

# **Application of Information and Communication Technology to Promote Sustainable Development**

## **A Case Study: Town of Luang Prabang, Lao PDR**

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### **1 Introduction**

Expansion of tourism in the town of Luang Prabang, Lao PDR, since the inscription to the World Heritage List in 1995 has been making impacts on the town in both positive and negative ways. Luang Prabang has necessity to promote policies and programs for sustainable development in order to utilize the value of the heritage for the local community.

Recently, use of information and communication technology (ICT) has been exponentially increased all over the world. Especially in developing countries, ICT has been actively utilized for development projects. Although ICT development might be considered as luxury and is often given low priority in developing countries, an appropriate and localized use of information technologies can have positive impact on its sustainable development. According to the Independent Commission for Worldwide Telecommunications Development, (1984, p.8)

*“ICT itself is not an element which makes people wealthy, but it could accelerate development for the local population by facilitating access to information and communication, thus complementing benefit of other fields”.*

Having worked closely with professionals in local institutions and government offices in Luang Prabang, the authors are convinced that ICT can serve as effective tools to promote sustainable development in the region. “ICT” in this paper is used as information technology using computer and telecommunication technologies focusing on interactive tools such as telephone and Internet.

The team of Tokyo Institute of Technology in partnership with UNESCO and local government, conducted a field survey to determine how ICT could contribute to sustainable development of Luang Prabang, Based on the result of field study, the joint project was established to meet the local needs in introducing information technologies. As local human resources development being a crucial and component of the project, the joint team identified four major areas where information technologies can be introduced.

This paper first lays out the project components 1) by explaining how the use of ICT can promote development activities in Luang Prabang, and 2) identifying potential obstacles that might hamper further sustainable operation of proposed activities in this field. The authors intends to analyze the social and cultural impact that ICT project had in local communities and organizations.

## 2 Background

### 2.1 Regional background

Luang Prabang province, located at the north of Lao PDR, consists of 11 districts and 911 villages, and has a population of 365,000 people. The town of Luang Prabang is the provincial capital located at the south-east part of Luang Prabang province and approximately 230km north of Vientiane, the capital city of Lao PDR. The town of Luang Prabang has 58 villages and 46,000 people. The town has a heritage conservation area, consisting of 33 villages with 30,000 people. After the town of Luang Prabang became a world heritage-listed site in 1995, tourism has been increasing. An average of 50,000- 60,000 visitors in 1995 and 1996 increased to 80,000 in 1998 (Luang Prabang government, 2000).



**Figure 1 Map of Laos**

Source: [http:// www.lib.utexas.edu/](http://www.lib.utexas.edu/)

### 2.2 Collaboration scheme and Heritage management

Tokyo Tech has collaborated with La Maison du Patrimoine (MdP) and UNESCO in the research activities since 2003. Since its inscription to the World Heritage Site, an Inter-Institutional Committee was organized, specifically in charge of the protection and rehabilitation of the heritage site. The Committee consists of the Ministry of Information and Culture (MIC), the Ministry of Communication Transportation Post and Construction (MCTPC), the Provincial Government and La Maison du Patrimoine (MdP). While MIC takes a leading role at the national level by proposing the issues for developing the adequate strategy, MdP serves as the focal institution for managing the heritage site. MdP is a national Lao authority, directly reporting to the MIC. It was created in 1996 according to the UNESCO recommendations following the inscription of Luang Prabang site to the World Heritage List. MdP has four important roles in 1) controlling, protecting, restoring and embellishing the listed heritage, 2) managing natural conservation, 3) developing the marketplace for local people, and 4) coordinating the relationship with international organizations and relevant donors.

## 3 Project components and activities

The joint team conducted a field survey to determine how ICT could contribute to sustainable development of Luang Prabang. Through the analysis of gathered data, the problems and needs are identified in the following three categories: 1) development and operation of a database, 2) establishment of network among institutions, 3) development

and management of web sites, and 4) establishment and development of local ICT centers and 5) local human resource development.

