

Establishing Sustainable NSDI: Combined Technical and Institutional Approach

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SUMMARY

Lao PDR is a landlocked country in South-East Asia. The challenges in the country are related to the unplanned use of natural resources and environmental degradation. Most of the ministries have already laid a good legislation to improve the situation, but actual implementation is delayed because of two reasons related to geospatial data. The first one is the lack of accurate and up-to-date data. The second is non-existing co-operation between different organizations. The objective of this paper is to review the main challenges in Lao PDR and how the approach implemented by National Geographic Department (NGD) and supported by Finnish funded Strengthening National Geographic Services (SNGS) has improved the situation. National Spatial Data Infrastructure (NSDI) is defined as a combination of technologies, policies and institutional arrangements that facilitate access to geospatial data. SNGS targeted to establish a sustainable NSDI in Lao PDR. The establishment is based on two approach method. The first is building up the technical capacity of NGD to create and maintain accurate and up-to-date data. This has included aerial photography of two thirds of the country (the remaining part was photographed by the Vietnamese project during dry season 2014-15), establishment of seamless GIS database and building up of a test Geoportal for data distribution. The second, institutional approach, targets to improve the co-operation between NGD and different organizations enabling data and information sharing. This has included the establishment of GIS committee and related technical working groups. It also includes increased amount of awareness raising and marketing, which both target to make the accurate geospatial data known in all levels of the society. This two fold approach has increased NGDs technical capacity to produce accurate and up-to-date data and made it more known among other geospatial users. GIS-committee has increased co-operation between NGD and other different other organizations. October 2014 SNGS continued with an extension (SNGS-EP). The extension targets to further develop NGD as an institution. The newly approved (September, 2014) Decree on Surveying, Aerial Photography and Mapping has further improved NGDs position among other organizations. As a result of various meetings, marketing and contacts, which all have been supported by the technical assistance from Finland, NGD is now co-operating with various other projects. Data distribution has been taken to a new level as well. In October, 2014, NGD decided to start the distribution of the orthophotographs free-of-charge to all government organizations.

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1. BACKGROUND AND INTRODUCTION

Lao PDR is a landlocked country located at the heart of South-East Asia with a population of 6.5 million (based on 1995 census and growth estimation). More importantly, low level population density of 27 person/km² and mountainous landscape, makes it the most rural country in the region. The country is ethnically diverse including main groups Lao (60% of the population), Khmu and H'Mong. Besides these Laos is inhabited by 48 bigger and smaller ethnic groups. Agriculture is still the main source of income and counts 50% of GDP. The biggest export product is electricity that is generated by several hydropower dams managed mainly by Thais and Chinese.

Even though growth of GDP is one of the fastest in Asia, Laos is still considered as a least developed country, reliant on the donor support. Lao PDR receives monetary and technical support from United Nations (UN), International Monetary Fund (IMF), World Bank (WB), Asian Development Bank (ADB) and from several other countries based on bilateral agreements. The main donors concentrate on improving central governance by supporting different sectors to better implement important activities in the field. Non-Government Organizations (NGOs) with lower capacities and resources support the local level by improving livelihoods in villages.

Because of strong commitment from Lao government, the country has made progress reaching the millennium development goals. Still the sustainability of the achievements has been questioned. Further on, unplanned use of the natural resources and related environmental degradation has created new challenges. The ambitious goals set up by the Seventh Five-Year Economic Development Plan (2010-2015) "targets to minimize environmental impacts of the development, increase the forest cover, complete land use planning, land allocation and identification of land areas for development, adapt and mitigate to climate change and global warming, protect the country from natural disasters and reverse environmental losses". Spatial data has been recognized widely as a critical tool to promote development and poverty eradication.

National Geographic Department (NGD) under Ministry of the Home Affairs (MoHA) is considered the highest survey and mapping authority in Lao PDR. In the last two decades NGD has received Official Development Assistance (ODA), most recently from Finland (1998-2003; Vientiane Plain Large Scale (1:5,000) Mapping Project) and Japan (1998-2003; Mekong GIS Project; update of 1:100,000 scale topographic maps). Vietnam has supported the organization by providing hardware, software and capacity building. Both Finnish and Japan funded projects have preliminary introduced methodologies and technologies emphasizing modern GIS and on-demand map production. Nevertheless the capacity building has not included broader vision to build the organization as an institution.

