOFI has the same problem with its other online reporting system. They have twice trained people in the provinces—two different people each time—but data is only entered when a DOFI person does it for them.

The reasons for unsuccessful mobilization are unclear; for example, there is no legislative requirement for reporting hard copy. One option would be to make online reporting mandatory and discontinue the use of paper forms.

government of China and consisted mainly of hardware (for example, smartphones provided to government officials). After three years, the project has laid fiber optic across Vientiane. Despite its original far-reaching objectives, the e-government project is focusing on building Internet infrastructure, with less of a long-term vision for the provision of services.

Some public agencies have initiated their own e-development activities. For example, national utility company Electricite du Laos has built a system for mobile payment of utility bills. The Central Bank has set up a mobile banking system. Particularly the latter may have future importance for the forest sector: mobile banking allows for better tracking of license and other official fees as well as safe and anonymous payments to informants. For the latter, also top-up payments on SIM cards can be used.

Institutional Limitations

There are several different government agencies DOFI needs to work with depending on the stage of the value chain and type of forests. In production forests, the main authority lies in the Department of Forestry (DOF) under the Ministry of Agriculture and Forestry (MAF), while the Ministry of Natural Resources and Environment (MONRE) is in charge of protected areas and protection of forests. A third ministry, the Ministry of Industry and Commerce (MOIC), is responsible for the timber trade and its controls.

This complexity in authority could be simplified by utilizing technology. One option that was considered was the creation of a database of criminals, but this would require a very complex system. More serious consideration was given to a registry of vehicles used to carry timber. Only

FIELD OBSERVATION:

REALITIES OF LAW ENFORCEMENT

When asked how much they have been able to stop illegal operations in the forest, DOFI staff replied that it is "very difficult for them to enter into the forest." They explained that it is challenging to police the borders most affected by illegal logging. "We don't have the manpower or equipment," said one DOFI representative, describing the growing problem of illegal roads connecting Lao forests with Vietnam. Keeping in mind that governors have legal authority over the forests in their province and that 10 provinces border with Vietnam, 9 with Thailand, 3 with China, and 2 with Burma and Cambodia, it is easy to see the complexity of the coordination challenge facing DOFI.

DOFI representatives said there was a big problem of organized crime, especially for transportation of illegal wood. Sometimes, they said, DOFI inspectors could not stop trucks carrying illegal wood because "they drive very fast and very dangerously." Successful capture of illegally harvested wood that is being transferred usually happens at roadblocks and is largely based upon intelligence provided by informants.

DOFI faces a major challenge to its effective policing of Lao forests, namely that it has limited authority over the day-to-day inspection of the forests themselves. The Provincial Offices of Forest Inspection, the people who carry out inspections, report not to the DOFI office in Vientiane but to the provincial governor with limited oversight from the national level.

registered vehicles would be allowed to carry timber, and registration would allow their activities to be more closely tracked.

There are a wide variety of current and proposed ideas for employing technology for improved forest governance. For example, it is possible to observe the loss of individual trees using object-based analysis software. Worldwide Fund for Nature (WWF) compared 2006 and 2011 images and discovered a growing network of logging roads from Vietnam into Lao forests. The government of Japan, through the Japan International Cooperation Agency (JICA), has provided computers for a forestry information center. Also, the government of Korea, through the Korea International Cooperation Agency (KOICA), is preparing to establish an agricultural database with the Ministry of Agriculture and Forestry. DOFI could consider placing GPS tracking devices on top of all trucks to monitor movements, similar to efforts aimed at controlling illegal fisheries.

The provincial offices nevertheless employ some interesting non-ICT tactics for catching illegal logging, including a network of paid informants located in each village and town. Informants' identities are secret, enabling them to quietly monitor illegal activity. Informants receive money for phone calls and fuel, and LAK 300,000 (almost $40) for every truck they report. Additionally, if there is a problem in the forest, and a POFI inspector knows he cannot solve it, or if there is a problem created by the provincial governor that the POFI cannot solve, the POFI might call in a DOFI inspector, because they are more independent.

FIELD OBSERVATION:

LOCAL LEVEL REALITIES

The culture of respect for official bureaucratic processes in Lao PDR is vulnerable to exploitation. Firms engaged in illegal logging do not consider it necessary to hide their illegal forestry activities. They act with impunity in the open, abusing bureaucratic processes to add a faux layer of official process to their activities. Official-looking papers carry a lot of weight in the forest, and false or irrelevant papers can often be mistaken for legitimate documents. Alternatively, companies overbid for a small portion, obtain a harvesting permit, and then recycle the permit multiple times to harvest and export much more than allowed in the original document. DOFI and development partners also said that it is quite common for local forest inspectors, having just confiscated an illegal shipment, to receive a phone call from a senior official telling the inspector to release it, that it has been cleared. The inspector then has no choice but to comply.

In Salavan, the mission was also shown several stacks of confiscated timber at the provincial office. The head of the office estimated the value of their seized timber at $200,000. The POFI staff explained that when wood is auctioned, 50 percent of the profits are kept by the provincial office and 50 percent are sent to the capital. Obviously, POFIs are in a position to earn several times their annual budget from the sales, which occur without much oversight.

Themes of community participation, community empowerment, and community policing were repeatedly raised during meetings with DOFI and other development partners.

These complex structures would benefit immensely from modern communication technology. For example, it should be possible to introduce a mobile phone–based reporting system so that POFI reports could be easily sent from local to national level. The idea would be to not compromise individuals' identities and circumvent any inappropriate control occurring at the local level. These interlinked systems would be able to share case information between different agencies, allowing smooth collaboration and increasing internal accountability within public administration.

Potential Community Involvement in Forest Governance

There is a high demand from the local communities for empowerment in relation to their surrounding forests and evidence that focusing on communities can lead to positive results. Previous World Bank projects have encouraged people to used mobile phones to report illegal logging or other suspicious activity. The projects developed community members' capacity for patrolling their own forests and focused on providing them with alternative livelihoods. The Laos Environment and Social Project financed by the Bank in 2006–10 established 24 community committees in protected forests, which produced some compensation for participants. This project is currently entering its second phase.

DOFI believes that in order to be effective, they need to engage with forest users and other local people who need to understand the benefit forests offer. It has also stated that it would like to distribute information at the local level if it could determine how it could best do so. Development partners report that increasingly people are abusing the annual allotment of 5 cubic meters of wood to sell to whoever will buy. Demand for charcoal is apparently up because of demand from a Chinese cement factory located in Lao PDR, putting pressure on stocks of small-diameter trees. DOFI recognizes that they "don't have a good handle on this." Developing efficient information exchange between authorities and community members would ensure that villagers are able to exercise their rights while still maintaining adequate safeguards against unsustainable practices and misuse of community rights.

3.4 Case Study: Moldova[21]

The Forest Research and Management Institute (known by its Romanian acronym, ICAS) developed two Web-based applications that will have long-term usefulness for Moldsilva's management of forests. The first application allows for forest monitoring information to be stored online, as well as for the calculation of forest volumes. Currently, Moldsilva staff manually calculate tree volumes using formulas from Soviet-era guidebooks. The second application digitizes forest management information into basic maps that show the surface area of selected plots. While the two applications are not yet integrated into other ICT systems, Moldsilva plans to proceed with digitizing the information collected by forest enterprises throughout the country.

In order to choose which applications it would develop and the entry-level competence and ICT capacity required, in July 2012 ICAS conducted a survey of more than 500 Moldsilva managers, forest engineers, foresters, and administrative staff at 19 forest enterprises. The survey found that the agency is mostly equipped with desktop computers, about half of which are more than five years old. Of these computers, 66 percent had access to the Internet, and 32 percent of the computers were linked via a local area network (LAN). In terms of the Moldsilva staff perspectives, the survey found that the largest area (20 percent) where respondents believed that computers could best be used to improve their work was in the calculation of estimated timber volumes. Just 15 percent

prioritized the modernization of their computers' mapping capabilities, and only 4 percent identified corporate e-mail as the most desired functionality that "modernization" could bring.

One issue with the survey was that it only allowed Moldsilva employees one choice for technology preference, somewhat limiting insight into the extent to which they perceived the potential benefit from multiple technology choices. Despite this, the results of the survey provide a clear indication that the surveyed employees lack deeper exposure to the benefits of modern communications technology. An average Moldsilva employee has between 20 and 30 years of experience and is unlikely to have much experience using technology in their work. Thus, while they were the intended beneficiaries of the pilot project, it is not clear that the end users are necessarily adequately informed of the possibilities provided by the new applications for their work. While they know which tasks require the most time, and have opinions about which are the most challenging, they were not in a position to identify technologies that were appropriate investments, taking into consideration the full range of possible functionalities and cost-benefit analyses associated with deploying the various tools available.

In this case, the patient diagnosed himself and prescribed his own medicine. An alternative option would have been, for example, to have surveyed how Moldsilva staff members spent their time and what their perceived needs were, and then to apply expert knowledge to identify, cater, and deploy specific technologies to meet those needs.

ICAS could have been more ambitious with technology, yet their choices were also realistic. Technology choices are based on trade-offs: technology leaps allow bypassing several intermediate steps in technology development and applying the latest available systems. Often this is linked to fundamental administrative reengineering structures and processes. This is a risky option, as there may be notable resistance among staff and such reforms mean navigating unchartered waters. More incremental gradual reforms do not necessarily allow institutional restructuring and using the latest, most advanced technology. On the other hand, this lowers resistance among staff, as they can relate their new tools to existing tasks.

Applications Developed: Volume Calculator and Mapping Tool

The first of two tools developed by ICAS, a timber volume calculator (APVPROD), is an online reporting interface that automatically calculates tree volume according to official volume calculation formulas that are specific to the major tree species found in Moldova. It replaces currently

FIELD OBSERVATION:

VOLUME CALCULATOR

During its February 2013 mission, the World Bank team witnessed ICAS training its first forest enterprise staff member in the use of the online volume calculation tool while visiting the Silva Razeni forest enterprise. The trainee first completed the calculations manually, then ran the same figures through the online system. While the manual process took the experienced employee 20 minutes to complete, it only took 2 minutes to complete the same operation using the online tool. The participants were visibly impressed and eager to begin using the online system. Interestingly, though, the online and manual processes produced slightly different results because the online tool is set to automatically round decimals. This aspect might need to be addressed.

applied manual methods. Until now, Moldsilva staff have been manually calculating volumes based on Soviet-era hardcopy volume tables, an approach that is time-consuming and vulnerable to human error.

ICAS hired two programmers from a local technical university who produced a Python-based online interface that automatically produces tree volume calculations based upon data collected in the field and the long-standing tree volume formulas. These data were entered manually by ICAS over a period of about three months. Programmers contributed about 80 percent of the code, while ICAS focused on organizing and providing the forestry information.

The online calculation tool saves staff time and reduces error. The agency is not yet able to fully leap into the digital world, because of a legal requirement for the agency to maintain paper versions of forest monitoring reports with official document legal status only being afforded to the physical reporting forms themselves. Thus, while it saves them time, until the rules are changed the online reporting system introduces additional work for forest enterprise staff. The situation is complicated by the requirement to use specific forms, so printouts from APVPROD would not satisfy the legal requirement. As such, this is an obvious area where a change in the legal requirements could streamline the work of the country's foresters.[22]

The other tool produced by ICAS under the project, the Polar Coordinates Plan (PCP), is an online database of all forest plots managed by Moldsilva. ICAS entered all of the forest surface area information into the online tool, providing Moldsilva staff with a quick plot reference guide when they are focusing on the status or potential use of a particular plot. The tool uses Google Maps, which automatically calculates the surface area and provides basic information about the borders of a parcel or sub-parcel dimensions and the composition and type of species found in a parcel.

Both the timber volume calculation and map reference tools are online and accessible for Moldsilva staff via a password, though Moldsilva/ICAS have yet to train its staff in their use. Originally, ICAS had decided to train people with low levels of technical knowledge and had prepared and printed guidebooks with the necessary terminology. Later, it was decided that training should be provided to a group of 25 people who already possessed some technical knowledge. Their role would be to act as change agents and train other users ("Training of Trainers" approach) and ultimately ICAS and Moldsilva plan to train all relevant staff in using the tools. Wider dissemination will occur after one year of testing monitored by ICAS, after which the Moldsilva management will issue an order decreeing that the electronic version has legal status.

Potential Areas for Improvement

These two applications have been among the first Moldsilva-specific ICT applications that have been more advanced than spreadsheet templates. Consequently, there are a number of opportunities for further development once the users recognize the potential the new tools provide: for example, the online mapping tool could be made more current and data rich by installing dynamic links between the maps and other Moldsilva databases. Currently, data must be entered into one of Moldsilva's databases and reentered into the map in order for it to appear on the map. Maps are rendered in AutoCAD and on MapInfo; it takes three steps to make the link. Maps are currently stored in one location and plot information in another.

ICAS would also like to make the maps more data rich. In addition to information on tree species, plot borders and dimensions of parcels and sub-parcels, and the composition and type of species found in a parcel, ICAS would be interested in adding data layers on the health of trees; parcels designated for cutting; recreational

forests; hunting locations (these change annually); and areas targeted for fire control. More complex data on additional management information would require more conceptual planning and details before it is included in the platform. ICAS also expressed an interest in deploying individual log tracking systems.

There is also a need to strengthen the internal controls in the information systems to ensure high quality and reliability of the data. There remains a need to develop software that catches errors in data entry. Currently, with different individuals entering data at different steps in its data collection processes, data entry standards vary. ICAS would like to have its systems catch errors and return them to the author in real time.

Possibilities for e-Government and the Role of Partners

The government of Moldova has made e-development a national priority and has, for example, developed an open data portal providing services for several sectors. The development has been part of the Bank-financed e-transformation project.[23] However, Moldsilva and other forest-related agencies have not been actively involved and still need to decide how and if they will buy into the system. Currently, Moldova's sector ministries are not mandated to give data to the portal and the e-Government Center is still at a stage of demonstrating its value to the various ministries. So far, the e-Government Center is seeing ministries coming to them after they see that income for other ministries increases after they introduce e-services.

The prospects for development of forest sector e-government services are bright, both because of the recent passage of specific laws recognizing the legality of mobile and e-signatures in the country and because of high Internet and mobile phone penetration in the country. Today, mobile penetration in Moldova is 94 percent, of which about 20 percent are smartphones (mostly using the Android operating system). Leading providers Orange and MoldCell both sell special SIM cards that come with virtual keys for mobile signatures already installed. This allows conducting even advanced transactions through a mobile network.

According to ICAS, for Moldsilva to participate in the e-government platform, two systems need to be created: one for the public and one for internal use. For a public-facing site, Moldsilva would be responsible for deciding which data would be posted and for updating the data regularly. This double structure is preferred over one system that would provide various depths of access. Moldsilva employees want one single nationwide platform for the organization that would include data entry, storage, corporate e-mail, and so on. This would enable the productive interaction of the enterprises, which do the technical work, and Moldsilva's headquarters, which does more administrative work.

One specific challenge for the use ICTs in forest management and e-governance overall in Moldova is the ownership of key data sets and inadequate collaboration among government agencies. As an example, the orthophoto imagery taken in 2007, while dated, remains the best remote sensing imagery available of the country's forests. The imagery collection was paid for by donor assistance but still the managing agency, the State Agency for Land Relations and Cadastre, charges for access to the images. Additionally, when the images are shared with Moldsilva and ICAS, the terms of the sharing agreement only allows internal use. There is limited potential for providing the public with maps containing imagery with geographically accurate forest management information.

