Agile Software Development under University-Government Cooperation

Shigeo KANEDA
Graduate School of Policy and Management, Doshisha University
Kyototanabe-city, Kyoto-fu, 610-0321, JAPAN

Abstract
Importance of the agile software development is recently increased in Japan. Doshisha University and Kyoto-prefecture developed two practical ICT systems by using agile approach without assistance of ICT vendor companies as a PBL (Project Based Learning). From this development experience, this paper clarifies that the connection of Web 2.0 and agile development results in low-cost and high citizen-satisfied ICT systems for local governments. From the viewpoint of applicability, the hierarchical structure of local government is similar to the Web 2.0 structure. The Web Service layer corresponds to the management section of the head quarter. The user side layer corresponds to the local office. On the other hand, from the viewpoint of agile development, the agile approach is a powerful tool for the P (Plan)-D (Do)-C (Check)-A (Action) management cycle of the local government. The PDCA cycles require repeated revision of the software. However, Japanese budget system cannot accept this situation, because the repeated expenditure means that the old expenditure is not appropriate. The collaborative PBL approach between university and local government solves the above problems. University students can acquire ICT system development technique in the prototyping process and the local government can implement a prototype system without budget expenditure.

Keywords: PBL, Software Development, Agile, University, Local Government

1. Introduction
Recently, one opinion has been born in the Japanese government and Nippon Keidanren (Japan Business Federation): faculty of engineering in Japanese university has not sent out the ICT (Information and Communication Technology) engineers whose technical knowledge are sufficient for the real world ICT application development.

One of the reasons is that the curriculum of the information science course of faculty of engineering is mainly focused on “Computer Science” and not on “Software Engineering.”

More essential problems are, however, the followings.

(1) Software engineering is difficult to understand for unskilled students who have not real experience of the application system development.

(2) Teachers themselves have not the experience of the real application system development. Thus, it is difficult to guide students with his/her self-confidence.

To resolve the above problems, the paper proposes agile software development under the university and local-government cooperation. The proposed PBL (Project Based Learning) approach has two major features. The one feature is that the partner is a local government, not a software company. A university cooperates with the organization having the knowledge/experience of the application domain. The other feature is agile software development approach. “Waterfall” model is not suitable for this “volunteer based” PBL project.

The Doshisha University in Kyoto and Kyoto-prefecture, a local government in Japan, developed two practical ICT application systems, respectively in 2004 and 2005, in the proposed PBL scheme. The one system is the “Prefecture Event Information Publishing System using NewsML” and the other system is the “Disaster Information Sharing System in Early Stage.” From these developments, the cooperation between application domain experts and university is very effective as a PBL curriculum.

In the following Section 2, the requirement for local government staff is summarized. Section 3 introduces the developed real application systems. The agile approach is suitable for university and local government collaboration. In Section 4, it is demonstrated that Web 2.0 scheme is effective for the future local government ICT systems. Section 5 concludes this paper.

2. Requirement for Staff of Local Government
Local government was often regarded as a stereotype of the bureaucracy. Staffs on of the local office site have no opinion. Every inquiry is raised to the top management. The local office can decide nothing. This situation is, however, drastically changing in Japan. The major reasons are diversification of
inhabitant requests and hardness of the finance. The expenditure purpose should be squeezed and the reflection of real inhabitant requirements is essential.

PDCA (Plan, Do, Check and Action) Cycles should be strongly required in the local government offices. The staff should propose a new policy, and the policy should be executed. After the execution, the result should be checked and new action should be required if the result has a problem. This PDCA should be repeated as the “cycles.” The inhabitant requirement changes every year. The policy and management should be taken a second look every year.

The ICT (Information, Communication and Technology) system is a good tool for citizen satisfaction and realization of PDCA cycles. Concretely, the ICT system should be modified many times in the PDCA cycles. One problem is raised in the Japanese local governments. “No-error” is required in administrative behavior of the local government. From this dogma, if a system is once developed, modification of the system means that the past budget expenditure is erroneous. The functions and GUI (Graphical User Interface) cannot modify easily. The specification should be perfect from the first time. However, the inhabitant requirement is not constant and system specification never be complete. Modification of application system cannot be avoided.