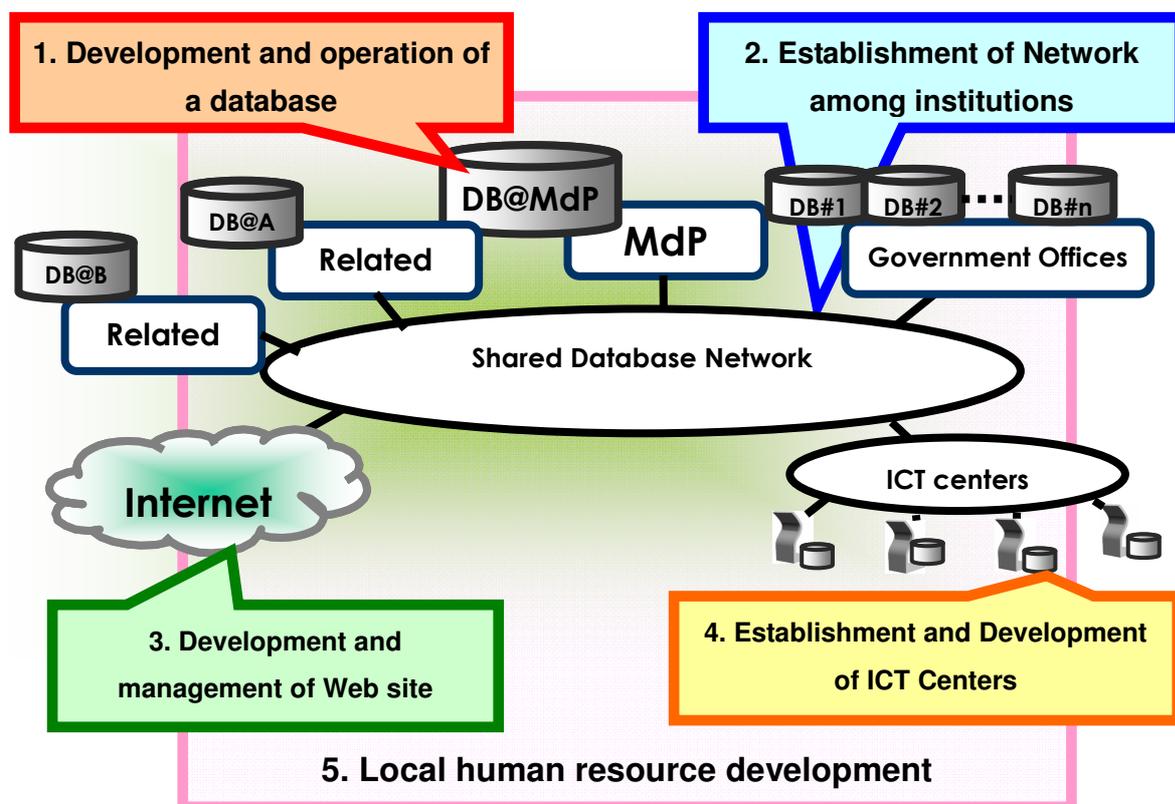


Figure 2 Project components based on the needs assessment  
Source: *brainstorming and meeting in MdP, Luang Prabang, Lao PDR, Jan 2005*

### 3.1 Development and operation of a database

Well-organized and shared information contributes to high productivity of organizations. Information management should be strategic in order to utilize useful information for organizations' benefits. In the past years, MdP accumulated abundant information. Such information not only has the cultural value as the information of the world heritage site but also is useful for the development and conservation activities in the other heritage sites. Most information in MdP is paper-based and is not in good condition. Further, the system they established on voluntary basis was a standalone system and thus, individually updated data cannot be shared effectively among users.

Given this condition, the joint team developed the prototype application database referred as "Heritage Database". This aims at improving the usage of information on more than 600 protected architectures and 280 wetland and 265 road in the town. This database includes the metadata for each inventories, photographs, and drawings. The system enables to search appropriate information from different parameters according to the different user groups. The characteristics of the system, which reflect local conditions are: 1) establishing client/server system, 2) using free and open source

software, and 3) creating web based user interfaces.