In order to have both short- and long-term e-development, an institutional commitment is needed to integrate ICT fully into Moldsilva's operations. Currently, this is not the case, and information management is not reflected adequately

in Moldsilva's organization, strategies, and priorities. Externally funded development programs dictate priorities and their project teams are easily seen as "Moldsilva's ICT departments." In addition to training its existing staff in the use of the tools it has created and will create, an institutional commitment would require hiring new experts and allocation of senior management to deal with information systems (for instance, a chief information officer). Currently, "Moldsilva considers [the Consultant team] as the IT group defining the strategy for Moldsilva" rather than assisting Moldsilva to define its own strategy. One ICAS member commented that Moldsilva still appears to view ICT as fashionable rather than necessary. "What we need to find out now is which information flows are taking place in the organization," one ICAS staff member said. "No one has done an analysis of these flows."

Moldova benefits from the presence of multiple competent nongovernmental organizations (NGOs) focusing on conservation and environmental protection. These can be useful partners for authorities in communication activities with the public. For example, the Ecological Movement of Moldova is an NGO that has a good relationship with Moldsilva. According to the organization, until 2009 Moldsilva used to be a "closed" organization, not sharing information, but now it is much more open. Since the end of the communist government, this organization has had a "very good" relationship with the agency. Other NGOs include the Ecological Movement of Moldova, Biotica, SylvaMillenium 3, and Ecotiras. ICAS representatives positively acknowledged their increasingly positive role, saying, "NGOs are more active … and have been very active on the subject of illegal logging." The apparent dedication and high professional standards of these organizations mean their role as partners could continue to grow. They collect their own data and have their own networks. When building ICT systems in the sector, it is essential that NGOs and other partners are included in the systems at an appropriate level. They could augment Moldsilva's data collection and strategic communication activities in a valuable way.

4 LESSONS FROM THE CASE STUDIES

Forest agencies designing their own strategies for e-transformation have many cost and capacity factors to consider. Ultimately they need to find their own path and make their own decisions about what they want to accomplish. This is necessary because there is no one predefined road map, no step-by-step process for pursuing advanced use of ICTs or the requisite organizational transformation—only some guiding principles. The experiences from Lao PDR and Moldova offer good insights on some success factors and lessons learned on how to introduce ICT in forest administration and how to use it to improve the state of sector governance.

The two countries are very different and both have their unique characteristics. However, there are also some similarities, which allow some joint conclusions:

- Both countries and their forest authorities have only a modest track record in using ICT in the forest sector and many applications are new.
- In both countries, the whole society is undergoing transition from a centrally planned economy to a more open one, and this has an immense impact on public administration as well and there are increasing needs to increase openness and accountability.
- Both countries are increasingly engaging with international markets, which changes the nature of governance challenges.
- In both countries, international development partners have been supporting forest development and assisting in building modern governance structures.

Thus, without being organized in order of importance, what follows are major topics that deserve more attention and consideration by forest agencies interested in pursuing more effective and efficient use of technology in their forest governance activities.

To date the work of many forestry agencies globally has mainly focused on the management of forests under their authority, while overall resource management at the landscape level has been less successful. This is visible in both Moldova and Lao PDR, where the forest agencies have incomplete national remits in terms of the entirety of their countries' forests and narrowly defined responsibilities. Yet, forest agency personnel most likely have the best comprehension of the long-term aspects of tree growth, climate, and ecosystems. Their knowledge and experience could be employed in advancing better natural resource management in the widest sense.

While massive amounts of wood are harvested illegally in both countries, it is important to consider that the root causes of the demand are mostly legitimate. Additionally, forest governance is not only about illegal logging. It is one of the key issues to be addressed, but issues like public accountability, access to information, public participation, equitable decision making, economic efficiency, and so on are all part the agenda and one should not limit forest governance discussion to the issue of legality. They are naturally closely interrelated issues. People in Moldova need to stay warm in winter. Furniture companies in Vietnam, China, and Thailand have large global demand for their products. As a decorative component of more complex manufactured goods than simply furniture, highly valued precious wood is in high demand in several countries and markets. This applies not only to regional markets in Asia but also to markets in Europe and North America.

4.1 Long-Term Institutional Strategy for Open and e-Government

Plans for using ICTs to improve forest governance need to be part of a wider, national-level development of e-government and open government services and policies, which highlights a need for long-term strategic thinking.[24] The initial introduction of technology for core functions, while still internal, increases the ease and efficiency of sharing information. Even if a forest ministry's main focus in e-government development remains internal, it remains a public institution, accountable to government, and ultimately the public. Citizens witness the effects of good or poor forest management with their own eyes. They are a part of the same society and their livelihoods may heavily depend on the continued existence and health of forests. It is also possible and often advantageous to involve the public in reporting on illegal activities in the forests. And, eventually, well-constructed access to official data and information online should enable horizontal coordination among members of the public interested in coordinating to protect forests and use them for sustainable economic and social development.

The forest agencies' current use and application of ICTs are moving them from a position where the tools are useful for them internally to the point where they will be able to provide services to and involve the public in processes of forest governance. Forest agency personnel consistently discuss their plans for increasingly complex use of ICTs for collecting and distributing information. The ideas and thoughts expressed by the forest agencies suggested that it is their application of ICTs that will eventually lead to their supporting a variety of open government activities.

There is an inherent pressure on government to be open with its activities and information, though state institutions usually want to improve their own internal information sharing and management before they move to providing the public with information and services. Both DOFI and ICAS/Moldsilva expressed a desire to focus their efforts on using ICTs to improve their data collection and sharing, though both found it easy to describe what activities they would like to undertake eventually.

Based upon the performance of the two counterpart agencies in this project, it is reasonable to expect that their sophistication will improve over time. This will contribute to an evolving push–pull dynamic with the public, where a large amount of publicly available data becomes the norm, and the public expects government agencies to continue along a path of ever-increasing openness. Implicit in this understanding is that engaging with the general public is an essential component of good forestry governance.

The long-term character of this thinking has implications for the technology that an agency will choose. For example, government agencies' must choose between free and open-source software (FOSS) and proprietary platforms; if they are indeed thinking several years into the future, forest agencies should from the beginning invest in tools that will provide them with the best combination of flexibility and reliability. The choice may also be based on the resources available. This is discussed in more detail below in chapter 6.2. Additionally there is the question of choosing between locally developed solutions and ready-made or off-the-Internet/shelf products. There are circumstances where proprietary systems would be a better choice and there are options where open source would meet client needs at a lower cost. When making the choice, issues like local capacity (both current status and development needs), budget, and longer-term e-development strategy need to be considered.

Moldova's government is clearly further ahead with its $23 million Bank-funded Governance e-Transformation Project, but Lao PDR is also moving toward greater transparency. ICAS told the mission that currently Moldsilva is most interested in an internal system, although in the longer term the agency has the means to pursue a more comprehensive e-government program.

4.2 Strategic Communication

A related point to forest agency plans for increasing transparency is the need for forestry agencies to communicate with their stakeholders. Agencies may want to hone their use of ICTs for internal purposes, but failing to communicate with the public leaves them vulnerable to having their programs and activities misunderstood or underappreciated. Forest agencies work nationally, but citizens observe the result of programs locally. It is probably not immediately apparent to an average citizen that a local situation is not necessarily representative of the state of forest management nationally.

While the provision of any data to the public is itself a message that an open agency is busy at work, forestry agencies stand to reap many benefits from defining itself and communicating to the public that it is competent and working diligently to fulfill its responsibilities.

Since all of the technologies in question produce information and data, the agencies should be thinking about how to use this data to tell its story to the public. Forest agencies must also have a plan for how they plan to use any data collected. Collecting data without a clear strategic plan for its use should be avoided. These considerations should be built into project plans.

The technologies for strategic communication, in particular, include mobile phones and the Internet, specifically list serves, targeted e-mails, location-based services, SMS broadcasts, tweets, a forest agency's website, and any messages distributed via broadcast media. Free automated analytical software such as Google Analytics can be installed on websites, allowing their operators to gather a wide range of usage data. It is just as easy for agencies to monitor which types of messages people respond to when they receive them via SMS. Additionally, partnerships with mobile network operators can allow for site-specific information, such as the location of the tower used by people calling or texting a forest agency. Both Lao PDR and Moldova have competing mobile network providers, which allow agencies to entertain competing offers for partnerships that could generate data stemming from or relevant to strategic communications.

4.3 We Know the Technology, but Do We Know the User?

Successful planning for the introduction of new technology systems should take into account the user experience. The question that remains to be answered is concerned with how technology could augment efforts to meet the legitimate demand for wood, moving tree harvesting activities out of the black market to a regime of precisely measured and regulated production. The best answer to this question is transparency. The public, the media, the private sector as well as other parts of the government need to be provided with a combination of information made available via modern communications technology and the tools to process, navigate, and understand that information. Technology-related activities in support of forest governance transparency could include, for example,

- Posting location data and maps of forests and forest management operations online;
- Providing overall statistics on the resource;
- Providing data to the public and the tools to analyze that data;
- Collaborating with other stakeholders and intermediaries to share data;
- Posting information on timber sales and other financial transactions online; and
- Moving toward as much real-time information as possible.

Owing to the fact that the Internet and mobile phones are portals to many aspects of people's lives unrelated to forests, their use for transparency activities requires effectively "crossing the bridge" in its entirety. This means that a forest agency cannot consider its job completed after it has posted its data online. It is unreasonable to expect an average member of the public to go out of their way to access the data, understand the science or metrics involved, and do their own analysis. The Internet, in particular, provides limitless competition for people's time and attention and applications and services need to be actively promoted and marketed. More advanced websites set standards for attractive graphics or animations, ease of use, the extent to which they link with social media, and how easily they enable discovery of information. This often requires making as much information as possible via a single interface.

FIELD OBSERVATION:

TECHNICAL CHOICE AND USABILITY

A good example of a unified forestry information portal is the Forest Explorer Map, supported by Australia's Department of Sustainability and Environment, which has recreation and public land administration readily available on the same map. Information is provided to citizens in a way that does not require additional steps by the user to get the information on different uses of forests.[a] On the other hand, the U.S. Forest Service's maps on the data.gov portal for Administrative Forest Boundaries[b] require users to download and use a special data extraction tool before any maps can be viewed.

a. http://nremap-sc.nre.vic.gov.au/MapShare.v2/imf.jsp?site=forestexplorer.
b. https://explore.data.gov/Natural-Resources/US-Forest-Service-Administrative-Forest-Boundaries/bhgq-ix9p.

4.4 Scale-Up and Sequencing

The desire for "scaling up" use of ICTs by forest agencies is a predominant focus for donors. In the cases of Moldova and Lao PDR, this appears more likely for Moldsilva, which is in the position of testing two new useful programs and training its staff nationwide in their use. It is taking something that was successful at the local level and is now attempting to reproduce it on a large scale.

If one counts non-ICT technologies in addition to ICTs, it is clear that there are several distinct technical knowledge skills and practices that forest agencies everywhere could usefully acquire and inculcate into their activities. These skills and tools can be mapped, then acquired and deployed sequentially. A lot of the tools in question achieve small efficiencies or automations. They are useful small pieces of a larger puzzle.

The point, however, is not to evaluate which of these tools and applications should or should not be scaled. Instead, the emphasis should be on the most useful process so that agencies have all of the capacities in place when they need them. Forest agencies should focus on determining the full set of skills and tools that would be useful for their work, then proceed meticulously in acquiring them. The best way for an agency to move forward will depend on a large number of factors. Most critical to understand, however, is that it may entail altering what a forest agency considers to be its core competencies. This could mean that

certain positions and activities become redundant, while other new skills and competencies must be brought in. And with new skills come corresponding new technologies, which could be as diverse as social media for strategic communications or complex mapping software.

Throughout this process it is essential to take into account the improvements in technology over time, as well as the decreasing cost. It is also important not to confuse technologies for anything more than tools. They should not be ends in and of themselves. It is also worth remembering that the effects of some activities, especially precedent-setting or deterrence activities, are asymmetrical, meaning that they can achieve a nationwide or "scaled" impact if well planned and executed.

4.5 Building Partnerships

The focus on the forest agencies' role and specific technologies appears to be missing the potential for outside entrepreneurs to help address many of the issues that agencies are facing. It is possible that, given the opportunity to profitably facilitate the process of citizen reporting, for example via custom-developed mobile phone apps, that the private sector might perform better at catching illegal logging than Moldsilva or DOFI. One could imagine virtual "bounty hunters" armed with the ability to enlist or deputize any concerned citizen via a custom-developed mobile app. This is not the same as crowdsourcing, however, because of the profit guarantee built into the business model, which would also result in greater sustainability.

The private sector would also be able to perform more mundane tasks, such as data analysis and visualization, training, and website maintenance. While these may appear like traditional cost-saving outsourcing activities, modern communications technologies induce a great measure of hype and a "silver bullet" mentality, as though their introduction can easily solve complex problems. The monetary and personnel resources demands are usually more than governments estimate. It could be more efficient to encourage for-profit companies to invest their own time and money into solutions that the government may want to develop.

Engaging with private sector operators, research institutions, and civil society organizations as well as innovative individual "hackers" and change agents can be useful and bring innovation to forest agencies. At the same time, this needs to be built into existing and foreseen institutional realities to be sustainable. For example, the structure and sources of budget funding matter. Many agencies may be cash poor but staff rich or there may be (donor) resources available for investment but no recurrent budget. Decisions have to consider if investment and recurrent budgets can substitute for each other or if cash and noncash resources can do that. This has an impact on technology choice as well; an agency may have staff for in-house implementation and support but not for payment for external services and licenses, or vice versa.

4.6 Changing Attitudes

Both DOFI and Moldsilva/ICAS will benefit from sustained engagement with international partners and development agencies. While they were not necessarily best placed to identify which technologies would be the most useful for their work, the staff members of both organizations are professional and genuinely interested in using technology to increase the efficacy of their work. As observed by a project team member during a training session, "Ideas—realistic or not—show that training and 'playing' with ICT and related concepts and ideas creates innovation where new ideas start to come up."

Perhaps, though, for future development, what is needed more than the introduction of new technology is a focus on changing attitudes. For example, in Lao PDR, while the location of illegal logging had been verified on the ground by GPS, the POFI staff did not appear to be interested in any subsequent follow-up actions. While technical skills per se had been strengthened, these were not linked to the institutional value chain and the main focus was on recording what had happened as opposed to creating a basis for follow-up action. Any potential follow-on activities should thus focus on building the mind-set necessary to take full advantage of what technology has to offer.

The approach taken in the two countries differed because of the varying levels of perceived capacity on the part of their governmental partners and their priorities as well as logistical challenges, even though both countries have comparable penetration levels for communications technology. However, both projects made what appeared to be uninformed technological decisions, particularly related to mapping and mobile data collection applications. Decisions were made without in-depth market surveys of available tools, including proprietary and open source. There are a number of other succinct comparisons, which are fleshed out in more detail in the country reports by the project teams:

- In both countries, technology choices suggested that counterparts were not fully aware of the full range of technology options available. They appear to have made somewhat ad hoc decisions. One particular example is the choice in Lao PDR of the proprietary Poimapper mobile data collection platform over an open-source software application that could have provided more flexibility in the future.
- Lao PDR has more defined language diversity than Moldova, complicating any strategic communications activities that DOFI might undertake.
- Of the two countries, only Lao PDR uses local informants based in communities to monitor illegal forestry. The informants are provided with mobile phones and credits to keep their connections active. In Moldova, patrols by foot, horseback, and motorized vehicle are much more common.
- In both countries, the implementing partners and local counterparts had strong working relationships, with marked openness to collaboration.
- In both countries, the local counterparts wondered strongly whether the pilots might be followed by additional (potentially large) funding. They may have believed that with follow-up funding, they would be able to have more time to achieve the goals of the pilots.