Establishing Sustainable NSDI: Combined Technical and Institutional Approach in Lao PDR (7824)
Sami Janne (Finland) and Khamvanh Lorkhamyong (Laos, PDR)

According to its mandate, NGD is responsible for the management and the inspection of activities related to surveying, aerial photography and mapping nationwide, as well as implementation and fulfilment of political duties assigned by the MoHA. Few years ago NGD was divided into two organizations, the original, still called National Geographic Department and state enterprise called Survey and Mapping Centre (SMC). NGD and SMC are still working together, but it seems that eventually SMC will become independently working organization. In this paper abbreviation NGD/SMC is used if the matter clearly considers both organizations. Currently NGD tasks include:

- 1) Strategic and operational plans related to the surveying, aerial photography and mapping;
- 2) Draft laws, regulations and policies related to the surveying, aerial photography and mapping;
- 3) Build infrastructure for surveying, aerial photography and mapping;
- 4) Develop and prepare basic national geographic maps and maps for other organizations;
- 5) Develop and manage a database of geographic information (surveying, aerial photography and mapping);
- 6) Provide geographic information from the database;
- 7) Conduct (basic) activities of surveying, aerial photography and mapping;

Current challenges of NGD are related to the organization's capacity to fulfil the mandates set by the ministry and the Government.

Finnish funded program Strengthening National Geographic Services (SNGS) has supported NGD/SMC in amending the existing decree that defines more detailed what are "the principles, regulations and measures on operations and management of surveying, aerial photography and mapping for public administration". The decree was approved by the Government in September, 2014. SNGS-Extension Project (SNGS-EP) is currently drafting the implementation instructions with NGD/SMC.

Besides assistance to the amendment of the Decree, SNGS has provided technical assistance to NGD/SMC from 2010. The program design targeted to raise the technical and institutional capacity of NGD to become the leading (nationwide) geospatial data producer and distributor. One of the concrete objectives of the program was to assist NGD/SMC to produce accurate, up-to-date and homogenous geospatial data covering the whole country and distribute it, if not free, with a reasonable cost to other government organizations. The orthophotography of the South and Central parts of Lao PDR are now marketed as the most accurate data set in the country and base for NSDI.

The idea of accurate base map is based on the fact that most of the countries worldwide have their digital base maps, provides an accurate geospatial reference to other organizations. With these the organizations are able to, instead of consuming time to create their own GIS data, concentrate on their substances and main strengths. This in general saves funds that are normally used for additional activities related to the creation of basic GIS data.

Besides building up the technical capacity of NGD to create a digital base map, both SNGS and its extension, has promoted NGD to establish the National Spatial Data Infrastructure (NSDI) to Lao PDR. NSDI, as an initiative, targets to facilitate data and information sharing. This will lead to better avoidance of duplication that is associated with the creation of geospatial data. As noted in the literature the successful implementation of NSDI can produce significant savings in human resources. Distribution of data sets can improve data quality by increasing the number of people who find and correct errors (Williamson, 2003).

In the future, as in other countries, when co-operative agreements dealing with data sharing and information distribution have been established, NSDI will start include other important data providers including important data related to the land, forest and environment.

The studies covering and comparing establishments of different NSDIs, as in other developed and developing countries, note that challenges related to it are the lack of appreciation, lack of resources and trained personnel, inefficient bureaucratic processes without systematic co-operation and lack of accurate and up-to-date data. Further on each country has its own national context, language and characteristics (size, population, political system, social and economic priorities and varied infrastructures and skills), national traditional and cultural attitudes and people who participate, develop and use Spatial Data Infrastructures (SDI) (Rajabifard, 2003).