**1) Establishing client/server system:** Client/server system enables to manage the data by concentrating on to the server which was previously stored on individual PCs and thus, this system promotes the consistency of data. Furthermore, advantage of this client/server system is to support its scalability. In order to add the new clients and servers, what is required is to simply setup the additional connection with network. In addition, since most of processing of DBMS is done by server, the client machine itself does not need high performance system to use DBMS. With current available equipment found in the town, and the level of technological development, it is important to have the system which can be operated with moderate performance.

**2) Using free and open source software (FOSS):** The license fee of the commercial software is more expensive compared with local commodity price in Luang Prabang. There are the cases that the system created by the international projects had to be suspended because the system could not afford the license fee after the termination of the project. In this sense, it is quite necessary to develop the sustainable system using software which does not require expensive annual license fee. In the meantime, illegal use of commercial software has become common globally, including many developing countries. Illegal use must be prevented from the moral point of view. The established server can be open to the public only when it uses legal software. In creation of the proto type, operating system and application software were organized with FOSS distributed for free of charge over the Internet. In the sense, using such software could guarantee the sustainability of its usage from the view point of cost and legal issues, if the local human resources are equipped with the appropriate skills to utilize such system.

**3) Creating web based user interface:** Web based user interface need only web browser. Since web browser is installed on almost of all PCs, no installation of specific software is required to use the database application created with web based user interface as a client. Web browser is the one of the most frequently-used software, so the users could be easily familiar with user interface. Besides, web-based system is applicable to link database application with web site.

Once the system was developed, data input has been initiated by the local team at daily bases. Although it was the first and new experience for the local IT members to touch database system, the participation in the process of the database system development served as on-the-job training for the team members.

### **3.2 Establishment of network among institutions**

If the network among the institutions is established in the town of Luang Prabang, information managed by database in each institution can be shared. In Luang Prabang, many important local government offices are heavily involved in infrastructure and other development work in the preservation zone. It is essential that updated information on

related activities be shared among multiple institutions. However, currently technical difficulty along with strong sectionalism among local government offices makes it difficult to effectively share information. Once abundant information is well-organized via DBMS and effective use of such information is understood among the offices concerned, the connectivity is necessary to provide access to same information. That is, Information sharing network among such institutions would promote the inter-institutional activities.

Currently, the experiment of wireless connectivity is taking place in Luang Prabang. The local team members are participating in this experiment to identify the best and most appropriate method to realize the network connectivity among related government offices. This experiment is receiving more attention among different institutions and the team is being requested to include other institutions to share available information using possible network connectivity.

### **3.3 Development and management of web sites**

Although one of the main industries of Luang Prabang is tourism, no official Luang Prabang Town web site existed. Creation of the portal web site of Luang Prabang linking the part of information on databases was considered to be a desired tool to disseminate information to public. The portal website of Luang Prabang aims at providing specific information to different user groups. The portal website should be created as the central information resource for people who need any information on Luang Prabang. Brainstorming session with Heritage Committee members as well as related governmental offices found that the portal website should include information resources of 1) tourism information, 2) local information including legislation, commerce, and entertainment to name a few, 3) world heritage, especially focusing on Luang Prabang's tradition. Creation of a portal website for Luang Prabang will become an effective information resource for the locals, tourists and people who are interested in world heritage all over the world. Types of information and expected benefit from the website are illustrated in Table 1.

Target groups	Types of information	Benefit
General public	Information on Luang Prabang Activities of MdP	LPG and MdP known to public
Tourists	Historic, cultural and tourist information	Tourist better equipped MdP officials save time
Researchers	Specific information e.g. architecture, environment	Academic knowledge Further research
Business people	Regulations Bidding information	Increased business opportunities No need to repeat information
International organization Aid agency	Management of world heritage conservation activities	Shared knowledge Increased opportunities of fund raising
Community people	Authorization process and regulations, good practice	Raised awareness

**Table 1 Benefits from the portal web site of Luang Prabang**  
**Source: brainstorming and meeting in MdP, Luang Prabang, Lao PDR, Sep 2004**

### **3.4 Conceptualization and development of local ICT centers**

ICT center provides access to information using ICT facilities for local community members and tourists. The function and mode of ICT centers differ from place to place depending on its local environment and specific needs of local and other users. The followings are the reasons why ICT centers can be beneficial for the public in Luang Prabang.