In order to cope with the change of user requirement and local government budget limitation, this paper proposes a new approach: the collaboration between the local government and university, and an agile software development approach. Doshisha University and Kyoto-prefecture developed two practical application systems, respectively in 2004 and 2005. In the following Section 3, the two practical systems are summarized briefly.

3. Development of Practical Application Systems

In this section, two practical ICT application systems are introduced. Both systems were developed under the cooperation between the Kyoto-prefecture and the Doshisha University.

3.1 Prefecture Event Information Publishing System using NewsML

“Prefecture Event Information System using NewsML” is developed in 2004 [1]. Figure 1 shows the block diagram. This prototype system has all functions for the practical use. The system size is about 22 Kline, implemented by using Xi, extended XSLT language developed by Yokohama Baykit, a Japanese open source project [2].

This system is a “Content Management System” for public relations between the Kyoto-prefecture and the Kyoto-prefecture inhabitants. Three kinds of public-relation information can be managed.

1) “Event Calendar”: The information to post in the Kyoto-prefecture Web-site, such as a seminar, a lecture or amendment of law.
3) “Public-relation Paper Draft”: Information for the “Fumin Dayori” newspaper publishing. The Kyoto-prefecture has a
newspaper “Fumin Dayori (Information for inhabitants)” for inhabitants.

A staff of Kyoto-prefecture inputs the original data of the public-relation information. The inputted data is transferred into the final decision section, and the data is converted into HTML format data, PDF files for distribution, and drafts for “Fumin Dayori.”

The three types of data are stored in XML format. The data is embedded in a NewsML, the international XML standard for newspaper item interchange among newspaper companies[3]. The system was practically used in Kyoto-prefecture and a part of the Kyoto-prefecture formal Web-site was generated every day. Finally, Kyoto-prefecture is developing a next version of the system, by guaranteeing budget in 2006.

The following analysis result is pointed out from the development project.

1) The development is conducted by the public-relations section in the Kyoto-prefecture head quarter. The business flow is complete and there is no coming out, as least, for public-relation jobs. On the other hand, the scope of the developed system is limited.

2) The system is isolated from the other systems as shown in Figure 2. For instance, when the meeting place of a seminar is changed, it is necessary to modify simultaneously the facility reservation database and the public relation database. However, this type of function cannot be implemented in this type of isolated systems.

3) The system was designed under the cooperation of university students and the staffs of the public relation section of Kyoto-prefecture. The Kyoto-prefecture staff proposed and checked the GUI screens. However, real user of the system is not the headquarter staff. The staff of local office is the real user of the system.

Thus, to confirm the effectiveness of the user participation approach, the authors developed another system under the cooperation of local office of Kyoto Prefecture.

3.2 Disaster Information Sharing System in Early Stage

This is a Web-GIS application system to share the disaster information among several engineering works (local) offices in Kyoto-prefecture [4]. This system handles three types of disaster information: river disaster, road disaster and sand...
disaster. The disaster information is usually reported from an inhabitant. The information often contains mistake or ambiguous. Thus, usually the staff of Kyoto-prefecture has to verify the real situation.

The disaster information should be shared among local offices of Kyoto-prefecture. However, only one local office can get the disaster information from the inhabitant. The other many local offices are required to make telephone calls for all local offices to get the real situation.

To solve the above problem, “Disaster Information Sharing System in Early Stage” was developed. Figure 3 shows a top screen of the developed system. The Web-GIS is Google Maps and the Google Map is activated through Google Maps API. The rightmost side shows the list of disasters. These three types are distinguished due to the color of the “Balloon” on the Map. The balloon data is inputted and modified from Web browser, Internet Explorer or Firefox. If one balloon on the map is clicked, the detail information is shown. This system is practically used in the social experiment of disaster prevention.

The Cross-business System which Local Office Desires.

**Figure 4. Cross-Business Requirement at Local Office**

The following analytical results are pointed out from this project.

1) Local office staffs communicate with the inhabitant directly. Thus, PDCA cycle, mentioned before, is necessary to be actualized at the local office. Finally, local office wishes the extended functions over plural businesses as shown in Fig. 4.