The main challenges related to geospatial data and therefore to the creation of NSDI in Lao PDR are:

1) Lack of accurate and up-to-date data

The biggest challenge before the project was that the existing maps were decades old. Some effort has been done to improve the situation (Finnish funded Vientiane Large Scale Mapping and Japanese funded Mekong GIS projects). The Finnish funded program SNGS produced aerial photography (resolution of 0.5 meters) and related orthophoto (in 1:5,000 scale tiles) that now covers 2/3 of the country (approximately 160,000 km²). The Government of Vietnam funded project (started end of 2014) has done aerial photography, which covers the last (62,000 km²). The aerial photographs were done in dry seasons 2010-11, 2012-13 and 2014-15. Because of various reasons (cloudiness, not approved cross-border to neighbouring countries etc.), some parts in the South, Central and North Laos were not covered by aerial photography. The main goal Finnish funded projects is to get accurate and up-to-date data recognized as an important tool for the development and therefore used in all organizations.

2) Fractured/scattered and uncoordinated production of geospatial data

Because of the missing up-to-date and accurate base map data, organizations have been creating their own geospatial data. Very often the creation is supported by their development partners e.g. donors. Because of the lack of co-operation and information sharing there is overlap in geospatial data production.

SNGS-EP is preparing a study to measure how much overlapping work has been done in Lao PDR in the production of geospatial data. The study concentrated on savings that could be achieved by using the same basic data in all government organizations.

3) Lack of co-operation

The missing co-operative committee or even co-operation in general has increased above mentioned fragmentation creating an environment where most of the organizations are concentrating on their own projects and programs without co-operating or sharing information with others. SNGS and its extension have done a lot to improve the situation. Based on the Decree, co-operative GIS committee has been re-established and NGD has now co-operation with several other organizations and projects, who are now mainly using NGD data for their work.

4) Lead organization

NGD is traditionally the highest authority in surveying and mapping and capable of understanding the technical fundamentals related to the field. Still, NGD/SMC is less familiar with modern GIS and creation of GIS applications or GIS databases. This has led to a situation where the tasks mandated to NGD have been overtaken by other organizations. These organizations very often do not have the capacities to create (or understand) accurate and up-to-date geospatial data. One of the main targets of SNGS/SNGS-EP has been to return these mandates to NGD/SMC. Amendments to the decree and awareness raising have been few of the activities to support the idea.

5) Dependency on external support

Many of the sectors are depended on external support mainly from different donors. This has made the production of geospatial data even more fragmented and donor led efforts. This means that projects and their counterpart organizations are trying to create basic data and very often without any concrete and accurate plan. SNGS projects has concentrated on creating a technical framework that targets to build up the capacities in NGD, but also other organizations, to understand the importance of the basic data, which is based on accurate surveys, measurements and procedures.

6) Lack of awareness

Even SNGS and its extension has been promoting the idea of NSDI, understanding of the concept is still missing In the decision making level GIS is not used. Further on geospatial sciences/technologies or their usage as cost saving option, is not understood on the government level. In general organizations do not know what kind of data is available.

Especially the SNGS-EP targets to raise the awareness with strong communication and public relationship related activities.

Although Lao PDR does not have NSDI established, there have been several mainly technically oriented attempts to establish co-operative geoportals offering different organizations the platform to display their data and information about it. These have been mainly developed and are maintained by technical advisors related to different donor funded projects.

In general NSDI development has been seen as a step by step process, including technical and institutional tasks, which finally lead to a fully enterprise GIS that supports all activities in different sectors. Even most of the NSDI development is carried out by using up-to-date and high-end technology, the sustainability is according to the literature strongly depended on the institutional arrangements including awareness rising, co-operation and ensuring continuous technical capacity for NSDI development and sustainability (Williamson, 2003). These activities include also a) official high level recognition of NSDI as a channel for sharing information across different organizations and b) establishment of executive and technical committees (Sorensen, 2007). As an addition a basic Geoportal can be established as an initial common repository. The first stage establishment of NSDI includes key players. In the second stage, which can be called institutionalization, second generation spatial data infrastructure is established and the stakeholder community widened to include other users (Sorensen, 2012).