**1) Needs for the local people to have access to information:** People in the town and peripheral rural areas have difficulties in obtaining necessary information for their lives. If local people can exchange useful information for their business and recreation, their social and economic activities would be flourished. In addition, currently locals do not have easy access to legal information related to the construction of the houses in the heritage zone of the town. Since such information is essential to preserve and maintain heritage architectures and landscape of the town, ICT center can serve as valuable source of information for local community.

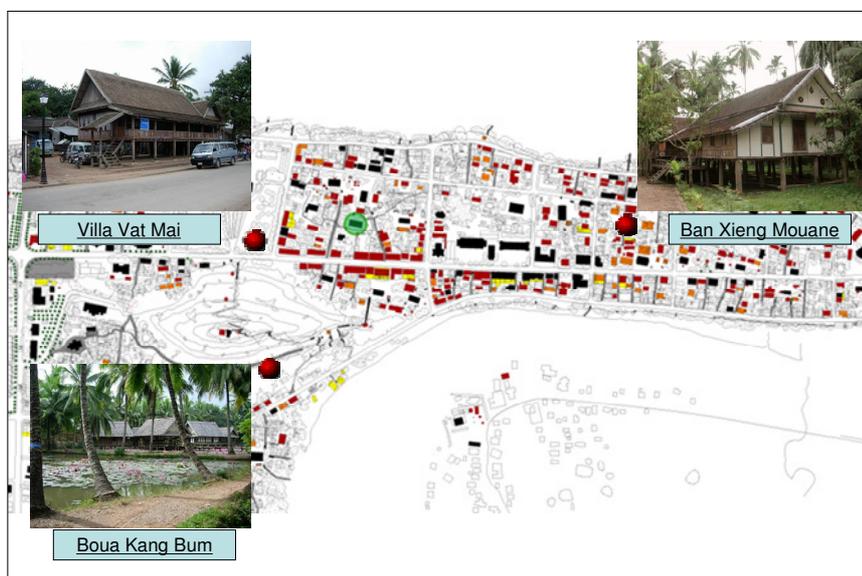
**2) Needs to develop active reuse of restored architecture:** There are a number of restored heritage architectural buildings in Luang Prabang, but some of these architectures are underutilized. The restored architecture should be open to public for its cultural value and the tourism business opportunity for the local community. Not only the conservation activities but also its innovated reuse is vital to provide benefits for the community. Currently such restored architectural buildings with heritage value are sometimes used for the events and ceremonies, but there is no regular activity. The restored architectures could be actively reused as educational museums, community centers, and heritage repair skill training centers. ICT center is the possible option as a useful function of the restored heritage architectures.

**3) Needs to establish the tourist information center:** There is no official tourist information center in Luang Prabang. The town has not yet been able to introduce important visiting sites to tourists. If the restored heritage architectures can be equipped with necessary ICT facilities, the site can play a role as a tourist information center.

As the first pilot sites, three heritage sites are identified as the candidate for local ICT centers, namely Ban Xieng Mouane, Bua Kang Bung and Villa Vat Mai. They are the remarkable places to represent the features of the heritage town of Luang Prabang. Ban Xieng Mouane and Villa Vat Mai are typical Lao traditional wooden houses. Bua Kang Bung is one of the biggest wetlands which traditionally take important role on close relation with people's life in this town.

Since the establishment of local ICT center is the first trial for the local communities, it was important to gather information and opinion from local representatives to conceptualize and make necessary planning. Based on the initial discussion and

proposal by the joint team, continuous discussion had been taking place among MdP and local communities since 2005. Discussion and proposal contain the spatial design, the operating organizational structure, contents/activities design as well as self sustainable operational plan. According to the initial proposals, the first ICT center will provide the following four main services.



