

論文 / 著書情報  
Article / Book Information

論題(和文)	
Title(English)	Analysis on Sustainability of Free and Open Source Software (FOSS) Application ~Database Management of World Heritage Site of Luang Prabang, Lao P.D.R.~
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出典(和文)	国際開発学会第12回春季大会, , , pp. 137-138
Citation(English)	JASID 12th Spring Conference, , , pp. 137-138
発行日 / Pub. date	2011, 6
Note	初出は国際開発学会全国大会報告論文集学会誌である

# **Analysis on Sustainability of Free and Open Source Software (FOSS) Application ~Database Management of World Heritage Site of Luang Prabang, Lao P.D.R.~**

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<Keywords> ICT, Sustainability, Free and Open Source Software (FOSS), Database

## **1. Introduction**

Luang Prabang, Lao PDR is an inscribed world heritage site. A joint project of ICT application to heritage management has been conducted under the collaboration of Tokyo Tech, Lao government and UNESCO since 2004. The most original and significant collaboration started with development and operation of a database management system (DBMS) at the Department of World Heritage Luang Prabang (Yamaguchi 2006). Using free and open source software (FOSS) needs to consider potential challenges and to identify possible solutions to be utilized in sustainable manner. The author worked in Luang Prabang for three months to observe and experience of utilizing FOSS in Luang Prabang in between 2010 and 2011. This paper discusses the challenges in its sustainable usage from technical aspect, human resource skills as well as external factors.

## **2. Database System and Application**

### **2.1 Introducing FOSS to Database Development**

FOSS is software that makes its source code publicly available. While FOSS has advantages including promotion of ICT sustainability at local context, and, it also has shortcomings such as requiring high technical skills as well as lacking in technical support for users (Sagawa 2005).

In Luang Prabang, database server and database applications were developed for digitalization to prevent losing document and to search stacked information efficiently in 2005. For example, heritage database was created to share and disseminate heritage information such as heritage buildings, etc. Authorization database contains important information about rehabilitation/reconstruction of buildings which are only authorized by the Department of World Heritage in Luang Prabang. The project introduced FOSS for creating such databases, considering advantages of 1) low cost of license fees, and 2) legality use of software. PostgreSQL is chosen as a relational DBMS which supports Structure Query Language (SQL), the most popular language for database management in the world. Zope has been chosen as an open source web application server to provide web-based user interface. Zope provides various helpful add-ons such as database adapter, which connects SQL database.

### **2.2 Issues for Sustainable Maintenance of FOSS System**

Since the establishment of database application in 2005, local team experienced difficulty in updating database in the recent years, and it was essential to analyze its cause to seek for possible solutions. The interviews and field survey identified mainly the following three issues; technical and human resource aspects as well as external factors. Most of these issues have discussed in former papers (Sagawa 2005, Touray 2004). On the other hand, “suspension of FOSS system development” and “difficulty succession of technical skills” has never been found in author’s literature review.

#### **1) Technical Aspect**

- a. Suspension of FOSS system development: The development of database adapter had been suspended for almost three years, so new version of Zope could not access to PostgreSQL. During that time, local ICT team members could not update the whole system including Linux OS, nor hardware architecture as the team had to continue using older version of Zope. At the time of initial development of database, this problem was not expected.
- b. Lack of FOSS resources in local language: Most of the information available on the Internet was only provided in English. They use Laotian in daily life, and searching for information in English refrained team members from working more positively.

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## 2) Human Resources Skills

- a. Limited technical skills to replace the current FOSS system: Although local members acquired technical skills to handle and maintain this particular system, they were not involved in designing the system at the initial stage. Thus, local ICT team faces difficulty to come up with other options than Zope.
- b. Difficulty in succession of technical skills: The original local ICT team members were promoted to management positions and new members joined in 2008. The gaps between original and new members are evident in their experiences and knowledge. Further, initial members had limited time to hand over technical skills due to their increased responsibilities. As department was upgraded within provincial government, duties and responsibilities of each member increased and thus, members could not concentrate on database management.

## 3) External Factors

- a. Insufficient availability for reference materials: Access to professional books and reference materials are limited in Luang Prabang. They are out of reach for locals due to high cost. Although needs and interest on advanced computer skills are growing in Luang Prabang, easy access to variety of information is still yet to come. Therefore it is difficult to get new and desired knowledge from printed materials in local site.
- b. Unstable access to online materials: Luang Prabang still experience unexpected blackout several times per week. And the Internet connection is slow and not stable. In such condition, local staff members face difficulties to access online community for Zope users or other online references.

## 3. Current Activities

PHP is considered as an alternative of Zope. PHP is a major programming language embedded in HTML to develop dynamic web site just like Zope. Many books are released around the world, and large community and mailing list exist to share knowledge among users. No additional adapter is needed to connect database, and PostgreSQL can be still continuously used. The use of PHP was concluded in the discussion with local staffs. It is important to involve local staffs from an early stage like the design of the system architecture.

Tokyo Tech team and local ICT team conducted HTML training for new local team members who had no opportunities to receive basic technical skills such as HTML and SQL. The training aims for new members to fill the technical gap with original staffs, and to encourage initiatives for all staffs. Collaborative training will be also conducted for PHP. In this training, each participant left notes using word processor. These notes should be combined into a manual in local language. Shared manual is a useful resource of information to keep knowledge in local site.

Authors consider introducing Virtual Machine (VM), which can virtualize whole system on the actual hardware. OS and server software run on VM with the standard virtual devices and peripherals, i.e. OS and server do not have to be updated even when the server hardware is updated. VMware Player is popular commercial VM software, but freely distributed. This idea needs to be discussed with local staffs.

## 4. Conclusion

FOSS has been utilized for six years in development of database systems in Luang Prabang to effectively share and disseminate valuable heritage information, as well as to efficiently manage authorization for reconstruction of buildings. This paper analyzed the factors influencing sustainable use of FOSS in local context from multiple aspects. Analysis assured authors the importance of constant survey to adapt to rapid changes of ICT trend and local environment.

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