The approach of SNGS/SNGS-EP in supporting NGD to establish NSDI is based on technical (geospatial base data creation and distribution) and institutional (improving NGD as an institute). To establish the NSDI the two projects with NGD targeted parallel to

- Strengthen and sustain NGD/SMC technically and institutionally;
- Increase co-operation between NGD/SMC and other organizations (and projects);
- Improve regulatory frame to strengthen the NGD/SMC capacities to implement the amended decree;
- Improve data and information sharing (GIS committee);
- Establish National Geoportal to NGD;

Chapter 2 explain the main challenges in Lao PDR in different sectors, which mainly are related to the quality (accuracy/age of it) of the data. SNGS targets, besides strengthen NGD/SMCs capacity, also provide support to other sectors.

2. SECTORAL CHALLENGES AND GEOSPATIAL DATA

This chapter provides a short review on different activities in Lao PDR and how they are or can be supported by accurate and up-to-date data.

Land Management: Land titling is currently based on unplanned sporadic activities. The government supports financially the continuation of the work in the poorest districts, but lack of the proper data has led to approaches and inconsistent methodologies that vary from province to another. Government organizations are using, when available, old hardcopy

photomaps, which were created at the end of 1990s to support the World Bank funded systematic registration project (2000-2009). During that time, NGD supported the land sector by providing the orthophotographs for piloting of the land registering. The lack of a systematic method and approved Land Policy hinder the process even more. Registering of the parcels is done mainly by using slow step-by-step processes, which are mainly based on a field work. Accurate and up-to-date data (orthophotos) would speed up the process and enable better planning and preparation in the offices. German funded project has supported the Department of Land Administration (DoLA) in land registration. This, still a pilot, targets to establish step-by-step system to efficiently register individual parcels and communal lands. NGD, with the support from SNGS-EP, has had preliminary talks with DoLA to support the processes of the registration of communal lands by using orthophotos, digital elevation model and GIS database.

The need of natural resources has led to a rapid increase in concession areas (plantations, mining, commercial agriculture etc.). The biggest challenge is that these areas are administered by different ministries, using methodologies that are based on old, inaccurate and out of date geospatial data. The methodologies related to the recording of land concessions are based on, if any spatial information, different maps from different sources. This has created an unreliable and uncontrolled system. The consequence of this is a confusing land allocation system with overlaps, environmental degradation and a missing beneficiary system to support villages. The overlaps e.g. in mining are costly, because the concessions fees are based on the size of the area.

Despite ambitious plans of the government to increase the forest cover towards 70 % by the year 2020 the natural forests are in danger. According to the inventory made in 2010 the forest cover is a bit over 40%. One of the main challenges related to the forest management is the illegal logging. One of the obstacles in forestry are the inaccurate boundaries between legal and illegal loggings (production forests, permitted infrastructure projects etc.). Boundaries of different forest types (production, protection and conservation) should be made available through a common distributed system making distinction between legal and illegal activities better known. The Finnish government funded Sustainable Forestry and Rural Development Project (SUFORD) aims to improve forest management to alleviate rural poverty. During the initial stages of the project duration Production Forest Areas (PFA) have been established around Lao PDR. Currently SUFORD is using orthoimagery for REDD related verification and for village based land use planning.

Climate change and Reduced Emissions from Deforestation and Degradation (REDD) strategy and implementation in Lao PDR is engaging various stakeholders. It targets to make credible estimates of national forest resources. The government of Lao in partnership with the World Bank Forest Carbon Partnership Facility (FCPF) has prepared strategies to allow Lao PDR access to the carbon markets in the future. There are various REDD projects in Lao PDR. Activities include policy development, linking forest communities to the carbon market and private sector engagement. Orthoimages are already playing important role in the REDD activities.

Strong economic growth mainly based on uncontrolled use of natural resources, is putting pressure on environmental protection. Environmental degradation combined with climate change is causing floods, droughts, erosion etc. Rural population depended on agriculture and surrounding natural resources are affected the most. There is a need to strengthen the capacity to mitigate these negative changes in the environment. Ministry of Natural Resources and Environment and its various donors are trying to improve the situation in management of natural resources. Most of these projects and related activities are strongly depended on accurate and up-to-date geospatial data.