**Figure 3 Three sites for ICT center**  
Source: produced by joint IT team, MdP, Lunag Prabang, June 2006

- 1) Providing information via database: Five computers will be installed in ICT center to provide visitors access to information. The initial database system contains Heritage database, Photo database, MdP website and the yellow pages. The contents are to be updated frequently with additional categories of information. Aiming at sustainable operation, user feedback is being collected, particularly, during the first three months. Further, in order to promote community participation in its operation and active use, the village organizations where the first pilot site is located were interviewed to come up with localized plan of use of the ICT center.
- 2) Promoting interaction: In designing the interior of the ICT center, comfortable setting was considered important to install computers and other equipment in order to promote interaction among users. Unlike commercial internet café, collaborative use rather than individual use is to be encouraged in this local ICT centers. Users can view displays and exhibitions on the wall, interact with other users exchanging information as well as resting with refreshment.
- 3) Educational activities: Educational activities for local children, especially those who do not have easy access to computers and other equipment at schools are encouraged. Together with the village leader and village youth organizations, it is planned to organize weekend sessions for school children in the ICT center. It is hoped that such activities encourage to raise awareness for information technology

as well as heritage information of the local villages.

### **3.5 Local human resource development**

Above all the project components outlined above, the continuous development of ICT application by the local human resources is essential to introduce useful and sustainable ICT applications. Therefore, the local engineers are indispensable, who have ICT skills of programming, database design, server operation, network operation among others. Furthermore, the local ICT engineers are desired to have perspective of the ICT utilization in the Luang Prabang reflecting the world ICT trends and local situations of Luang Prabang.

During the initial field survey and needs assessment, it was emphasized by multiple governmental organizations that Luang Prabang lacks such ICT engineers. The previously implemented projects related to computers and use of software offered only limited local training. Given this situation, the local IT team was organized with 6 members - a Lao team leader from MdP, 5 Lao members from MdP, local government and central government. Although these members did not have ICT skills, they have strong desire to take initiative in ICT field in Luang Prabang through experience in the project.

Through the experience to introduce proto type database application and web site in Luang Prabang, it was evident that local human resources who can systematically develop and manage the database system are essential to obtain the benefit from utilization of the ICT applications. Since the beginning of the project, the continuous workshop has been held for local IT team members. The local team gained basic knowledge and practical skills on 1) web site development, 2) Linux server management, 3) management of LAN and 4) development of web based application. Although further practical experience is still necessary, the team has created the web site of the other government institution and established photo database application of Luang Prabang as a specific product of the workshop. The key to the success of the continuous workshop is to plan training activities that can be practically reflected in local needs using available technologies.

## **4 Potential obstacles experienced in local social and cultural context**

During the first phase of the project, several issues are identified as potential obstacles in introducing and managing ICT in Luang Prabang. The following is the list of issues to be carefully considered for the sustainable use of ICT in the future.

### **4.1 Language support on ICT applications**

To attract the different target groups such as local communities, tourists and other international groups, the contents on the web site and database applications should be in multi-language, at least English, French and Lao. Poor language support of web site and database application might disappoint the potential users in the service. Currently, however, the following issues prevent in providing the multi-language service on the ICT

applications.

**1) Difficulty in translating contents:** Most original document resources in Luang Prabang are in Lao or French. Thus, these document resources have to be translated into English. However, due to limited number of local staff members who are able to translate the text, particularly, with technical terminologies, from Lao to English and from French to English, available human resources are overloaded. In the future, it is necessary to collaborate with local university which was established two years ago. Collaboration in ICT field has been discussed recently and thus, involvement of students and faculties who are in the filed of tourism management and computer science (to be developed in 2007) could be a potential partners.

**2) Poor Lao language support on the system:** Lao language support of the computer system has not been sufficient yet. In terms of web contents, Lao characters can be displayed by downloading specific Lao fonts, if the contents are created with Unicode and Lao fonts in the development process. But there is no Operating System (OS) which has User Interfaces (UI) with Lao language. In the case of Microsoft Windows, Lao language can be installed using the specific software called "Laoscript". But there is no Input Method (IM) on other OS like MacOS and Linux. The linux localization plans to develop the linux distribution called Laonux.