2) “One stop service” is a major target of the local office. The one stop service system accesses various businesses. The isolated system never fit this requirement.

4. Agile Approach and Web 2.0

From the above analysis, two points can be concluded: 1) two layered structure of Web service is similar to the ideal structure of local government, 2) the proposed PBL approach, agile and user participation software development, is suitable for the realization of the PDCA cycle of the local government.

4.1 User Participation and Agile Software Development

As mentioned in Section 2, PDCA cycle is supreme order for local government staffs. However, It is not permitted from budget restriction that the ICT system is re-modeled. To solve the problem, there are some candidates approaches.

One of them is re-structuring of budget system. This is very hard approach. Another approach is to make a no-error specification at the first development. Of course, the target of requirement engineering is this one time specification making. However, This is very difficult, because the requirement of inhabitant can change every year.

Another problem is that the distance between the system user and staffs in the plan section of headquarter, having the budget decisive authority. The user of the system is mainly a local office staff. Only users can decide final system specification for PDCA cycle. However, often a plan section staff, not a local office staff, describes the final and detailed system specification. To write the specification, “hearing from the users” is employed. However, staffs of plan section don’t know the real business and workflow at the local office. The hearing and specification may be incomplete.

The only way to solve the above problem is “user participation” in the requirement analysis phase. The proposed PBL approach between a local government and a university results in user participation, especially collaboration between local office and the university. Fortunately, the PBL approach costs small budget, because this is an education curriculum and basically voluntary based approach. Especially, if the PBL approach employs “agile development”, the system can be re-modeled many times. Thus, the system function can be changed many times, accompanied by change of user requirement. Agile approach conformed to PDCA cycle actualization.

4.2 Web service and Local Government

In Fig. 2, each plan section of local government wishes to have an isolated system. The isolated system is not ideal from the software engineering viewpoints. However, there is some
inevitability in the isolation, because each plan section wishes to control the business data and services. On the other hand, mentioned before in Fig.4, local office staffs wish to cross-business application system to realize PDCA cycle for the inhabitants.

Figure 5 shows the architecture of Web 2.0. Each Web service server can realize some service function concerning the database. On the other hand, each portal site can realize cross-business services for the users. This Web 2.0 architecture is suitable to realize the ICT application system for the local government. The plan section corresponds to the Web service server and the local office corresponds to the portal site.

### 4.3 Current Status and Its Problem

Strictly speaking, the current ICT application system development style of the local government is nearly equal to Figure 2. Thus, each application is a isolated system and the database scheme is optimized for the closed business area. Data communication function is partly supported by using file transfer, such as CSV format data.

The major problems are 1) database scheme is partially optimized and over all “Conceptual Modeling” for all data in the prefecture is omitted in the design process, and 2) data transfer between applications is not real-time. Thus, cross-business application development is difficult. More “Open” architecture should be employed to make an innovative and user-friendly application system, and to contribute for easy development/modification, and PDCA cycle realization.

### 5. Conclusion

This paper proposed an agile software development PBL (Project Based Learning) approach for the information science department, faculty of engineering, universities. In this scheme, the university cooperates with business supervision, namely the user, which has the contents, not with software vendor. Doshisha University and Kyoto-prefecture developed two real application systems under the above PBL approach. One is “Prefecture Event Information Publishing System using NewsML” and the other is the “Disaster Information Sharing System in Early Stage.”

The former is a typical application system developed by the job plan section of the head quarter, the public relation section. The public relations section has responsibility in management of all public information items in Kyoto-prefecture. This type of application systems becomes often an isolated system which has no direct path to the other application systems. The later system is “Disaster Information Sharing System in Early Stage,” developed by the local office, engineering works office.

According to the development, the following analytical results were obtained. (1) Cooperation with local office staffs, having domain knowledge, presents an effective PBL (Project Based Learning) curriculum. The students can know real world application development and understand the importance of software engineering. (2) The agile software development is suitable for the realization of PDCA (Plan Do Check and Action) cycles, required in the daily jobs of the local office. (3)
The structure of the local government business is similar to the two-layered Web 2.0 (Web Service) architecture. Web service architecture presents easy modification of the application system.

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References