5 BROADER, GLOBAL LESSONS LEARNED

The experiences of the forest agencies in Lao PDR and Moldova provide insights into larger issues involved with the use of technology and forest governance. The topics broaden into relevant social ecosystem and policy questions that could augment or hinder the successful use of ICTs in governance projects. Most of these insights are interconnected, though it is useful to consider them individually.

One key element for successful reform processes is finding the right entry points for reforms; even good initiatives can fail if introduced too early, too late, or at wrong levels. In both Lao PDR and Moldova, the pilot activities were linked to ongoing support from development partners on forest governance. This provided a good platform for introducing new types of working. In wider ICT4D discussion, there often is discussion on gradual approaches versus leapfrogging (introducing extensive reforms at one go). Often these two approaches are seen as mutually exclusive and operators should choose one or the other. However, the experience from the two countries does not necessarily support the conclusion that only option would be feasible.

This project used the introduction of small improvements to engage with the agencies and to introduce the possibilities of ICT in forest administrations. As seen in the country reports, the tools developed were closely linked to the agencies' current activities with the objective of making routine processes more efficient and less prone to human error. The objective was to allow staff and management to familiarize themselves with ICT in a way that helps them in their daily tasks. As discussed throughout this report, simply "computerizing" existing processes does not necessarily improve the effectiveness of forest administration, and if its current mandate does not reflect the needs of the society, this will not be changed. That requires more fundamental reform.

At the same time, even small gradual reforms can be useful, because they introduce the benefits of ICT in a familiar context to forest agencies and their staff. This stepwise approach can serve as a starting point for reform when ICTs are first introduced to improve efficiency of operations by changing existing processes (gradual approach) and wider, more fundamental reforms (leapfrogging) can be introduced at a later stage, when e-skills and readiness have improved. The decision between gradual approach and leapfrogging is not necessarily mutually exclusive but a matter of sequence. Small gradual reforms can act as preludes for larger, agency-wide changes. This stepwise approach may also be a practical necessity if human capacity or technical infrastructure does not allow widespread e-governance systems or data availability is insufficient.

5.1 Managing Expectations

It remains challenging to identify useful metrics for projects seeking to introduce new ICT tools into the operations of organizations with complex responsibilities. This is often the case because the most desired changes are the most intangible. Were mind-sets changed? Are the results scalable or replicable? Did people learn? Will there be lasting impact?

One possible issue is that the comparatively simple nature of the technology identified in the project could lead to only limited success. However, the overall objectives as outlined never presumed that the most advanced technology should be identified and/or deployed.

Of the two counterpart organizations, DOFI faced the most difficult challenges. "The use of the fileserver network environment is nonexistent," one consultant team member said. "The main reason for this is that the personnel in DOFI had not been properly trained to use it." Even basic GPS concepts of longitude and latitude needed to be explained to POFI field staff. "Geospatial information such as location coordinates is not used. Currently the system uses mainly village and district names," explained one DOFI staff member. It appears that the two teams set modest but realistic goals for themselves. This is especially true because stakeholders were thoroughly consulted during the process. As such, the wide-ranging organizational capacity needs and potential for technology should not confuse observers into thinking that the rapid introduction of ICT tools was feasible.

A more important question is whether attitudes have been changed and whether that may affect overall organizational culture such that technology is utilized more effectively. Inasmuch as this is challenging to measure without rigorous survey methods, it did seem that the DOFI staff's involvement in this project allowed enlightening exposure to new tools and concepts that will be useful as they continue carefully down the road of organizational capacity development. On the other hand, Moldsilva's management has made the administrative decision to make use of the new applications mandatory.

5.2 Implications of Technology-Induced Empowerment and Decentralization

One key insight visible in Lao PDR and Moldova, and also globally, relates to the growing importance of the individual as a result of the changing abilities of communications technology. Modern communications technologies empower individuals and increase de-institutionalization of content creation and information dissemination. They also lower hurdles for advocates seeking to organize collective actions. This is the case because the devices, in combination with social media, make it so easy for people to capture and share information.

The devices in question do not necessarily have to be advanced smartphones; SMS has also proven to be an effective tool for opening up government and for civil society coordination activities.[25] Using tools as simple as phone trees or Twitter, messages from one concerned citizen can reach and mobilize a large group within moments.

For those who have Internet access, well-informed individual bloggers can also have asymmetric effects on the public's views of, or activities related to, forestry governance. This can also be true in situations where few people have Internet access. If local radio stations cover blogs and reach a wide audience, the impact of one individual can be easily amplified. But it is

essential that the blogger and radio operators have access to relevant information. In the forest sector, this is often produced by the public forest agencies; these dissemination channels then provide value services by adding public opinion and sharing knowledge.

These new dynamics present a double-edged sword for forest governance. On the one hand, it is easier to reach more people with more information and to engage them in dialogue related to forestry. On the other hand, ubiquitous mobile makes it harder to control strategic communication messages and ensure that the facts are accurately represented and understood. Efficient information sharing also makes misinformation easy.

Institutions understand institutions, but they often have more difficulty in understanding individuals. Yet, the capabilities of ICTs mean that engaging with particularly well-connected individuals or civil society partners (change agents or champions of change) can be an efficient way of conveying the agency's message. Forest institutions should thoroughly contemplate the potential role of the individual armed with a mobile phone and concerned about the forest. It is essential for forestry institutions to understand how these tools work and can be applied.

If forestry institutions plan to communicate with citizens or engage them in monitoring efforts, the public will need to access the intended means of communication in order for those plans to work. Agencies need to take into consideration the fact that that some key segments of its target audience may indeed lack access to the Internet and mobile communications. Furthermore, this lack of access may have a direct correlation with challenging economic conditions of the people in question or there may be issues related to minority languages.

5.3 The Need to Leverage Intermediaries and Partners

The experiences from Lao PDR and Moldova also highlight the essential role played by intermediary institutions such as media and civil society organizations. This is because, despite the truth about individual empowerment, people still need the professional skills of reporting and analysis in order for key facts to be discovered and shared.

Intermediary institutions can help forest agencies promote good governance more widely (supply of good governance). They can also increase demands for accountability and transparency (demand for good governance). Yet, in order for intermediary institutions to better play their role, it may be necessary to provide them with forestry-specific knowledge and expertise. This need is common for many other technical areas as well. Often, for example, ministries of health or health-focused NGOs conduct short-term training for journalists to familiarize them with specific areas of disease, medicine, treatment, and so on. The goal is to enable journalists to report more accurately, such that people are better informed, so that disease-related stigmas are reduced and so that more people might seek testing or treatment for diseases they have.

Forest institutions and agencies may not view communication with the public as their primary responsibility. Yet, forest governance could also benefit from providing such training to journalists. Communication matters for forest institutions because people often lack information about what is happening outside of their immediate surroundings in a specific sector. This is evident by analyzing their available sources of information. Forest governance challenges are local, nationwide, and global in character, and there are likely many scientific facts, economic trends, and laws about which the average person is unaware. There is also the simple fact that media reach more people than forest institutions' communications.

Forest institutions are in a position to utilize ICTs to leverage the role of these intermediary institutions for increased reach and effectiveness of communications activities for forest monitoring and policing. The tools provide answers to the question of how forest institutions can use ICTs to make the lives of the media easier, such that information is more accurately reported and reaches more people. They can, for example, send a broadcast SMS to a group of journalists when their blog and Facebook page have been updated. They can e-mail pictures, as well as audio and video content to journalists to add context to their other communications work. Intermediary institutions can help forest agencies enlist the general public in fighting corruption, especially if forest agencies utilize ICTs to exchange more information with intermediaries more rapidly.[26]

5.4 Information Security

One enormously important aspect of information management is data security. Forestry institutions need to be mindful of information security in order to avoid having their systems taken down, their data stolen, or their communications hijacked. They should also be careful to protect the privacy of members of the public who may have anonymously reported illegal logging activities or corruption at the local level. Security vulnerabilities are an unavoidable reality for all types of ICTs, particularly mobile phones and the Internet, with new threats discovered on almost a daily basis. There are many different types of computer attacks and risks, such as viruses, Trojan horses, and spyware. Additionally, there are risks related to human error or unintentional software and hardware problems.

All information management systems have their risks and no perfectly safe systems exist. Therefore, the key issues are recognizing and managing risks. Additionally, it is essential to focus on preventing attacks and mitigating their effects and planning for postattack recovery. A key approach for mitigation that many forest agencies neglect to adopt is data backup. Many of those who implement some approach to backing up data take markedly conservative approaches, mainly by opting for backing up only on physical devices located on their premises. Alternatively, these agencies could take advantage of remote backup, which has consistently seen positive trends of decreasing price mixed with improved user friendliness, more choice, and increasing security. Agencies should also have well-known standard operating practices both to prevent accidents and attacks as well as to minimize the impact of such mishaps. Additionally, virus protection software needs to be updated and always used. These common sense precautions can reduce risks notably.

5.5 "Pilotitis," Scalability, and Monitoring

Often in e-development projects, donors and program administrators do not know whether to expect technology to yield quick (revolution) or gradual (evolution) results. This ambiguity may have been caused by optimistic predictions—or even hype—about technology's potential or oversimplified characterizations of the role technology has played in other projects. Project managers may find it difficult to prepare budgets for projects that involve coding, localization of existing software, or establishing a complicated public-private partnership with a local technology company or mobile network operator. They want to avoid boondoggle projects, but they feel a need to allocate enough money for their projects to be taken seriously.

These and other unknowns often lead to cautious project approaches. Donors try to find a balance between having meaningful and visible utilization of new technology on the one hand, and risking large sums of money and their reputations on unsuccessful endeavors on the other. The solution to the cautious project manager's dilemma is a pilot project. The ICT4D field is rife with pilots. Experts refer to this ongoing phenomenon as "pilotitis," a negative characterization of the tendency for donors and implementers to support no more than short-term experiments aimed at demonstrating proofs of concept.

Competition for donor funds can perpetuate pilotitis: "donors want to be perceived as innovators, and the NGOs they fund often compete for funding by differentiating their approaches.[27] This phenomenon can lead to would-be implementers proposing project approaches that aim to impress donors with purportedly cutting-edge use of technology at the expense of approaches that might otherwise ground projects in what is most realistic and useful and would have long-term sustainability.

In order for a project to achieve sustainability, its goals and methods should be accepted and adopted by the client forest agency and its target audience. The project will accomplish financial sustainability only if it is implemented according to a planned business model. A successful project will also be characterized by its measurability; the right metrics require planning, combined with adaptations and adjustments along the way. Managers should be consistently mindful of whether original targets are being modified or replaced and ensure that changes to the objective—if any—are disclosed and consulted with stakeholders. It is also useful for project managers to define the scope of technology's role in a project, concurrent with what organizational and attitude changes are necessary for the technology to be best utilized.

LONG-TERM ENGAGEMENT AND SCALE-UP: PROJECT MWANA

Project Mwana in Zambia was launched as pilot project in 2010, but today it continues to function as a system that monitors and transfers information about medicine stocks, epidemics, and counterfeit medicine, HIV results delivery, beneficiary feedback, blood sample tracking, clinic reporting, and reminders to patients using the SMS platform RapidSMS.

The project's monitoring and evaluation efforts found that samples made their way from collection to caregiver an average of 56 percent faster and that 30 percent more test results were delivered by SMS than by paper.

Project Mwana was led by UNICEF Zambia in partnership with the Zambian Ministry of Health, along with the Clinton Health Access Initiative and the Zambia Center for Applied Health Research. The mobile network operators supported the project by making text messages affordable. While UNICEF brought the expertise with technology, the Ministry of Health gave the project legitimacy and the other actors provided health expertise. "From the very beginning," the program manager said, "we designed the system with scale in mind … negotiating with all of the major telecom companies in Zambia, knowing that we couldn't scale to the whole country unless it worked on all networks."

While the example refers to health, similar coalitions could be built to support new or enhanced forest governance activities. Mobile network operators aside, a number of NGOs offer networks of forest monitors as well as their own funds and professional scientific expertise. Moving beyond the pilots, scaling up or transforming projects into sustained[a] information systems, service delivery mechanisms, or specific activities requires several different things.

Source: http://www.unicefinnovation.org/projects/project-mwana.
a. The euphemism "self-sustaining" is commonly used in these discussions, though in situations where a government has adopted a policy of ongoing subsidy, the term loses its appropriateness.

One other observable characteristic from reports and research on ICT4D projects that successfully graduated from pilot status is that success was due to cooperation among a coalitions of actors, including governments, private companies, and nonprofit organizations. In the words of a manager for a health sector ICT project: "Most importantly, technology was the foundation, not the focus, of the program. The team went to great lengths to understand and strengthen the existing health interventions, not replace them with something new. And we did this in close partnership with the government and partner NGOs."[28]

Often pilot and full-scale implementation projects are launched without collection of baseline data or other appropriate metrics to later measure whether projects have been successful in reaching their intended targets. In particular, pilot projects often do not even set performance targets, proceeding instead with an approach of experimentation (proof of concept) followed by a general, unscientific discussion of whether they perceive a project to have been successful. Project promoters often launch activities simply to see what happens when a technology solution (for example, online reporting, interactive voice recognition system) is set up and if the technology works. However, more often than not, there is inadequate monitoring and evaluation to analyze if investments have led to changes in people's behavior or development outcomes. Making this analysis is particularly complicated if baseline data is not collected.

Despite a large number of pilot projects in e-governance in several sectors, there is relatively little information on the costs of these projects and what would be the resource needs. ICT projects are often cumbersome and all countries have experiences with projects that have had serious cost and time overruns. These may have been caused by either inadequate planning or changing needs during the implementation. Good cost estimates are essential as is monitoring of costs. It is also essential to recognize that some cost elements may be difficult to estimate and are not always well budgeted for. Particularly, if work is done by in-house resources rather than by external service providers, there is a risk that some cost components are not included in budgets. For example, while open-source software (see chapter 6.2) has lower licensing costs for the software itself, there may be high development costs. Better information on the economics of e-reform would be needed.

6 AVOIDING COMMON ICT FOR DEVELOPMENT ASSUMPTIONS

One oft-repeated programmatic mistake is to assume that if an organization creates or builds a new tool, then people will use it. This "build it and they will come" assumption has led to the creation of countless websites and resource centers. Even if ICT tools are often free or low cost, it does not necessarily mean organizations should create, for example, whole new information platforms from scratch, especially if a preexisting tool could essentially perform the same tasks.