Lao PDR is one of the most heavily bombed countries in the world (per capita the heaviest). During the Second Indochina War (aka Vietnam War; 1964-73) over 580,000 bombing missions were carried out over Laos and 2 million tons of ordnance were dropped on its landscape. Some of these have remained active and are still causing casualties and injuries. Approximately 25 % of Laos, more than 8,000, villages are still contaminated by unexploded ordnance (UXO). These unexploded ordnances are also slowing down the socio-economic development by making large areas inaccessible. Almost all rural development projects and related activities require, because of the safety reasons, UXO clearance. This takes a considerable amount of resources and time making the overall progress slow. Information about current status of the clearance should be available to all for planning purposes. Mine Activity Group (MAG) is currently using the orthophotos to better plan the forthcoming activities. This reduces the field work and more importantly makes it more efficient.

As a summary accurate and up-to-date geospatial data is needed by various organizations. The main challenge is the slow sharing of data or/and information between different organizations.

3. TECHNICAL AND INSTITUTIONAL APPROACH FOR ESTABLISHMENT OF NSDI

3.1 National Geographic Department

NGD spent years without sufficient budget from the government as well without technical support from the donors. Basic knowledge in surveying, mapping and GIS was there, but understanding new technologies such as modern GIS was missing putting it behind other organizations. As an institution NGD has been seen as a non-co-operative and an organization that has been falling behind in geospatial technologies. Data maintenance including updating was not understood and not even possible because of small budget. Marketing skills were missing making awareness of its existence low. This has led to a situation where, a previously relatively strong organization known as a traditional map maker, has lost its position as a leader in geospatial data.

Short assessment of *Strengths, Weaknesses, Opportunities and Threats (SWOT)*, done in the *first years of the project(s)*, showed that there was potential to improve NGD both technically and institutionally. The main strengths, weaknesses, opportunities and threats are shown below with the improvements done by the SNGS and its extension.

The main *Strengths*:

- 1) The basic understanding in surveying, mapping, geodesy, photogrammetry and cartography is high. NGD is the only organization in Lao PDR with education and high level of knowledge on these topics. SNGS has further built up technical capacities by updating the knowledge by training and replacing the hardware and the software with state of art equipment.
- 2) Long tradition in surveying activities and map production has made NGD very confident in implementing these tasks. Still some activities are not done systematically, but using old fashion and conventional (manual) data storing and documentation, which has left possibility of errors in the important data sets. During SNGS improvements were made to data maintenance and storing. Still the system is relatively expensive to sustain and therefore sustainability is a question in NGD/SMC future.

The main *Weaknesses*:

- 1) The lack of understanding broader use of GIS, accurate and consistent digital data. Even though the capacities have been build up during the SNGS to correspond modern age mapping requirements, the innovate use of GIS is missing.
- 2) The lack of co-operation with other organizations. During the SNGS projects initiatives to support NGD/SMC to co-operate with other organizations and projects has been done. Co-operation covers now large scale mapping with Korean Development aid (KOICA), preparation for the Census with Swiss Development co-operation and the new initiative to support German funded land management project. The Government of Vietnam is currently supporting NGD and the project done by them covers the aerial photography of the North as well 1:50,000 scale mapping of the Central and North Laos.
- 3) Because of lack of awareness rising, NGDs role or mandates are not known by other organizations. Marketing has not been a major activity to organization that does not really benefit anyway on the work they do. During SNGS extension project awareness raising and marketing are both in the spot light. There are plans to introduce NGD/SMC in events and create a short film covering NGD work and services. Further on concentration to approach different ministries in raising awareness on mapping and using accurate geospatial data is in the top of the list.
- 4) Lack of strong institutional leadership that understands the future requirements and importance of the co-operation. During the years before SNGS, NGD has fallen behind in the progress and stronger ministries have taken over the leadership in geospatial data production. During the extension of the SNGS several new activities are building up on the idea of sustaining NGD work. The umbrella of all activities is a strategic plan. Several different activities are under this plan and all target to build up NGD institutionally. The plan includes e.g. 10-years mapping, marketing and human resources plans.