#### **4.2 Local human resource development**

**1) Lack of accessibility to the Internet:** When we learn ICT skill, accessibility to the Internet is a common and important factor since good amount of manuals, materials and tools especially for FOSS are organized and distributed on the Internet. Furthermore, experiencing the actually operated system on the Internet could be important practice to know how ICT can be utilized. But Internet environment in Luang Prabang is not always sufficient for local ataff members to learn ICT skill from Internet.

Not only dial up Internet connection but also always on Internet connection via DSL (Digital Subscriber Line) are available in Luang Prabang. DSL service is provided by local telecommunication operators, LaoTel and ETL. The monthly fee of DSL service is approximately \$300US for 256/128 kbps (Down/Up). (ETL, 2006) Compared with GDP per capita of Laos, \$339.46US in 2003 (Ministry of Foreign Affairs of JAPAN, 2006), it is easily imaginable that use of DSL line for private users is not a feasible option. There are about 20 Internet cafés in Luang Prabang which provide pay-by-the-minutes internet service with 2 cents per minutes. Although such service is popular among foreign tourist, it is unreachable service for local communities and Lao tourists.

**2) Available ICT equipments:** In Luang Prabang, since equipments including PCs are expensive compared to local commodities, it is impossible even for the local government and university to obtain necessary equipments. The price of PCs is often equal to that of the developed countries and PCs are easily broken by frequent surge of electric supply and

humid climate. Those who could afford PCs are limited to the institutions which are supported by international project fund or shops which provide service to foreigners. Although there is a strong need for learning computer skills and knowledge in Luang Prabang, the resources are limited in each institution to be spent on hardware. Experience of organizing constant workshop found that repairing the equipment is not an easy task due to unavailable repair parts and skills to accommodate each specific case.

**3) Level of basic education:** Through the ICT workshop, it was found that lack of English skill and basic Math skill of local staff members could be the potential obstacle to learn ICT skills. Due to limited number of Lao books and materials to learn ICT, more English books and training materials are currently used. Technical terms and computer languages are often based on English, and thus, minimum English skill is required to learn ICT skills. Further, the basic Math is required for logical thinking to deal with some parameters and functions. Local workshop experience found that Lao staffs lacks in basic Math and it would often be a obstacle to understand programming language. In the long time basis, effort to promote the basic education of English and Math becomes an important issue for localized ICT development.

#### **4.3 Self-sustainable financial plan of ICT center**

To develop and promote sustainable operation of ICT center, self-sustainable financial plan becomes vital. The initial cost is relatively high due to high price of ICT equipments, and thus, financial operational plan needs to be created to cover such initial cost. Currently, however, proposed income generating activities in ICT center face two constraints. First, the income generating activities should avoid competing with private sector. During the initial needs assessment on ICT activities, local internet café and other IT service provider were skeptical about the establishment of ICT center. They were reluctant to provide information or to share their opinion. Obviously they were afraid that the operation of ICT center might compete with their business. Income generating activities at ICT center should consider the market price of the service as well as target groups as main users. Second, the refreshment service as a potential income has to be organized in line with local association of such services. Each village organizes services according to the rules established with relevant association. In terms of refreshment service, village commercial association is in charge and any new income generating activities has to go through relevant association.

## **5 Cultural and social impact of the introduction of ICT in Luang Prabang**

### **5.1 Systematic training on ICT skills gave confidence to local ICT team**

Local ICT team organized to participate in ICT skill training and other project activities are full-time members and 6 members come from three different organizations in Luang Prabang and Vientiane. The practical training activities are needs-based and thus, the products from

the training actually served as useful tools of the organizations. Through multiple activities, the local ICT team of the project has been recognized as Luang Prabang's ICT team. Governor's office often contacts the team for assistance and such experience and recognition became motivating factor for the local ICT team to contribute to the town. Co-organization of team members from three organizations also works well in this environment. The each member periodically reports back to their offices on the activities and project implementation. In fact, this process is contributing to disseminate ICT related activities in different organizations in Luang Prabang. Further, local ICT team often organize Heritage Committee meetings to inform and/or receive authorization of new activities. This is also serving as important channel of communication.