It is also important to avoid assumptions about the true potential of technology as a part of projects with many other nontechnological aspects. Technology will most likely be able to help realize a project's objectives, but it may play a comparatively minor role compared with other components. Moreover, any ICT4D strategy should not be driven by the belief that modern equipment alone solves the agency's computation or communications problems. This assumption has been a common problem in many different contexts. As the Verifor Project noted, "Technological advance by itself will not bring about improved forest sector governance."[29]

Instead, investments in ICT tools should be based upon a well-informed understanding of how target groups use and perceive the value of technology. A paradox within the ICT4D field is that the more a particular group could benefit from cutting-edge technologies, the more likely these people are to need the tools to be simple. This is true because the greater the need, the more potential solutions there are.

Additionally, the introduction of new technology should be linked to institutional changes and reforms. The minimum requirement is that the processes in the forest agency and the underlying functions are clearly defined. If the agency has become irrelevant in its core functions, the introduction of new technology alone will not change that. It may become more efficient, but not necessarily more effective and, even less likely, more relevant for the public good.

ICT and e-governance reforms need to be based on a genuine commitment to improve governance outcomes and the quality of public administration and services. Political will is a necessary condition for any reforms. The forest sector actors do now see a need for improving governance, but it is not likely that introduction of technology in itself would lead to any notable change. Political will is an essential ingredient of governance reforms, and improving information management is a tool in implementing these reforms. Demonstrating various options for effective enforcement can become an element in the debate on how to improve governance. For example, if law enforcement needs to deal with forged permits and licenses, improved access to information on authorized logging would assist officials in identifying bogus documents. But at the same time, it needs to be recognized that technology is not helpful if there is no demand or will to use the information.

6.1 Data Availability

Much of the talk about open data neglects to consider that a dearth of actual, usable data may inhibit open data and open government programs. It may be necessary to work with forest agencies to either assist them in digitizing their information or to strategize for new data collection activities. It may also be useful to engage these institutions in a data source identification exercise wherein unconventional sources and types of data could be identified.

ICT is about managing data, making it more accessible and easier to process to become relevant information. However, it does not help if the underlying data is not available. For example, a 2010 global forest resource assessment found that there were 45 countries that had carried out a national forest inventory and only 22 countries that had done it more than once (FAO 2010). In the remaining countries, the sheer lack of inventory data will make it difficult—if not impossible—to share relevant forest resource information with the public.

Improving use of information and information technology in forest administration requires investments in a number of areas. In order to achieve genuine change to the development outcomes, there need to be changes in the institutional readiness and structures, in data availability, and finally in the technology itself. None of the three will lead to major changes by themselves.

6.2 Platform Choices

There is an ongoing debate in ICT4D work over the right technology, and one particular issue is whether organizations should opt for open-source or proprietary software. The question, however, involves more complexities than simple procurement decisions. The basic question is whether agencies should use expensive proprietary software that can more quickly and easily be used or integrated or opt for free and open-source software (FOSS) that might require more in-house expertise and maintenance. On the other hand, FOSS allows development of localized (for example, local language) versions if the agency has technical, human, and financial resources for such development work. The trade-off between the two can be succinctly understood as facing more upfront costs for the purchase of proprietary software versus more implementation costs over the long run for operating open-source software.

While proprietary software is likely to have more powerful capabilities than open-source software, it may be more difficult to master and to fully utilize. It might, in other words, not be worth purchasing if a forest agency does not intend to use, or is not capable of using, the advanced features. On the other hand, if an agency lacks in-house technical capacity, it may find itself constantly having to pay outside ICT experts to keep open-source software functioning smoothly, or to implement small customizations. If they have the human capacity, forest agencies can participate in the communities created to discuss particular software, contributing both questions and lessons learned, and thus share experiences with peer organizations.

There are user groups for both proprietary and open-source software, but the dynamics of the two types of community are different. Driven by their willingness to share and collaborate, the individuals

EXAMPLE

FOSS VERSUS PROPRIETARY GIS SOFTWARE

One example of this dilemma is embodied by the differences between the proprietary ArcGIS and open-source geographic information system (GIS) software such as Quantum GIS (QGIS). ArcGIS is a widely used proprietary GIS software produced by ESRI. As of 2011, the company had more than a 40 percent share in global GIS software markets. Licensing ArcGIS is considered expensive. A basic desktop license for one year costs $1,500.[a]

Development of Quantum began 20 years later, in 2002. While developer communities surround both software packages, they work differently. ArcGIS has three types of communities with 59 subtopics. QGIS has two main mailing lists, one for users, and the other for developers. Volunteer enthusiasts do much of the work done on QGIS. The organization, which features a "bugs" tab on its home page, welcomes "contributions in the form of code contributions, bug fixes, bug reports, contributed documentation, advocacy and supporting other users."

QGIS is visually less attractive, has less functionality, and is less stable than ArcGIS. And yet, a growing number of people prefer to use it because they think ArcGIS is too expensive and they are enthusiastic about the potential for collaboration on an open-source product. Currently, while there have been some technical difficulties in transferring data from ArcGIS to other GIS software, it is popular because, once it is learned, it works. It requires less technical (even coding) skills than QGIS. These issues capture the basis for different opinions.

a. Basic version for single users. Prices differ based on features required and client organization (http://www.esri.com/software/arcgis/arcgis-for-desktop/pricing).

OPEN-SOURCE SOFTWARE

Open-source software (OSS) is a computer software or application which is made available free of charge under special conditions. OSS can originate from public sector activities (for example, research projects, donor-funded development projects) or from the private sector. For the private sector, the business logic can often be found in fee-based services (for example, training, installation, and customization) linked to the software.

Using OSS is often proposed as a way to reduce costs in ICT applications. The assumption is that not using proprietary software and paying related license fees would make costs lower. However, it needs to be recognized that software license fees are only part of the costs of an ICT application. Costs related to customization, installation, training, hardware, and so on would still occur and they may be much higher than the license fees itself.

However, OSS may provide notable benefits as a development platform. It allows for (a) constant adaptation and upgrading of applications by local experts, (b) replication in other sectors, (c) flexible production of different language versions to cater for local minorities, and (d) replication of useful models in other countries. OSS is potentially a useful approach for increasing the use of ICT in a cost-efficient way, but it does not come without its limitations.

Source: Open Source Initiative (http://www.opensource.org/docs/osd).

participating in communities founded around open-source software have more of a stake in the future direction of the software. They are able to create new functionalities or modifications to the software rather than wait for the company to do so.

Perhaps the biggest difference between online communities for proprietary and open-source software is that, whereas open-source community members can help each other fix problems or run with proposed improvements, only the proprietary software maker can make any changes it its software. Moreover, communities focused on niche, or very specific aspects of open-source tools, are more likely to be formed as the software gains in complexity and adoption.

The choice to be more or less active in a software-centered community could be an individual one, but it could also reflect a forest institution's views or attitudes to the ICT tools it uses for governance. Either way, given the evolution of ICT tools, the experiences and lessons learned by all forest institutions would be shared with their counterparts globally.

For a forest agency interested in innovation, some form of institutional transformation is necessary to initiate sharing habits. Much of the transformation, fortunately, is conceptual. It starts by redefining how an organization understands itself such that new forms of collaboration are viewed as positive and necessary.

PART II: GUIDANCE FOR COMMUNICATION TOOLS

7 DESIGN PRINCIPLES

The set of technological tools available to forest institutions and stakeholders is evolving and expanding. New software and hardware innovations seem to embody the very word "innovation"; many of the most useful innovations actually involve creative and practical applications of existing tools. Many of the practical innovations come from practitioners in the field. Others come from individual entrepreneurs or via processes of social innovation, in relationship with the private sector. This diversity demonstrates that development in the ICT field cannot be designed to be led top down.

Technological development is rapid and practitioners may find it difficult to keep abreast of all recent developments in technology. By the same token, these rapid changes have led to a decline in the costs of ICT tools (including hardware, software, and external data) and many software tools and data sets are free for users. All this has made new technology widely available. On the other hand, it is also critical to recognize that these tools cannot be expected to magically solve all of a forest agency's problems. But they can, if applied strategically, increase the speed, professionalism, efficiency, and effectiveness of an agency's work.

The reality is that introduction of ICT tools is as much about organizational change as it is about the technology itself. Senior management and cadre professionals at all levels—not just the IT staff—need to claim ownership over technology development and solutions, even if they are only end users and not familiar with the technologies themselves. Crowdsourcing activities, for example, require an organizational commitment to transparency and engagement by authorities, not just the introduction of a new technology. Forest agencies need to recognize and nourish the symbiotic relationship between concepts and the practical manifestation of concepts as tools and strategies. Specific knowledge can change views about what is conceptually possible, thus evolving concepts beg to be turned into reality. This dynamic requires forestry agency leaders to identify staff with the aptitude for small-scale innovation, because all tools require some measure of localization and customization for each circumstance. Leaders must also empower their staff with the space to experiment, which comes with the implicit acceptance that not all experiments will produce successful results. Development in the ICT field is risky.

This section builds upon the set of key recommendations and conceptual framework provided by Castrén and Pillai (2011). The set of 10 key design principles for ICT and forest governance outlined in Table 7.1 serves as a guide for forestry professionals thinking through the options and resources needed for practical application of ICT tools. In some cases, a person with good general technical knowledge will be able to use the tools proposed in this report, while in other cases it would be necessary to utilize the skills of a professional coder or computer specialist. In either case, the forestry agency professional will benefit from building upon the ten guiding principles.

TABLE 7.1 TEN KEY DESIGN PRINCIPLES FOR ICT DEVELOPMENT IN THE FOREST SECTOR

1. Be familiar with national ICT policies and e-readiness.
2. Define the problem clearly, assess the information needs, and compare possible solutions.
3. Determine the best entry points and the appropriate technology.
4. Design culturally appropriate and relevant applications.
5. Involve end users and publicize the service
6. In designing projects, consider costs, long-term financial sustainability, and scalability.
7. Address data security and privacy issues, and develop risk mitigation measures to prevent misuse of technology and inaccurate data.
8. Ensure the existence of adequate information on the resource (for example, forest inventories and resource assessments) or the ability to improve data collection.
9. Identify stakeholders (for example, indigenous peoples, women, and the rural poor) and try to ensure their participation; avoid elite capture.
10. Ensure buy-in from forest authorities and other stakeholders.

Source: Castrén and Pillai 2011.

With these principles in mind, this report provides practical explanations of some common and useful applications of ICT tools for five main areas of activity: (1) data acquisition and use, (2) communications, (3) engagement, (4) organizational coordination, and (5) measurement, monitoring, and evaluation. It is likely that any forestry institution, when evaluating the potential for ICT tools to improve and enhance its information collection and organizational coordination activities, would choose among these commonly used tools and approaches.

There is no single way of ensuring that forest agencies are able to go through a successful e-transformation. There are several limiting factors and many of them fall outside the realm of an introductory presentation like this report.

First, it is important for forest agencies to understand that there is no single route or formula by which it should proceed to deploy or integrate ICTs into its work. It is likely easiest for institutions to first pursue e-governance activities that are under their control and that rely on existing staff. Based on the field experience in Lao PDR and Moldova, it is evident that in countries where the initial knowledge and e-readiness is limited, a gradual approach to introducing ICT and e-governance is more appropriate compared to extensive reform at one time. Also, while this guidance focuses heavily on a variety of useful technologies, understanding how people and organizations interact with these technologies deserves equal attention.

Second, ICT can be used in a number of ways and these different uses require different levels of technical knowledge. This report focuses on issues of open data, communication with the public, and crowdsourcing. Other issues, more technical and internal to forest management bodies, are related to, for example, forest inventories and remote sensing (RS). These topics—while vital in professional forest management—are not part of this report.[30]

Preparing for an ICT project requires much of the same information as many other development projects. First, in order to make informed decisions about which e-tools would be useful, a forest agency officer should know several basic facts about the country and operating environment. Second, the agency should carefully consider how existing assets and capabilities need to change and how the possible effects of new tools could alter its internal operations. The foundations for e-transformation are built by fully understanding the key drivers of reform: the external operating environment and the internal situation in the organization.

7.1 External Operating Environment

The application of technology in support of forest governance should be appropriately tailored to the economic and social realities of the country. Different aspects of the operating environment will be more relevant at different times and for different tools, and it is not necessary to take everything into consideration at once. Given the ostensibly endless range of considerations that could fall under the "operating environment," the evolution of technology and the variation between countries, it is not possible to give precise or universally applicable advice. Nevertheless, by starting with these key areas it is possible to launch a comprehensive discussion of the most important factors. Some of the key facets of the operating environment include, but are not limited to, the following concerns:

- **Economy:** What is the overall state of national economy and fiscal situation? What are the main economic activities related to forests and what is the importance of forests to the national economy?
- **Forest:** What is the overall structure and status of the country's forests? Which species are endangered and are there sought-after high-value species? How widely spread is informal subsistence use of forests? How accessible are the forests?
- **Forest-related income and economic activity:** Which types of businesses use wood products either for final products or as a part of manufacturing processes? What is the overall income generated from forests in the country? Which specific trees and which specific regions are the most important in terms of forest-related economic activity? Is wood harvested mainly for domestic consumption or export?
- **Infrastructure:** Do people have reliable electricity? Are mobile phones and broadband services available in most parts of the country? How mobile or isolated does public transportation leave citizens?
- **Internet:** What is the level of Internet penetration? What is the percentage of smartphones in use? Do people primarily access the Internet via their mobile phones or at home or at third-party Internet kiosks and cyber cafés?
- **Public ICT usage:** What proportion of the population is computer literate? What proportion of the population has access to the Internet? How is social media used in the country? Are there national e-development programs or wider, whole-of-government e-programs and policies? Is there a vibrant private sector and informal "hacker community" that could provide e-services?
- **Media:** What are the amount and type of media in the country? Where do people get their news and information? Do the sources and behavior differ by age group, region, or in specific characteristics of particular groups of the population?

7.2 Internal Factors and Organization

In order to initiate and manage a successful ICT transformation, organizational leaders face many complicated and difficult decisions. It is essential to decide who will do what, what professional development staff need to make the change, and whether any skills or individuals are redundant under the new operational paradigm. Management should also take into consideration how an influx of new individuals with new sets of skills might affect the workplace. If a group of young new ICT specialists come into an organization, for example, they may be more interested in technology than forests. If agency management is new to the technologies introduced, they may find it challenging to estimate the amount of time and other resources needed for a staff member to be trained or for software to be developed or adapted.

It needs to be recognized that not all changes have to happen at once, and gradual introduction to e-transformation is in many cases more appropriate, allowing management and staff to learn as new approaches are introduced. As a change process proceeds, forest agencies should take into account several key considerations:

- **Institutional development and setup:** Are the role and functions of the forest agency clear and is the legislative framework up-to-date? Are major institutional reforms or changes to relevant legislation expected?
- **Capacities:** What are the available ICT skills and capacity? Is it the expectation that transformation is implemented by in-house experts or are there plans to outsource some services or activities? How well equipped is the agency in terms of technical equipment and connectivity?
- **Training:** Are there trainers available in the country for a new ICT initiative? Are there appropriate training facilities?
- **Clients:** Who is the ultimate client for the agency: the general public, other parts of public administration, parliament? Who expects information or services from the agency and what type of information is available? Will any new types of information provided to the public generate new audiences or citizen activity? What are the accountability structures?
- **Management:** Does the agency management have a special focus on information, data, and knowledge? Is there a dedicated senior manager in charge of information development and knowledge management (that is, a chief i**nformation officer)?**
- **Budget:** Are funds available for a new activity and are the resources mainly available for staff costs, investments, or recurrent costs? What will the recurring costs be of an ICT activity?