The main *Opportunities*:

1) New, young and educated workforce, with experiences from other countries are now improving the overall capacity of NGD/SMC. SNGS has supported these persons to overcome the slow old bureaucratic system that tends not to allow younger generation to achieve too much.

2) Organizational change and move under the MoHA now provides data marketing and distribution channels to provinces and districts (previously NGD did not have province/district offices). Distribution to provinces can be made possible by using existing government built fiber optic network covering main urban areas of the country. Currently the concentration is to train the offices to at least support the central office by providing the capacities for field surveys. E.g. using hand held GPS.

The main *Threats*:

1) Falling behind in general development in geospatial technologies. Other organizations are becoming more advanced GIS users and are even capable to provide mapping services to other organizations,

2) Sustainment of the activities and achievements started and done during SNGS. SNGS-EP is only targeting to sustain activities, which had been started during the previous projects. It targets to find sustainable and same time economical solutions for map production. It also targets to train the personnel to better understand modern IT system and sustain the technically challenging Geoportal.

3.2 Program Approach

As mentioned above, the most challenging issue in establishment of NSDI in Lao PDR is sustainability. This is especially important in the countries that are still developing and heavily depended on donor funding. Therefore, besides building up the capacities in the technical side using different high end technologies, SNGS targets equally to strengthen the institutional capacity of NGD. This includes establishment of co-operative committee (National GIS Committee) and awareness rising/marketing including higher government levels to achieve recognition and support to accurate mapping. Further on it includes better planning mechanism that targets systematically to increase NGDs capacities to better serve as a survey and mapping institute.

3.2.1 Technical approach

In the technical approach two main points are

1) The accurate and up-to-date base data: The last four years NGD has concentrated on, with the support from SNGS program, to create an accurate and up-to-date digital base map. The approach has improved the situation several ways. Technical update of the geodetic network was one of the first. Two thirds of the country has been covered by aerial

photography. The photography has been followed by orthophoto production with a resolution of 0.5 meters. NGD has the digitization (2D/3D) that targets to establish seamless multi use and purpose GIS database. The seamless database and related 1:50,000 mapping of the south is planned to be published in spring, 2015. The last third of the country as well the mappings (in scale 1:50,000) of the South and Central areas are expected to be done by the project funded by the Government of Vietnam.

One of the most important tasks of the program is to make the NGD data available to other ministries and their departments, non-government organizations, development partners, aid projects etc. that are currently working on poverty eradication, mitigation of environmental impacts, forest management etc. Because of the tight budgets, most of the government departments are not able to purchase the data with the price set by NGD. The project, especially its extension (SNGS-EP), targets to promote idea that the data is available free-of-charge to all government organizations to ensure that these organizations are basin their data sets on same accurate data. There are several challenges related to this and one of the most important ones is the revenues of NGD. The Ministry of Finance sets every year income targets for NGD. Making the data available for free-of-charge will make it NGD difficult to reach the targets (even this data is funded by Finnish Development Co-operation).

2) The Geoportal. One of the first steps, to improve data distribution and establishing a nationwide NSDI, is the creation of web-based tools for accessing geographic information and services. In the first stage the Geoportal, named the National Cooperative Geoportal of NGD, was used to allow limited access to data including orthophotos, basemap and DEM. Later on the plan is to include other providers as well by collaborating and sharing data. Currently the geoportal is used to display orthophotos and the seamless map database of NGD. Towards the Spring 2015 Geoportal has gone through several improvements. Operating system in service is updated to Ubuntu 14.04 LTS version and geospatial software stack based on GeoServer, OpenLayers, PostGIS and GDAL is also updated with new features. Because of new features in software and system service level, some modifications and reconfiguration has been done for simplified maintenance tasks in mind. Using OpenLayers 3 JavaScript framework enables new visual outlook in client demos on the public web, and GeoExplorer (part of OpenGeo Suite) and QGIS are used mostly in internal (in house) data service demos. Towards the Spring 2015 Geoportal has gone through several important improvements during 2015 and QGIS are used mostly in internal (in house) data service demos.