### ***5.2 Creation of database promoted the concept of "sharing" information***

Database creation was a new concept and activity taken place in Luang Prabang. It aims at sharing information effectively among relevant organizations and users. As the Heritage Database is equipped with useful functions, other organizations found it interesting and useful. For example, MIC is now offering valuable data on intangible heritage of Luang Prabang to be a part of Heritage Database. UDAA would like to create database on urban development activities to be shared with MdP and other governmental offices. Before ICT project started, information was considered to be "kept" in the organizations and not to be shared so widely. This useful example of the Heritage Database serves as a motivation for the organizational leaders to participate in database creation.

### ***5.3 Establishment of ICT center increased collaboration among related institutions***

Creating database and establishing ICT center in the town was a new experience. Local IT team made a frequent visit to discuss the potential functions and available resources including Urban Development Authority Agency, MIC, MCTPC as well as local heritage committee. For example, the Ministry of Tourism shows interest in ICT center activities and thus, the potential second ICT center would be combined with facilities of tourism information. Since the government authorities often operate its function in vertical way, it is rare that different projects can be so closely coordinated. Further discussing with local village was important since the ICT center aims at promoting use of computers and other information technology at local level. The idea of educational activities to be organized at the ICT center and involvement of women's association and youth association to organize the relevant activities was collected information through interviews and discussion.

### ***5.4 Introduction and training using open source software raised awareness on legal use of the software***

In many developing countries where license fee of the commercial software is over-priced compared with local commodity price, illegal copy of the software easily prevails. For the sustainable use of ICT, the issue of legality has to be understood and tackled at early stage.

The reasons often used to justify the illegal copy of the software is that commercial software is so costly that only illegal copies are options to continue to use the program installed by the international project. In such environment, introducing useful program via free and open source software to create database system was eye-opening experience for the local ICT team and organizations to understand the “options” besides illegal copy of the commercial software.

### ***5.5 Planning self-sustainable project activities gave local team the experience of “planning”***

Through the experience of ICT center development, the local team was required to take initiatives in its planning and organizing and its operation. It was necessary to collaborate with other relevant section of the MdP (such as architectural and environmental sections) as well as village leaders and different village association. The idea of “sustainability” had to be kept in mind when planning the activities of ICT center. Database created by the local IT team become a main function at the initial stage of the ICT center and thus, the content of database has to reflect needs investigated among potential users. Financial planning was the most difficult part since the local team had no independent experience in calculating income and expenditure in its operation. In order to see the initial operation of ICT center, local ICT team will contribute their time in its operation along with gathering constant feedback of the users.

## **6 Conclusion**

In the World Heritage town of Luang Prabang, the field study identified the five specific needs in introducing Information and Communication Technology (ICT) area. First, establishment of proposed database application system is essential for efficient and technically sustainable information management. Second, when the network is established among government related institutions, organized data in each institution would be beneficially shared for promoting cooperation among related institutions in Luang Prabang. Third, creation of web site enables to disseminate valuable information to the potential users through Internet. Fourth, by establishing ICT centers, abundant useful information could be provided to the public within local area through an easy access. This would help raise public awareness in local communities, and eventually contributes to the preservation of the heritage architectures and landscape of the town. Fifth, to realize these needs, local human resource development becomes vital. During the implementation of the activities introducing ICT to Luang Prabang, the project faces several difficulties which may become potential obstacles for sustainable use of ICT. Those factors include poor language support of Lao script on the system, lack of basic English and Math skills for local ICT team members, lack of local human resources for

translation, and costly ICT equipment as well as internet access.

Further, the paper highlighted the major findings on how ICT introduction had social and cultural impact on local organizations and communities. ICT activities in Luang Prabang motivated organizational leaders to share information by creating useful database. Benefit of database was understood by different organizations and thus, promoted collaboration to organize new activities such as establishment of ICT center in town. Further, these new activities encouraged local village association to speak out for the use of ICT center for the local community to benefit from such activities. Given a special attention to those factors, it is hoped that further activities takes place with close collaboration with local institutions and other related government offices, together with local communities.

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