The following sections aim to provide forest agencies with guidance on some of the key tools that enable forest-related e-governance activities and services. The main focus is on communication and engaging with the public. These descriptions will also help with the challenge of laying a well-considered groundwork prior to the outset of institutional transformation. This information is intended to free agency decision makers from the circular problem of needing to know what ICT tools are capable of before they can even begin to learn what these tools do.

8 INFORMATION MANAGEMENT AND E-GOVERNANCE

While the Internet and mobile phones are nothing new for forest agencies, the evolving specific concepts, niche tools, and applications require dedicated consideration. Tools evolve faster than widespread comprehension of their usefulness, meaning that there is a large amount of unused potential technological application. Technology levels the playing field, removing much of the distance between officials, forest users, and stakeholders.

The relative ease of collecting and producing more data and information presents agencies with unavoidable questions, particularly in relation to its human and financial resources: what types of information and data should it collect and distribute? Should lowered transaction costs of information collection and distribution change the very character of forest institution? Should an agency use technology to involve the public in governance processes?

As agencies begin to grapple with these and other questions, it becomes obvious that the change character of communications technology requires a new self-conception for forest agencies. Understanding the specific capabilities of the main technologies helps move this reconceptualization process along. Accordingly, seven important tools are considered below: data management; mobile data collection (data collection by SMS and mobile data collection on smartphones); mapping and data visualization; community mapping; forest-specific software; cloud computing; and social network analysis software.

8.1 Managing Data

Forest data is the essential element of many ICT activities. Precise information about the state of a country's forests enables better policy design and implementation. Forest managers planning for an ICT activity should think through the life cycle of data, from collection to storage and integrity, to analysis, to mapping and visualization, to remote access and sharing with the public, other state and local administration, parliamentarians, the private sector, and other interested parties. While doing this, it is important to think through the format of the data; who will have virtual or physical access to servers; which devices will be used to collect and disseminate the data; and who the ultimate consumers of the data or data products will be.

Example of data management planning: If the intention is to eventually display the data on a map, then it will be important to geocode the data at the beginning and to be aware of the accuracy of the coordinates. "Geocoding" means adding longitudinal and latitudinal information to data in a format that mapping software can use to accurately place the data on a digital map. It is always easier and more cost efficient to collect all the relevant data in one go rather than separately and to err on the side of caution. As an example, modern GPS-enabled smartphones and other handheld devices allow collecting georeferenced information at no additional cost. Therefore recording this can become useful even if there are no initial plans to share the data in maps. In most cases, it would be impractical or too expensive to include such additional data afterward.

8.2 Mobile Data Collection Tools

Entering forest monitoring data into mobile devices and sending these data to a central location dramatically increases the overall speed of data collection, improves accuracy of the data, increases its manipulability, and allows agencies to react more quickly to trends that analysis of the data identify. Recent technical development has dramatically changed mobile data collection, making it a cost-efficient and easy option.[31]

There are two main approaches. One utilizes the SMS function on basic phones to send data; the other utilizes custom forms on phones into which data points are entered before they are submitted. In both cases, a computer program automatically sorts the data received. In order to choose between the two options, forest institutions should determine

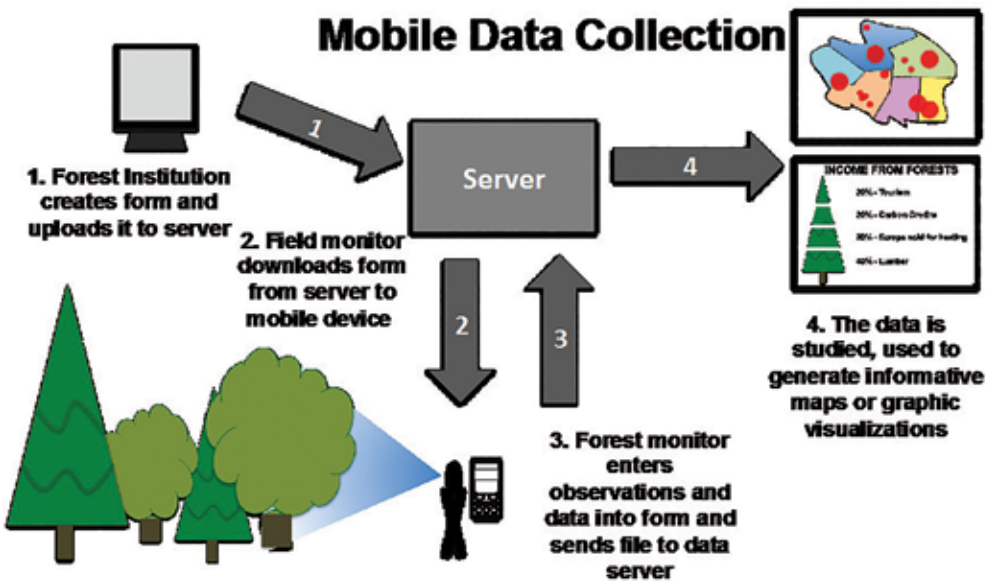
- Whether to purchase phones for a project or rely upon enumerators' own phones;
- The current available budget and likely future budget levels;
- The level of literacy, numeracy, and technical literacy of enumerators; and
- How much technical capacity there is available on staff or available for hire.

Data Collection by SMS

Data collection by SMS is an easy and low-cost method of mobile data collection. Effectively, any mobile phone can be used, although the technology is more limited than more advanced data collection systems.

In SMS-data collection, individuals—the general public, forest officials or officially trained enumerators—send text messages to a central location, providing data points from a certain area (Figure 8.1). The content of the message can be free-form (that is, people can text in whatever they want) or with only predefined messages or codes accepted. If the content of the messages is predefined, it can be automatically sorted, analyzed, and visualized. Regardless of the type

FIGURE 8.1 MOBILE DATA COLLECTION



of phone or carrier, an SMS is limited to 160 characters.[32]

SMS is one of the most widely used applications for mobile phones and people are generally familiar with the technology. Therefore, when engaging the general public, SMS reporting can be a very efficient tool for increasing citizen participation in forest monitoring and for increasing the total number of observations available to forestry institutions. Forestry institutions can easily remotely replenish the airtime that enumerators use and add additional airtime as a means of incentivizing continued monitoring. SMS is also a two-way media, there are a number of applications in other sectors (for example, health and agricultural extension) where individual and public service announcements are delivered by SMS.[33]

This technology can also be used more informally. For example, a forest agency can simply issue an appeal to the general public, an effort commonly referred to as crowdsourcing. This approach can sometimes lead to unexpectedly useful results. However, it may also introduce a significant demand on the agency's time, as results can be numerous and random. Crowdsourcing also introduces management challenges, since each individual contributor will want to know that their voice has been heard and that their contributions have been taken seriously.

The main advantages of collecting data via SMS include its low cost and its availability on even the most basic of mobile phones. The software required for various aspects of SMS reporting and data collection allows for automated sorting and data visualizations. The software is also usually free, making SMS data collection a very low-cost option, where the overall cost depends on the number of expected messages delivered in the system and if handsets need to be procured separately. There are, however, some disadvantages in using SMS as a tool for data collection, including that a single mistake in a message can result in submissions being incorrectly processed. Also, the complexity of the conveyable information is limited by the 160-or-less character limit.

Examples

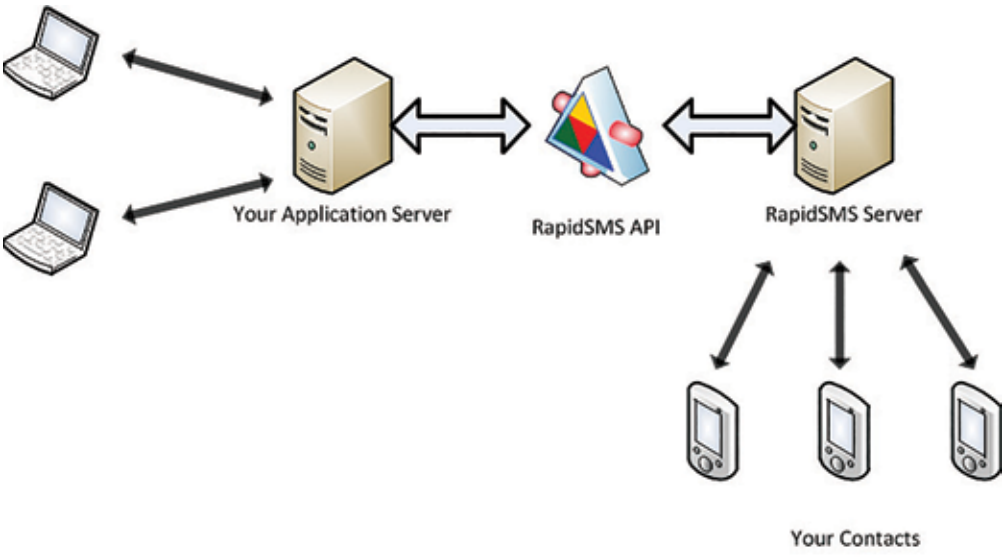
In Cambodia, a consortium led by Pact ¬(a U.S. NGO) used FrontlineSMS forms to monitor a project delivering Voluntary Carbon Standards (VCS) verified carbon credits from a community forestry project.[34] After producing this relatively technical report, the organizations decided to expand use of the tool into more coverage areas. Their experience also highlighted the value of involving target communities in assessing the data.

Both FrontlineSMS[35] and RapidSMS are free and open-source tools utilizing SMS for data collection, and they have the important capability of processing and sorting incoming SMSs (Figure 8.2). The choice between these and others depends on the intended scale and nature of use: for example, FrontlineSMS is generally considered to be more user friendly and easier for the nonexperienced user, but is not ideal for implementations involving very large groups of enumerators or for situations where a large amount of customization is required.

Useful Guide

The Ashoka Changemakers SMS Quick Start Guide[36] delineates the process for understanding the advantages and disadvantages of using SMS for data collection. It covers the basic equipment required, normal setup procedures, challenges, and costs, and directs readers to various relevant case studies.

FIGURE 8.2 THE FLOW OF DATA IN RAPIDSMS



Source: www.rapidsms.net.

Mobile Data Collection on Smartphones

Using more advanced smartphones for data collection allows for more detailed and complicated systems and the incorporation of different media in data collection. At the same time, costs and user requirements are higher than with SMS data collection.

This form of mobile data collection relies upon forms that are installed or downloaded on either smartphones or tablet computers. Forms are created by the organizers of the data collection using spreadsheet software (for example, Microsoft Excel or Open Office), saved in the normal spreadsheet format (in Excel, *.xls), and uploaded to a forms server. Enumerators download the forms directly to their smartphones through the Internet. Completed forms are uploaded to a central database. In addition to text, existing mobile data collection tools allow for the inclusion of photographs, videos, audio recordings, and, if the device has GPS, the geographic coordinates from the data collection site. These additional options can add to the veracity and usefulness of the other information collected.

Mobile data collection platforms such as Open Data Kit (ODK) are free and highly customizable. Indeed, many popular tools are built on top of ODK (World Bank 2013). There are also several proprietary systems that may require less technical knowledge from the organizers but are more costly to operate. The choice between the options depends on a number of factors: detailed technical requirements and capabilities of the systems as well as budget and knowledge available in the organization. Generally, mobile data collection has universal benefits to essentially every type of public services administration. At the same time, the platforms require smartphones and specialized training, making it potentially expensive to run large data collection operations.

Examples

The Surui Forest Carbon Project[37] uses ODK to collect data and information about the Amazon forest for the global carbon market.

Other software packages that can be used for smartphone data collection include FormHub, Kobo Toolbox, OpenROSA, Poimapper, and

DoForms.[38] All of these tools are examples of mobile data collection platforms, including both free and open-source tools and propriety products. They all have slightly different features and project managers will need to make the most appropriate choice following a comparison based on case-specific criteria.

Useful Guides

"Mobile-Based Technology for Monitoring and Evaluation"[39] is a helpful guide that provides the reader with a useful comparison between collecting information on paper and on mobile devices. It also provides useful graphics on how data flows between devices and servers, broken down by various mobile data connection speeds. It also provides a cost breakdown of the various mobile device options.

World Bank (2013) provides an in-depth summary of various technologies that can be used to collect monitoring and evaluation data in rural development projects. It covers smartphones but also other tools that can be used. The guide is linked to a website (http://solutionscenter.nethope.org/) that lists a number of applications and service providers, allowing project implementers to compare options.

8.3 Mapping and Data Visualization

Data needs to be presented in a clear and visually attractive way when disseminated to the public. Nonprofessional audiences, in particular, need to have access to data that is easy to read and does not require extensive background knowledge. Extracting insights from data can be difficult if the data is, for example, organized in spreadsheets or complex tables. Often, presentation of data in maps and other visual tools is needed. Mapping requires careful planning and execution. It is important that data can be placed accurately in a map, such that it is possible to make accurate observations and comparisons.

Designing accessible visualization of data requires addressing a number of issues related to both visual and technical design. Particularly in developing countries, there is a need to accept a trade-off between high-quality, innovative graphics and visualization on the one hand and accessibility through narrow bandwidth on the other. Thus, at the design stage, it is necessary to plan appropriately to ensure wide access to maps or other data visualizations. This includes taking into account issues such as how graphics-heavy a map should be in low-bandwidth environments, whether the data will only be accessible online or will also be available for download, and whether maps can be viewed on a mobile device, to name just a few.

Other important issues to consider are the user experience—visualizations cannot be too complex for the average level of education among the target audience or the average person's attention span—and how a forest agency can best retain the interest of the public and the press.

How It Works

At a basic level, mapping involves collecting geocoded data that is fed into computer programs that plot the data points onto a map. Data visualizations can be either the products of a computer program or insightful visual explanations (pictures, graphs, and so on) of data.

One particular benefit of mapping is the many new insights into data that emerge from the layering of several different yet related geocoded data on a single map. When developing data visualization applications, forest agencies should identify which data they have at their disposal, and which data they could acquire from other

sources. It is also useful to think through the realizations that could come through layering different types of data. For example, it is possible to overlay tree species densities with predominant types of economic activity and make correlations between the two.

Finally, it is important to make sure the file format used during data collection (for example KML, or Key Markup Language), can be read and plotted efficiently by the mapping program used. Development Seed's TileMill[40] map generating tool, for example, has been designed to be flexible. It can read several different file formats, allowing interaction with other programs.[41] The World Bank offers a special site with data visualization tools.[42] Additionally, an Internet search of the words "data visualization" will return many stunning and useful examples.

8.4 Community Mapping

Community or participatory mapping has been used in rural development projects for a long time. Technological change allows a vast expansion of the model from the previously applied mapping for participatory local planning purposes to more widely applied models that share many characteristics of crowdsourcing (see chapter 10.1). The objective is to make it easy for any community member who wants to contribute to the map to do so. With computerized mapping tools, unlike with traditional mapping methods, this can be done on several occasions and over a longer time period. With constant updates, the map becomes a community resource, empowering previously unknown community members and stakeholders to represent themselves. It may also be necessary to organize separate community events to lay the basis and ensure wide participation, but allow contributions online afterward as well.

Community mapping could complement and be a useful contribution to forest agency–led mapping because giving community members a sense of ownership may lead to their contributing more information than they would provide to a visiting agency field officer.