3.2.2 Institutional approach

One of the main objectives of the SNGS program is to strengthen NGD as an institution. In the first phase this has included the establishment of the co-operative GIS-committee and related technical working groups. GIS committee was established 2003, but because of the lack of the funds the committee was not able to continue its work. The work was re-activated in 2010 to coordinate GIS related issues between different line ministries and their departments. The main tasks of the committee are 1) to coordinate and inform about geographic information of each organization for future development, 2) to study and to set technical standards for geographic information, 3) to set up policies for harmonizing data exchange and 4) to search funding for the committee's activities.

So far the committee has been funded by the SNGS program. In the future other more sustainable cost covering models should be used. Further on, when the importance of the up-to-date geospatial data is better understood and funds are more actively incorporated to support the committee work, it should become the advisory body to the government on geospatial data, related technologies and human resources.

SNGS-EP targets to promote the idea of government support to the activities of NGD. The state support requires justification and therefore the extension project has an activity that concentrates only to estimate the benefits of using the accurate and up-to-date data in different organisations. The institutional approach of SNGS includes also building up NGD and SMC to better plan and implements activities. This activity covers strategic planning (short and long term), understanding the budgeting, cost calculations, data pricing policies and how to allocate funds to certain activities. All these target to make the organization and its activities more sustainable.

Important part of the institutional strengthening recently has been awareness rising. This activity has included stakeholder and client interviews, marketing workshops and seminars in the capital Vientiane and in the provinces. SNGS has supported NGD in arranging seminars, workshops and training that has covered potential users of geospatial data. In the extension phase a vice minister level seminar, including representatives from different ministries, has been arranged to introduce the products of NGD and more importantly how other organizations are using and can use them to improve their work, save costs and other resources. The main objective is to get the geospatial data understood and recognized as a necessity for socio-economic planning and development. Further on it should be incorporated as a needed tool to the 8th Socio-Economic Plan (2016-2020) to further on develop the country.

SNGS targets with its institutional capacity building, besides adding technological solutions to the marketing and data distribution, to improve the skills of NGD personnel to approach clients. This requires training that covers different sectors and their needs. NGD, to better provide or at least propose services, needs to understand basic needs and methodologies related to different line sectors such as land management, forestry, environment etc. Existing nationwide coverage of fiber optic cable enables fast transfer of data to province offices. Preliminary visits and studies to enable the data transfer and utilization of provincial offices have already been made. To fully use these new facilities capacity building covering the provinces is one of the planned the future activities.

4. CONCLUSIONS

As seen, the establishment of NSDI in Lao PDR is in its initial stages. Nevertheless the progress has been made in both, technical and institutional side. Activities have concentrated on overcoming the overall challenges described in Chapter 1 and to support different organizations to comply with sector related challenges, as seen in Chapter 2. With the support from the SNGS program, the capacity of NGD as an organization to better serve other line sectors with accurate and up-to-date geospatial data has improved.

The institutionalization has included the establishment of GIS committee and related working groups. This has already improved co-operation between different organizations.

Further on, the program has been concentrating on building NGD capacity and strengths to better comply with modern requirements related to multi use and purpose GIS database. This is done to keep NGD on the same page and pace with other organizations. Further on, the young professionals have been actively used for different technical tasks. They have also participated on activities related to the improvement of NGD as an institution. In the future province offices of NGD are planned to be used as active data distribution channels.

The biggest challenge is the sustainability of the NGD activities. Currently NGD receives technical assistance from Finland, Switzerland, Korea and Vietnam. It is impossible to foresee how much of the activities will be sustained after the project ends. Nevertheless all support targets to make activities sustainable. Further on make frequent updates to the base map there is a need for higher level recognition. NGD, with the support of SNGS, has already had a minister/vice minister level seminar that targeted to distribute information related to the use of geospatial data and related possibilities e.g. cost savings.

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BIOGRAPHICAL NOTES

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