Examples

Humanitarian OpenStreetMap Team (HOT)[43] is one organization that has worked with the World Bank on community mapping projects. HOT produces a tasking tool for community map managers, allowing them to efficiently coordinate the activities of community mappers.[44] An interesting community mapping application is Water Point, which is a crowdsourcing tool for mapping the distribution and status of water and sanitation services. It is based on collecting GPS-referenced data on water and sanitation and presenting the data on Google Earth's platform.[45] While this is a water-specific example, the same approach could also be valuable for a forest-related topic. It also shows that community mapping and crowdsourcing are complementary.

Quantum GIS, Grass, MapServer, OpenLayers, OpenStreetMap, Ushahidi/Crowdmap (open-source), and ArcGIS (proprietary)[46]—these programs offer a variety of tools for accurately layering different types of information from various data sources on digital maps.

FIELD EXPERIENCES:

COMMUNITY MAPPING IN INDONESIA ON INDIGENOUS LANDS

In Indonesia, local activists hope that good maps will be their best weapon in fighting a land grab by wealthy and powerful interests that has been under way for centuries. This new type of indigenous activism is taking root in the thin soils of Borneo, and at its root is the hope that sophisticated interactive maps—incorporating the precision of GPS satellite tools with cultural and land-use information that can only be obtained from residents on the ground—will convince governments to better defend traditional cultures and the natural resources they rely upon.

So the mapping project—part of an effort by civil society groups in Indonesia to chart land occupied by traditional communities—is designed as a tool to try to convince local and national governments to deal with traditional communities in a different way. The mappers want to help local people lay down their claims to land and prove how important it is to their well-being.

The project activists and community member are afraid that without evidence in the form of a map or land certificate that shows land use, it is easy for logging, mining, or palm oil companies to get licenses from local governments. They simply claim the land is unoccupied and move in. Overnight, long-term inhabitants of a patch of forest can be redefined as squatters and trespassers.

A map that has been signed and approved by the community can provide testimony of how indigenous people manage the land.

Source: Schonhardt 2013.

8.5 Forest-Specific Software

Sometimes forestry institutions choose to build software tools specifically suited to their data storage or computational needs. Moldova's forest agency, for example, developed tools for automated tree volume calculation and the graphical display of forest parcel records in this project.

Before starting application development only for the unique use of one institution, it is essential that project developers survey existing software packages. For example, the FAO has developed professional ICT applications for forest institutions under its Open Foris program.[47] These tools are open source and intended for use by national forest institutions. The current components include Open Foris Calc, Open Foris Collect, Open Foris Species Editor and the Open Foris Geospatial Toolkit. The Open Foris Geospatial Toolkit is designed for creating GIS/RS maps. Open Foris Collect is designed to enter site-specific data originally collected on paper or with mobile devices, applying the FAO's Inventory Data Metamodel.[48] This data, once entered, can then be imported into Open Foris Calc, which can calculate volume, carbon levels, and biomass and use the data for mapping. The FAO is also working on a forestry-specific mobile data collection tool for Android.

8.6 Cloud Computing

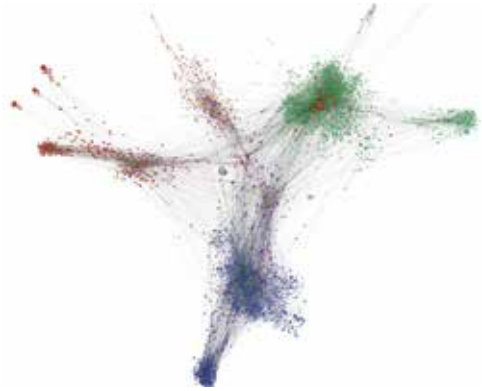
There are several services provided on the Internet that can automate or store information for forest governance activities. Utilizing these services on the Internet is referred to as cloud computing. The "cloud" refers to data and applications stored and run on computers and servers in a separate and usually unknown location. Conceptually, cloud computing is a form of outsourcing, particularly for processing, managing, and storing data. Usually it saves organizations time and money to use these cloud services, though initially there may be a learning hurdle for organizations to overcome.

For some, transitioning from storing data on a computer in the office to storing it in the cloud is a worrisome prospect. They worry about unauthorized access or use of their data by an unknown third party. The realization, though, that cloud data storage and other services have a high level of security and reliability usually assuages their concerns, particularly if agencies' own data management infrastructure and backup processes are not reliable. Many cloud services are also easy to use and accessible through various platforms.

8.7 Social Network Analysis

A small but growing focus for research on ICTs and forestry involves the use of special software to analyze social networks and their relationship to forests. At its most basic level, social network analysis reveals the existence and strength of relationships between people or organizations. The people and organizations are referred to as nodes, and the links between them are the ties. These relationships are captured in graphs generated by the software, heuristically enabling the identification of characteristics of the relationships previously unknown (Figure 8.3).

FIGURE 8.3 EXAMPLE OF SOCIAL NETWORK ANALYSIS GRAPHIC SHOWING NODES, TIES, AND GROUPS



Source: Gephi.org.

Social networks and stakeholder analysis are essential elements when developing forest governance and could contribute to, for example, beneficiary mapping or identification of value chains and networks in illegal logging. Analysis of criminal networks could reveal previously unknown ties and lead to enhanced understanding of the identity of key operators in an illegal logging network.

How It Works

Social network analysis requires use of special software used by an experienced user. As in all data analysis, the product of an analysis generated by software will depend largely upon the availability of good data. Even with good data, the graphical settings need to be fine-tuned to yield visually comprehensible and, therefore, useful results.

Gephi is an example of a free tool.[49] Training is available through a free, online university-level course in social network analysis.[50]

9 COMMUNICATIONS

Improving transparency and accountability requires active communication with all stakeholders. Engaging through media is also a way of ensuring buy-in to policy decisions among the general public. Social media and other new tools provide forestry institutions several opportunities to enhance their communications activities, engage the public, and to get feedback on their work. Most of the common tools are free and Web-based, and available for both institutions and individuals. Effective communication needs to use all kinds of media, and, in most cases, traditional means of communication (print media, posters, radio, community meetings, and so on) cannot simply be replaced by new media. However, on many occasions they may complement each other. When planning communication, it is also essential that no stakeholder group becomes excluded as a result of the choice of the media. For example, groups like the elderly, speakers of minority languages, people with disabilities, or the illiterate need special consideration and easily can be excluded by new media.

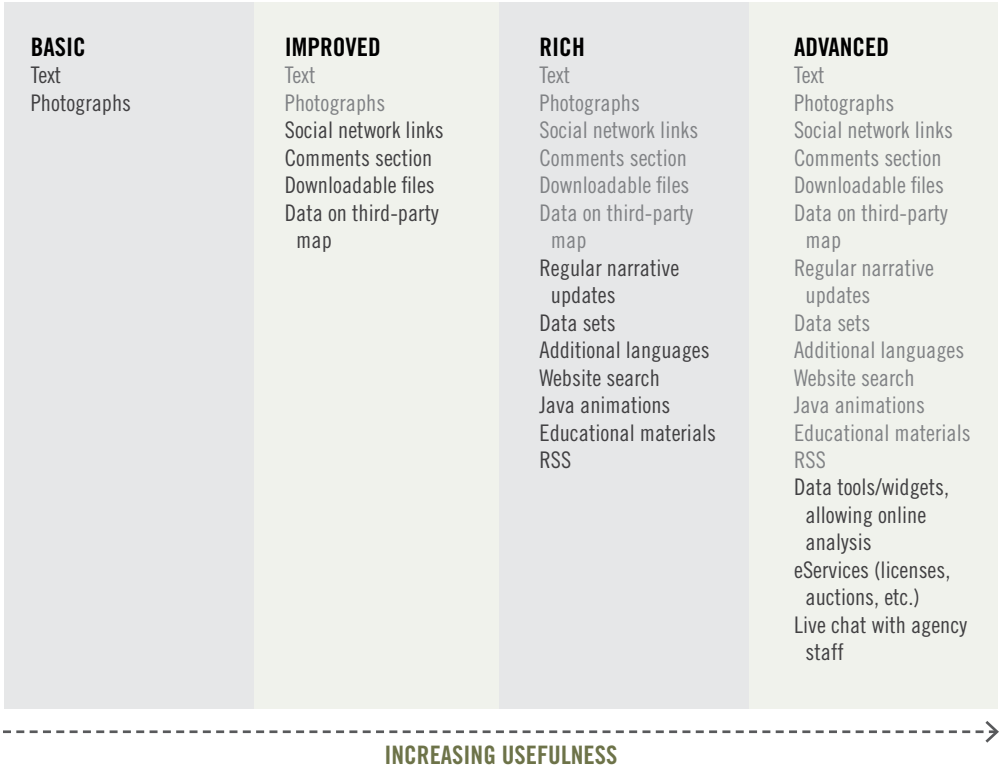
9.1 Websites

It is common for a forestry agency to maintain an institutional website. It is less common that these websites take full advantage of all features that a well-designed website offers in terms of communications, audience engagement, and e-government services. They are also often updated inadequately and populated with outdated and somewhat random information.

Designing a website is a trade-off between its usability and resources needed to develop and maintain the site. The richer and more engaging a website, the more resources are required to set it up and to keep it running; the more feedback requested, the more user interface needs consideration; the more the public is involved, the greater the transparency and accountability, and the greater the chances the public can help improve the reach and efficacy of the agency's work. The website design needs to identify the intended uses and resources available. **Figure 9.1** captures many useful website functionalities, proceeding left to right with increasing complexity, cost, and audience engagement.

Many development projects have set up their own websites. These can be effective tools for a project to engage with stakeholders, to disseminate publications, or to inform key audiences. Due to the dearth of Web content in local languages, one effective use of funds is increasing online content in local languages and dialects. This is particularly valuable if done in the original script and if it can be confirmed that the target audience has ready access to the Internet. However, for websites to be a good use of resources, it is essential that there is a realistic plan and adequate resources to keep them functioning and useful even after a project's completion.

FIGURE 9.1 FOREST AGENCY WEBSITE OPTIONS



Website development tools are increasingly widespread and most countries and particularly urban centers have private service providers who can be contracted to develop a website for a forest agency. However, it is essential that the agency itself also be engaged in the design to make sure that the site meets its communication needs. It is also essential that the agency has a designated webmaster on staff whose job it is to maintain the organizational website and update it actively with updated information.

9.2 Social Media

The world's largest social network offers forest agencies a venue for communicating with the public in a forum where they are already active. Given the massive level of global users, there is a good chance that much of any a target audience in a country will have a Facebook—or other, locally popular social network—account. Typically, governmental organizations use social media to increase the reach of their communications activities and to engage with audiences. A forest agency could post maps or pictures to convey information, such as the location of forest fires, available recreation zones, or sightings of dangerous animals. It could encourage concerned citizens to like its Facebook page. As its usage continues to grow, the potential of Facebook and other social media as a tool for strategic communication also increases. For example, Facebook has a special page for organizations to create their own accounts.[51]

Flickr[52] is a social photo-sharing site that is useful for organizations wishing to share a large number of photos with the public or a specific group of people.

Twitter[53] is the world's most popular microblogging site, offering a large range of creative applications. Twitter can be useful for forest agencies looking to make announcements to the public via the Internet and mobiles phones. It can also be used for efficient organizational coordination. In Twitter, users create accounts and post short messages—"tweets"—that are received by people who have explicitly chosen to "follow" an organization or a person's posted messages. Tweets are limited to 140 characters.

Twitter can be an efficient way of disseminating news and following trends in public opinion. For this to happen, it is essential that the main forest agencies' key audience is using the service. Second, for the agency to keep followers engaged, the agency needs to be active in Twitter and share information and news frequently. The same applies to all online and social media.

These are examples of some globally recognized social media services. There are also many others and in some specific countries, other services are also well known and sometimes more widely use. For example, Mxit is a popular instant messaging system in South Africa and Weibo is a popular microblogging site in China. When developing a social media strategy, it is essential that local market conditions are analyzed first and that the tools selected are widely used or expanding in the target areas.

9.3 Broadcast Media and Community Radio

FM radio remains a primary source for people to access news, information, and entertainment. In particular, community radio is often grounded in the communities where stations are physically located, engaging people with local information. Establishing partnerships with these stations could enable both communication of messages to communities and community dialogue around forest issues.

It is possible that potential partner radio stations already have experience in using SMS for audience engagement, for example, so that all a forest agency need do would be to provide the content for text messages.

Radio stations typically broadcast a mixture of news, music, interactive, and informational content throughout the day—sometimes in multiple languages. One of these program formats could be suitable for informing the public about forest governance issues, or engaging them in on-air discussions about forestry issues. Some radio stations have programming where the radio journalist seeks information from the Internet based on listener requests and shares the results with the audience.

FIELD EXPERIENCES:

HOW CAN COMMUNITY RADIO BENEFIT FOREST GOVERNANCE?

Fighting corruption and increase awareness of citizens' rights: In Malawi, the Development Communications Trust (DCT) broadcasts "village voice" recordings from a network of radio clubs around the country, which report (among other things) on local level delays, corruption, malpractice, and mismanagement by service providers, including international NGOs, and local authorities and politicians. These problems are then broadcast on national radio (MBC), and the ministry, individual, or organization responsible is invited to reply on air in the context of a mediated dialogue with the community in question. The DCT says that 70 percent of radio club problems are resolved satisfactorily after they have been aired nationally. It is currently supported by UNDP, Oxfam, and the Malawi national AIDS body (DFID 2008).

In Sierra Leone, KISS-FM in Bo and SKY-FM in Freetown have been reporting on corruption and governance. The station started a series called "Mr. Owl" to report on local police corruption. This resulted in increased pay for the police and the establishment of a community affairs department. A voter education program, "Democracy Now," resulted in higher voter turnout in the station's listening area compared to other parts of the country.

Increasing women's empowerment: USAID's Women in Governance (WING) pilot program in Mali distributed more than 500 Freeplay radios to women's listening groups in April 2004. The radios were designed for rural African conditions and can function on batteries that can be charged either manually by winding or through solar power.

Increasing awareness of environmental issues and public participation in policy development: In September 2009, Developing Radio Partners (DRP, a U.S. NGO) launched a year-long pilot project—Our Environment, Our Future—that brings residents information they need in the way they can best use it, by radio. DRP is working in partnership with Breeze-FM, a community-oriented private station in Chipata, Zambia, with six radio stations in rural Zambia and Malawi. The project helps the six stations create and broadcast local environmental programming. It also encourages innovative use of mobile phones to expand the stations' interaction with listeners, using the text messaging software FrontlineSMS (see chapter 8.2). The project is helping build skills in environmental reporting and in developing relevant content, for example, the impact of deforestation on local agriculture, sustainable farming methods, and many others.

Source: Myers 2010, USAID 2005, and http://developingradio.org; from Castrén and Pillai 2011.

9.4 Group SMS Messages

It is also technically simple for a forestry institution to use SMS to broadcast messages to a large group consisting of both members of its staff and the public. One commonly accepted principle is that messages—unless emergency warnings—should only be sent to those that have "opted-in" to receive them in advance.

How It Works

If a forestry institution plans on sustained use of SMS messaging, it is possible to purchase bulk SMSs online at a discount and to utilize the same tools to send their SMSs as for mobile data collection. For irregular use, however, it is simpler to compose the messages and have one or more partner mobile network operators send them out for a per-message fee.

Many of the tools that can be used for data collection by SMS can also be used for group SMS messaging (see chapter 8.2).

10 ENGAGEMENT WITH THE PUBLIC

Forest agencies that adopt strategies for using ICTs for public engagement increase the chances of succeeding in their more traditional roles. The tools can be used to inform and educate the public about the agency's role and current activities. Reaching out to the public for its opinion can give a country's citizens a sense of ownership over the management of their forests. It is most important to note here, however, that tools can be used to leverage public interest in maintaining healthy and sustainable forests so that both organizations and individual citizens become willing participants in extending the reach of a national forest agency's governance activities.

The selection of technology for engagement is very much dependent on the level and type of communication needed. As an example, a forest agency's management will require timely summary data and the possibility to get more detailed information as needed. On the one hand, communication channels are well established and the recipients are familiar with the topic. On the other hand, the general public will need less timely information but, at the same time, may require more diverse media and more background to the information provided. This increases costs. Creating an appropriate engagement and communication strategy requires balancing these different needs within the available budget and legal requirements (see also chapter 4.5).

10.1 Key Concepts

Crowdsourcing

In simple terms, crowdsourcing is requesting help or participation for completing an activity or solving a problem. It is important to consider for how long a crowdsourcing activity might take place. Both temporary and open-ended appeals to the public make sense in different circumstances. While a campaign with a limited time frame might increase participation because of a sense of urgency, a forestry institution might also want to maintain, for example, an illegal logging hotline operating with an open-ended mandate.

An agency needs merely to request input or assistance from the public in order to crowdsource. Organizing the receipt and use of feedback requires more planning. Some good examples include a comments section on an organization's web page, an e-mail address, a wiki, a web page dedicated to a crowdsourcing effort where people submit ideas or entire proposals, or simply an answering machine.

More complex and important than the receiving of the information is its utilization. It is important to manage expectations so that people are not disappointed with an agency's response (or lack thereof) to their input. An agency might try to incentivize participation with prizes or recognition.

Costs

Often the most costly aspect of crowdsourcing is processing what the "crowd" submits. The richer the information requested or provided,

the more staff time will be necessary to process it. For example, if a forest agency requests photographs and videos of insect-infested trees, it may receive thousands of videos and hundreds of hours of video. The material could take weeks to sort. Alternatively, if all an agency requests is an SMS containing the name of people's favorite national parks, the information could be automatically collated.

Open Data

The ideas behind the global push for open data are simple. The data possessed by a government is a public resource. The potential insights from analysis of this data could, in some way, provide unprecedented benefits to society. The more people with access to the data, the greater are the chances that more insights could be found, and the more benefit to a society.

Open data is a core component activity of open government and is related to e-government, or e-government services. Whereas open government describes the release of government data online, e-government services refers to government services being made available online, such as permit applications or customs duties.

Several countries have jointed the Open Government Partnership,[54] which is a "a new multilateral initiative that aims to secure concrete commitments from governments to promote transparency, empower citizens, fight corruption, and harness new technologies to strengthen governance." The global interest in open data, along with the tools, widgets, and expertise that have emerged, has made government release of data the norm. This trend gives forest agencies the opportunity to follow suit, and to take advantage of public involvement in forest governance.

Even without this recent global trend, however, forestry institutions have always stood to benefit from providing as much data as possible to the public. The work and resources outside organizations might invest in processing and visualizing the data provide great added value to both a forest agency's communications and analytical work. However, despite the benefits of sharing data with the public, in many forest administrations the tradition has been to keep information classified. Additionally, many agencies are poorly equipped to share information widely.

How It Works

The principle means of providing data is via an agency's website. Data sets should be published in formats that can be read by common programs, such as Microsoft Excel. It is also common for open data platforms to provide specific tools or widgets to make it easier for outsiders to analyze the data that has been made available. Agencies should take special care to make sure that data released is accurate. Any supplementary information they can provide that explains the methodology used to collect the data can also be useful for outside researchers, organizations, or individuals using it.

Costs

Costs come from the need to produce a dedicated website that may or may not have a unique logo or branding. Depending on the amount of data a forest agency has, it may only take a single individual to clean up and post the data sets. This may or may not be the same person responsible for maintaining the website. A forest agency may also promote the use of its data by producing some success stories stemming from using the data. This last activity may require outside communications expertise.

FIELD EXPERIENCES:

KENYA OPEN DATA

Kenya has made open data a national priority. The Kenya Open Data Initiative was launched in 2011, making key government data freely available to the public through a single online portal. The 2009 census, national and regional expenditure, and information on key public services were some of the first data sets to be released. The website is a user-friendly platform that allows for visualizations and downloads of the data and easy access for software developers. Indeed, tools and applications have already been built to take this data and make them more useful than they originally were.

Kenya's open government data portal initiative has been widely acclaimed globally as one of the most significant steps Kenya has made to improve governance and implement the new constitution's provisions on access to information. By November 2011, nearly 390 data sets had been uploaded to the site, with a plan to upload more data in the future. There had been more than 17,000 page views and more than 2,500 data sets downloaded and embedded to various websites and portals. There are now more than 100 requests from the public for new data sets, and there is a clear demand for more data to be made available.

Kenya's information is a national asset, and this site is about sharing it. The goal of Kenya Open Data is to make core government development, demographic, statistical, and expenditure data available in a useful digital format for researchers, policy makers, ICT developers, and the general public.

Source: https://opendata.go.ke/page/about.

10.2 Interactive Voice Response

Interactive voice response (IVR) systems provide access to audio content via mobile phones. IVR systems act like phone menus, offering prerecorded audio content: "Press 1 for the operator; Press 2 for the Wildlife Department; 3 for the Department of Forest Inspection," and so on, or information can be streamed via the phone.

IVR systems can also be set up to capture content, like an organized voicemail system: "Press 1 to leave a comment or question on commercial logging operations; Press 2 to leave a comment or question protecting forests," and so on. This allows a project to engage in asynchronous conversations with its target audience. A subject matter expert, for example, could produce a daily show that answers the questions left on the IVR system the previous day, and solicit comments and questions from the audience for the issue scheduled to be discussed the next day. Importantly, IVR systems can automatically call users and play prerecorded messages. This is important because in most countries the receiver of a call does not pay to receive it.

IVR can be of immense value to forest agency communication initiatives, especially if the agency wants to communicate complex information to a large number of people. It can be a useful tool especially if the target audience is illiterate or is made up of multiple language groups.

IVR is useful for situations where

- There is a high rate of mobile phone penetration among diverse social groups;
- There is a large diversity of languages spread throughout a country;
- There is a high rate of illiteracy;
- A small group possessing information needs to engage with a large, disparate group;
- The information that needs to be conveyed is richer than can be handled by SMS; and,
- Information providers and consumers need to interact asynchronously.

There are a few issues to bear in mind when considering implementing an IVR system:

- Unlike advanced voice recognition systems, simple IVR cannot function as a tool for data collection. Similar to voice calls, it is more expensive than SMS.
- Producing the audio content for placement on the IVR requires audio production equipment able to produce material to be clearly understood when listened to on a mobile phone.
- People may be unfamiliar with IVR systems, slowing widespread usage.

Examples

There are number of tools that can be used as a platform for IVR systems. Some of the better known software that run IVR systems are FreeSwitch and Trixbox (both of which are built on Asterisk) and Verboice.[55] The Center for People's Forestry[56] in India has used IVR to register comments and concerns from the public in Uttar Pradesh State.

Costs

While it is possible to operate their own IVR equipment, forest agencies might find it simpler to outsource the service. Mobile network operators often provide IVR systems or functionality as a commercial service. An agency only needs to provide the audio content that the operator puts on the system. The major costs, however, will come from the specialist labor required to operate the IVR software (private branch exchange, PBX), and from the recurring costs. For example, if an agency decides to initiate a prerecorded message about how the public can help prevent forest fires, the calling charges can quickly drain a communications budget.

10.3 Location-Based Services

Location-based services (LBSs) use technology to provide information at the physical location where the information is useful. A simple example is an information service using a sign with a phone number and a three-digit number posted outside a regional forest management office. In the example, the service would give information specific to that location to anyone who calls the number identified and enters the code.

LBSs can be effective tools for providing specific information to target communities. For example, a forest agency could use LBSs to provide information about the responsibilities of and services provided by a forest management office right outside the building. The phone number on the LBS sign could also connect to a live person who is prepared to answer questions or provide location-specific information. The example of Murmur in Figure 10.1 is from an LBS in Canada with a general phone number and sign-specific code. The service provides historical information about the area immediately surrounding the sign.

FIGURE 10.1 LOCATION-BASED SERVICE SIGN

Source: Geocaching.com.

There are three main approaches to providing LBSs:

1. Triangulating a mobile phone user's physical location and providing information based upon that location. The triangulation is achieved by using one or more cell towers to determine a mobile phone user's physical location or by using GPS.
2. Use of signs with standard service telephone number but location-specific code.
3. Use of stationary technological devices, such as an electronic billboard or kiosk, with pre-loaded content.

Deployments can be of several different types. They can serve to (a) empower citizens with civic education or actionable information; (b) brand an organization; or (c) inform members or visitors of a community about ongoing social issues specific to a location.

On-device GPS can be used to provide LBSs in combination with proprietary apps, yet this requires cooperation from the satellite connectivity provider and is expensive. It is also of limited comparative utility because an LBS will most likely be used in dense, higher-income urban areas where any of the other options would be more practical and cost-effective.

The factors affecting the cost of an LBS include conceptualization, branding, and content development. Content development may involve a large amount of research. There will also be logistical costs associated with deploying any physical components of an LBS, such as signs.

10.4 Games

Electronic games can provide a large range of opportunities to educate and inform diverse audiences. They provide players with the opportunity to learn while doing, and to do so in a safe and controlled environment. They can be particularly valuable in reaching new audiences who may be beyond the reach of more traditional and fact-focused ways of communicating.

Games could be for youth or adults. For younger audiences, a forestry institution might choose games that entertain in order to educate. For adults, a game might provide an opportunity to solve actual policy challenges, such as balancing multiple competing interests regarding the forest resources and estate. Such real-life games are often referred to as "serious games."

Agencies have different options and can choose to create downloadable games, online games, or games for mobile phones. These variations are full of choices, which mostly depend on the level of computer and Internet access as well as smartphone penetration. For mobile phones, it is necessary to choose an operating system that would be used for the games. This is a critical choice and depends on the market shares of competing operating systems. For Internet-based games, the average available bandwidth affects the complexity and visual presentation of the game that could be deployed. Online availability is a necessary precondition for efficient dissemination; relying only on physical media for dissemination is a costly and likely short-term solution.

Existing games can also be adapted to forestry themes in order to save time and money. One option would be to set up a partnership with a for-profit organization as social innovation: the agency could form a partnership with a company that fields and maintains the game in order to earn revenue.

Designing a game-based engagement strategy requires that the agency identify the key learning objectives and messages it wants to disseminate through the game. Working with game designers, it would be possible to identify the game processes through which these objectives would be reached as a result of successful play or navigation of the game.

Examples

There are both commercial and not-for-profit games in this arena. The U.S. Forest Service has launched a series of Campfire Games on its "Smokey Kids" web page (Figure 10.2)[57] to educate children about forest fires. Other educational games are, for example, "Identify the Natural Resources" and "Heifer Village: Nepal" (Figure 10.3).[58] The games can be either directly linked to school education or meant for more entertaining purposes (edutainment).

FIGURE 10.2 SMOKEY BEAR GAMES FOR KIDS

All of these games contain functionalities that could be adapted by a forest agency wishing to convey information or to teach via the gaming format. SimCity, a commercially available game that has been constantly updated and improved for over a decade, provides a good example of how a game allows players to pursue their own

strategy. In the game, players use available resources to build entire towns in an effort to keep their residents happy. Players can clearly see the impact of their resource management decisions on the economic and social conditions in a town. This type of game is used as an example here because, if modified to depict forestry-specific scenarios, it could educate by entertaining.

Cost

Developing a game can be an expensive proposition. It would take at a minimum several months, though development could stretch into years. The cost is affected by whether a forest agency would produce something from scratch, significantly modify an existing game, or simply translate an existing game into a local language. Part of the challenge for making a game an effective communication or learning tool is that agencies would have to contend with the universe of games competing for players' attention. Thus, in an effort to achieve the best value for money, agencies may opt to convey simpler messages via simple games that might only be played a few times before they are completed.

FIGURE 10.3 HEIFER VILLAGE: NEPAL

11 COORDINATION

11.1 Information Pages and Wikis

A public wiki is an open and collaborative resource web page that is open to contributions and edits from anyone with permission from the site owners. "Wiki" is said to stand for "what I know is," but is in fact derived from the Hawaiian phrase wiki wiki, meaning "fast." Potential editors could include the public at large or only staff of a forestry institution. Public wikis are useful for stating a large range of facts for the record and providing the opportunity for organizations and members of the public to contribute information about forests and forestry institutions' activities.

The most well know wiki, Wikipedia, has a convenient format and is widely known to the general public. Wikipedia pages only require scrolling rather than clicking through the various pages of a website, making them easy to use even with slow Internet connections. In addition, wikis list sources with hyperlinks at the bottom of the page, enabling easy further research.

The easiest way to set up a wiki is to create a page on Wikipedia itself. This will require less time and human resources. Wikipedia provides easy tools and instructions, and hosts the wiki for free. If an organization does want to manage its own wiki, for example as a part of its web page, it could start by finding a wiki hosting service, or wiki farm, to provide the services, tools, and guides.

11.2 Dashboards

If a forestry agency sets up several different information systems, it can be difficult to keep track of all their movements and changes. To meet this challenge, organizations often will set up virtual dashboards, which unite varied information into one interface. Dashboards are useful if the information in question fluctuates often. A forestry institution might consider including ranger reports, information on confiscated timber, timber transport checkpoint reports, weather, various wood prices, Rich Site Summary (RSS) newsfeeds, wood auction results, and so on.

Dashboards can be of varying complexity. They can incorporate a variety of data streams, such as online social media, live video, weather, text messages received, reports from field staff, and so on. The costs will be determined by the number of paid staff required to collect and contribute information and data, and by the maintenance of the dashboard platform. It is essential that clients know where information is available and which information is reliable and up-to-date. Having a "one-stop shop" for information helps the agency to ensure that information is updated and readily available. It also makes marketing, branding, and public awareness work easier. In many cases, forest sector development is characterized by externally funded projects. If these projects all set up their own websites and information portals, information becomes fragmented and more difficult to maintain.

12 MONITORING AND EVALUATING ICT INVESTMENTS

The main aspects of the costs associated with ICT and communication are captured in Figure 12.1. The graphic explains how the information flows to different stakeholders and to different audiences vary in character and scale of impact this has on costs. In principle, as messages become less time-sensitive, the larger the audience and the larger the cost. The graphic is applicable to both SMS and IVR, because, for both tools, the recurring costs are directly associated with the size of the audience and the frequency of engagement with that audience. Thus, when considering the use of either SMS or IVR, it is important for forest agencies to frame their communication strategy within their budget.

It is important for agencies to build monitoring into their ICT projects so that they can determine whether the project has been successful and learn for the future—as well as ensure tax payers and other constituencies that their funds are spent responsibly. It is one thing to buy a piece of fancy equipment, yet something entirely different to plan how its introduction will improve a forest agency's operations.[59]

It is necessary to think about monitoring from the project conception phase. Forest agencies should start by developing a results framework with both performance and impact indicators. The World Bank has developed a useful guide on developing this essential component of project management.[60] One essential yet often ignored element is analyzing the pre-project situation to establish the baseline.

To determine the impact of an ICT forestry project, many of the usual approaches to monitoring and evaluation (M&E) apply, including randomized control trials, control groups, baselines, and so on.

The field of M&E of ICT investments is still developing, not least because of the unique problems of attribution introduced by the Internet. While it can be easy to gather numerical data on, for

FIGURE 12.1 RELATIONSHIP BETWEEN TYPE OF COMMUNICATIONS AND RELATIVE COST

example, a forest agency's website, the best approach for generating insights into the efficacy of a particular strategy is to conduct a survey of a target population's use of technology and means of accessing as well as sharing information. It is also useful to know the change in behavior of the target population and surveys need to be designed accordingly. These surveys need to be able to address two questions: first, did the ICT-induced change reach the target audience? And second, did the audience change their behavior with positive development outcomes? One key challenge with measurement of ICT projects is the common tendency to measure the performance of the technology rather than the development outcomes. There are no commonly accepted forms of sources of evidence. Some donors or implementers may be more interested in proving the capabilities of technology rather than achieving actual outcomes.

Iterative surveys are useful for answering these questions. These can be carried out in person, over the phone, or even by SMS. A forest agency could conduct these surveys itself or subcontract the service to an outside company. Either could take advantage of the same technology discussed earlier, in particular mobile data collection. At the same time, however, it is essential to analyze the views and opinions of potential clients who are not using the e-services available. Particularly for public agencies, it is essential that there is no unintended exclusion of relevant stakeholders and that services are made available through different media.

One key insight regarding measurement of website performance is that user-friendly functionalities and numerical data need to complement each other. For example, if a forest agency's website gives users the opportunity to comment on an article, post it to their Facebook account, and so on, these actions can be counted. Table 12.1 shows a list of some data points to help forest institutions choose which data they should measure. It is important to note that, while these data sources are useful regardless of which thematic area they are used to measure, it is not necessary to use all of these data points at once. Rather, a forest agency should determine which data points would provide the richest information in their particular context and use those.

TABLE 12.1 DATA POINTS FOR M&E IN ICT INVESTMENTS

QUANTITATIVE MEASUREMENT	
Independent page views	Unique IP addresses
Forwards (if a web page has that functionality)	Different destination websites visited after visiting site being measured
Visitors from different countries	Twitter or blog mentions
Retweets (Twitter), Likes (Facebook), +1's (Google+)	Number of stories in mainstream media attributable to a website
Number of postings	Number of surveys taken (if available on a website)
QUALITATIVE	
User surveys	Surveys of those an information resource is trying to impact

13 LOOKING FORWARD

As they continue to involve ICTs in their work, forest agencies will be able to count on some fundamental global trends. Access to the Internet and mobile phones will continue to increase, as will the percentage of people owning smartphones. The costs of connectivity, satellite imagery, and computational power will continue to decrease. Together these trends only point to new opportunities with technology and with larger audiences. Perhaps most important is the fact that, with time will come experience. The trend of ICT4D pilots is sure to end as organizations find and hone successful approaches. With experience will come greater public awareness and greater availability of people with the necessary ICT skills. These trends will be mutually reinforcing, meaning that, in the short term, forest agencies would be wise to begin using ICT tools as effectively as they currently can. The earlier they start, the sooner they will learn and proceed down the path of increasingly effective application of ICTs for providing sustainable, healthy forests for future generations.

Forest administrations in both Lao PDR and Moldova have started their e-development from a modest level, but they have shown that if one takes the right approaches, ICT can be introduced and "low-hanging fruits" picked to improve agencies' operations. At the same time, it is clear that this cannot be done in isolation from wider institutional development in the organizations. ICT alone does not fundamentally change the agencies if their underlying processes are not addressed adequately. Information is an essential element in all public administration, and the forest sector is no different. Therefore, information and knowledge management should be one of the core functions of these agencies.

Two countries is a small sample and all countries have their own characteristics. However, some general lessons on how to promote e-transformation can be drawn from these two cases studied. These observations provide guidance and tentative checklists for other countries and organizations when they design and implement their e-reforms.

First, the experiences from these two countries indicate that introduction of ICT should always be designed in a way that is aligned with existing capacity and e-readiness among the staff. This is also a risk factor if e-development is predominantly driven by externally funded projects, as is often the case. Even in these two countries, much of the past development had been done through donor projects and with temporary project teams almost acting as ICT departments for the agencies. This model can be efficient in delivering the latest technology and often the teams are able to focus on the task at hand, making progress relatively swift. Yet, this can also become unsustainable and unpredictable if the project teams are not well matched with the rest of the organization and if the agency management is not involved in the changes. Therefore it would be essential that agencies have designated staff at senior management level that is in charge of information management issues (chief information officer). This would ensure that information management is well aligned with the rest of the organization and its core mandates.

Second, technology choice is essential yet it should not be the dominant driver; the starting point should be the needs and processes in the organization and the technology should be adjusted to match that, not the other way round. Different technology options serve best different contexts and uses; for example, open-source applications may be the best option if the agency has adequate in-house capacity or if local service providers can be used. But there can be indirect costs to set the system up and to make necessary adjustments. The examples in this project demonstrate that it is essential to compare different technical options in terms of cost, availability of support service, in-house criteria, and other relevant factors. This is particularly important if development projects are implemented by external consultants financed by donor projects. Teams that do not have through knowledge of the existing capacity may simply replicate solutions from other contexts or propose solutions that they are most familiar with rather than solutions that fit the agency's needs best.

Third, the whole value chain of information management needs to be considered. ICT is only a tool to manage information, but it requires that the data that are used are adequate, relevant, and reliable. If the underlying input data does not match the needs of the organization, then the output hardly meets its needs. For example, many countries have inadequate data on their forest resources, and increasing data processing and managing capacity in the forest agencies does not change that. When countries invest in information management, they also need to invest in information generation. Also, the end of the information value chain matters; this report discusses many ways how agencies can improve their information exchange with the public. Information disclosure is governed by different legislations and regulations. Therefore, it is essential that legislation allows sharing information with other agencies and with the general public. The value of information can be maximized if it is shared. It is a public good in the purest sense of the concept: once made available, it is non-excludable (impossible to prevent people from using it) and nonrivalrous (one individual's use does not reduce availability to others). In some cases, national regulations may prevent sharing or disclosing information. When reforms are planned, these issues need to be studied and necessary changes proposed. When doing this, some conflicting needs have to be considered: individuals' security and privacy need to be respected. There is also the issue of cost recovery in public services; generating information has its costs and the agencies have a legitimate interest to cover their production costs.

The examples in this report show that e-reforms can be initiated and progress made even with relatively small resources and in forest organizations that have limited previous experience from e-governance. They also show that understanding local contexts and capacities is an essential precondition and, in some cases, gradual introduction of new topics and approaches will open opportunities for larger reforms. These smaller steps can appear time-consuming, but building local capacity from the bottom up builds foundations for capacity that is needed if and when larger, leapfrogging reforms are implemented. These bigger reforms need to look at all dimensions of information use and management, ranging from right technology choices to underlying processes and functions of the forest agencies.

NOTES

1. For more extensive discussion on the use of ICT in forest governance, see Castrén and Pillai 2011.
2. http://www.profor.info.
3. For example, see publications on forest inventories by the FAO, available at http://www.fao.org/forestry/fma/73408/en/; for remote sensing and earth observations, see Khorram et al. 2012; for general introduction on information management across a wide range of forest subsectors, see World Bank 2008.
4. For a more comprehensive discussion on forest governance and e-development, see Castrén and Pillai 2011.
5. In Moldova, the original focus was on public participation and open data; however, during the implementation it became evident that, considering the overall readiness for e-solutions in the counterpart organizations, a more gradual introduction of ICT would be needed.
6. For example, Chhatre and Agarwal 2008.
7. Delivered to a port in Vietnam or China. The credibility of the claims made on the online advertisements cannot be verified. See, for example, http://www.alibaba.com with keywords rosewood Lao.
8. Note that all interviewed professionals stated that no one has a clear understanding of the actual level of demand.
9. Forest Trends 2010.
10. When a World Bank team visited the POFI in Salavan Province in February 2013, there were several stacks of confiscated wood, for which the office head gave an estimated value of $200,000. This can be compared to the annual operating budget of the unit of $3,000, far less than the income made by many of the 47 sawmills (far more than are needed for legally harvestable wood) located in the province. Its control over the sale of the illegally harvested wood gave significant negative incentives.
11. Department of Forestry 2005. In the Global Forest Resource Assessment 2010 (FAO 2010), the share is reported at 68 percent, but the report has much wider definition of forests.
12. LAO PDR 2010.
13. See Governance e-Transformation Project for Moldova, http://www.worldbank.org/projects/P121231/governance-etransformation-project?lang=en.
14. The country process is described in more detail in the Lao PDR country report of this project (see chapter 1.2).
15. The consultants referred to its use of a public folder within the DOFI LAN as the "dropbox," though it was dissimilar to the cloud-based commercial Dropbox file storage service.
16. Held in February 2013.
17. The project was able to collaborate with several bilateral projects under implementation in the country. Often the bilateral project procured equipment (for example, GPS devices) and this project provided training and support in their integration with DOFI systems.
18. http://www.rapideye.com.
19. http://www.ecognition.com/products.
20. http://www.poimapper.com/.
21. The country process is described in more detail in the Moldova country report of this project (see chapter 1.2).
22. Preliminary information obtained after the fieldwork for the project was concluded indicates that Moldsilva has changed its regulations and both allows electronic reporting and has made using the application developed during the project mandatory.
23. See http://data.gov.md/en/.
24. Open government activities provide information about government activities, expenditures, and policies and make available data that has been collected with government support. E-government services feature the provision of government services via the Internet and mobile phones.
25. http://blogs.worldbank.org/publicsphere/sms-gateways-public-accountability.
26. See Stapenhurst 2000; World Bank 2012b.
27. http://www.ssireview.org/blog/entry/designing_mhealth_programs_with_scale_in_mind.
28. http://www.ssireview.org/blog/entry/designing_mhealth_programs_with_scale_in_mind.
29. ODI 2007. See also chapter 23 in Brown et al. 2008.
30. For information on forest inventory practices, see, for example, publications by the FAO available at http://www.fao.org/forestry/fma/73408/en/. A good general introduction to remote sensing and earth observation in particular can be found in Khorram et al. 2012.
31. For a detailed description on mobile data collection in forest and rural development projects, see World Bank 2013.
32. 160 characters including spaces is the limitation in Latin script. In some other languages, for example, Arabic, Chinese, Korean, Japanese, or Cyrillic alphabet languages, even fewer characters can be included.
33. See for example, http://www.grameenfoundation.org/.
34. http://www.frontlinesms.com/wp-content/uploads/2011/12/FINAL-OM-REDD-FrontlineSMS-Trial-Report-2012.pdf. See also http://www.pactworld.org.
35. http://www.frontlinesms.com; http://www.rapidsms.org/en/develop/.

36. http://www.frontlinesms.com/_PREV/user-resources/download/Changemakers-kiwanja-SMS-Guide.pdf.
37. For example, http://www.rainforest-alliance.org/climate/projects/surui-project; and http://opendatakit.org/2012/06/surui-tribe-in-the-amazon-using-odk/.
38. http://www.formhub.org; http://www.kobotool-box.org; http://www.opendatakit.org; http://www.dimagi.com/collaborate/openrosa; http://www.poimapper.com; and http://www.doforms.com.
39. http://www.theclearinitiative.org/mobile-based-tech.pdf.
40. http://mapbox.com/tilemill/.
41. For example, ESRI Shapefile, KML, GeoJSON, GeoTIFF, PostGIS, and SQLite file formats. World Bank contractor GeoIQ uses OGC KML, GeoRSS Atom, GeoJSON, Spatialite, and GeoPDF to keep its platform as open as possible.
42. http://data.worldbank.org/products/data-visualization-tools.
43. http://hot.openstreetmap.org/.
44. http://tasks.hotosm.org/.
45. http://www.waterpointmapper.org/.
46. http://www.qgis.org/; http://grass.osgeo.org/; http://www.mapserver.org/; http://openlayers.org/; http://www.openstreetmap.org/; http://download.ushahidi.com/; http://www.ushahidi.com/products/crowdmap; and, http://www.esri.com/software/arcgis.
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50. https://www.coursera.org/course/sna.
51. https://www.facebook.com/pages/create/.
52. http://www.flickr.com/.
53. http://www.twitter.com.
54. http://www.opengovpartnership.org/.
55. http://www.freeswitch.org, http://www.trixbox.com/, http://www.asterisk.org/get-started/applications/ivr, and http://instedd.org/.
56. http://www.cpf.in/.
57. http://www.smokeybear.com/kids/?js=1.
58. http://www.neok12.com/diagram/Natural-Resources-01.htm and http://www.forgefx.com/casestudies/heifer/heifer-village/.
59. ICT can be a powerful tool for monitoring and evaluation in forest and other rural development projects. For a comprehensive discussion on ICT and project M&E, see World Bank 2013.
60. World Bank 2012a. See also UNCTAD 2011.

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MOBILE PHONES, TABLETS, AND ACCESS TO THE INTERNET HAVE BECOME UBIQUITOUS IN RECENT DECADES, AND DEVELOPMENT PRACTITIONERS HAVE RECOGNIZED THE IMPORTANCE OF USING TECHNOLOGY IN ACHIEVING DEVELOPMENT OUTCOMES IN VARIOUS FIELDS, INCLUDING IN THE FOREST SECTOR. THERE HAVE BEEN MANY INTERESTING INITIATIVES IN THE FOREST SECTOR PROMOTING THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS). HOWEVER, THESE HAVE GENERALLY NOT LED TO NOTABLE SCALING UP, AND PILOT PROJECTS HAVE REMAINED SMALL-SCALE ACTIVITIES.

WITH THE GOAL OF DEEPENING ITS UNDERSTANDING OF HOW BEST TO USE ICTS FOR FOREST GOVERNANCE, THE WORLD BANK SUPPORTED TWO PILOT PROJECTS WITH FUNDING FROM THE GOVERNMENT OF KOREA THROUGH ITS TRUST FUND FOR ICT FOR DEVELOPMENT. THESE PILOT PROJECTS, IMPLEMENTED IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC AND MOLDOVA, AIMED TO DEVELOP NEW TOOLS, AND ALSO TO CULTIVATE INSIGHTS INTO THE BEST APPROACHES FOR INTRODUCING NEW TECHNOLOGIES WHILE FACILITATING ORGANIZATIONAL CHANGE. THIS REPORT COVERS LESSONS FROM EXPERIENCES IN THE CASE STUDY COUNTRIES AS WELL AS A GUIDE TO ICT TOOLS AND THERE POTENTIAL APPLICATIONS WITHIN THE FOREST SECTOR.

Cover Photos: Agency Moldsilva, Republic of Moldova, and Ministry of Agriculture and Forestry, Lao PDR.

PROFOR

PROGRAM ON FORESTS (PROFOR)

THE WORLD BANK
1818 H ST NW
WASHINGTON DC 20433 USA

EMAIL: PROFOR@WORLDBANK.ORG
WEBSITE: HTTP://WWW.PROFOR.INFO

Profor is a multi-donor partnership supported by:

13918E/1/07.14