Vitalizing Local ICT-industry by Acceleration of FLOSS-based Software Product Development: A Case Study of the ICT-industry in Okinawa

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***Abstract*—Occupational condition differentials between major enterprises in areas around central Japan and small-medium-enterprises in rural area are caused by hierarchical structure in Japanese industries on the information communication technologies (ICT). In order to remove this inadequate situation, we have drawn a blueprint to reform the ICT-industry by proposing a reference model to develop Free/Libre/OpenSource-based software products and a system that can support the development. The system has been implemented in an organization to help the local ICT-enterprises in Okinawa and the reference model is also now provided by that organization. This paper reports an outline of the system and that of the reference model. A result of test-run of software products development along with the reference model, using the support system, is also shown in this paper.**

Keywords- OSS-based software products; local ICT-industry; development support.

I. INTRODUCTION

The industrial structure of the information and communication technologies (ICT) industry in Japan is similar to that of construction industry. That is, it is organized in a pyramid structure, where a main contractor exists at the top of the hierarchical structure. In the pyramid, not only sub contractors but also sub-sub contractors, and often much deeper degree of contractors can be members of the hierarchical structure. In such an industrial structure, only contractors in upper layers have opportunities to perform creative activities, because they play roles in upper process, such as requirement analysis and/or system conceptual design. Small-medium enterprises (SMEs) located at the bottom of the hierarchical structure are usually associated with lower process of system development. Hence, they mainly take charge of coding or relatively smaller unit-function development, and tend to accept relatively non-challenging work.

The occupational condition differential between major enterprises in the Tokyo area and SMEs in rural areas is caused by these hierarchical structures of Japanese ICT-industry. To eliminate these differentials and to vitalize the local ICT-industry, this industry structure should be modified, or more specifically, it should be corrupted and restructured. In order to break the dependencies in the hierarchical structure, it is important for bottom members to have their own products. As the first step to rebuild the structure, we have designed a reference model of work process to develop Free/Libre/Open Source Software (FLOSS) based products and a development support system for the SMEs in the rural ICT-industries.

The ICT-industry in Okinawa is also embedded in this typical problematic pyramid structure. In the ICT-industry in Okinawa, many of ICT-enterprises are SMEs and main customers of them are sub contractors and/or sub-sub contractors in a large project. They seldom close a contract with neither user enterprises nor public sectors directory. That is one of the reasons why the ICT-related SMEs in Okinawa have an occupational wage problem. Three years ago, we have drawn a blueprint of an organization for industrial reform to solve this problem. This organization is now realized as an institute, named Ryukyu software business support center.

II. OKINAWA SOFTWARE DEVELOPMENT ACCELERATION PROJECT

Based on the blueprint, "Okinawa software development acceleration project" has been conducted from the fiscal year 2009. The aim of this project was to transform the local ICT-industries in Okinawa from commission-based business model into production-based business model. Because the production-based business can help SMEs to make contract directly with end-users, this transformation was considered to be needed to vitalize the local ICT-industries.

The goal of the project was to establish the standardized software development method based on FLOSS project and to implement the supporting system environment which developers were able to utilize for developing their software products. These functions are consolidated in the Ryukyu software business support center in order to develop their own software product based on FLOSS and its resources.

A. Background and Objective

In the Internet, there are varieties of software database called "FLOSS repository," where many FLOSS projects are registered by developers from FLOSS communities. Such software can be used with no expense. Furthermore, we

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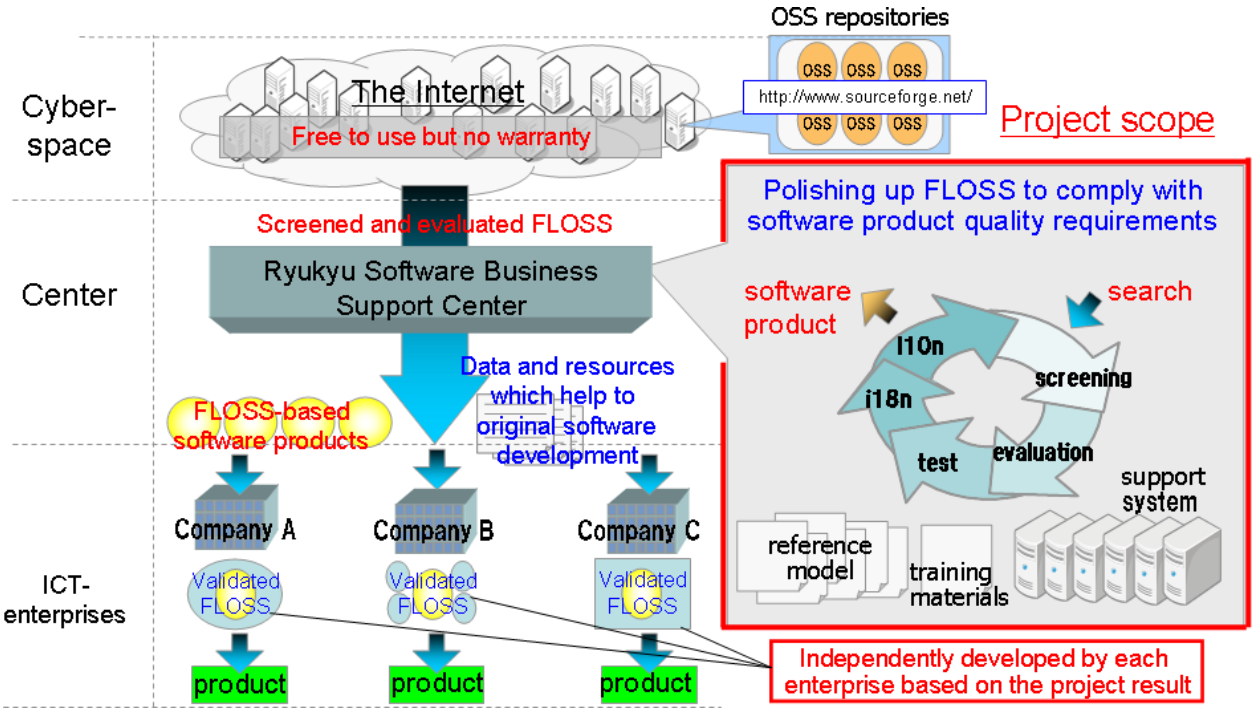

Figure 1. An overview of the Okinawa software development acceleration project and activities around the Ryukyu software business support center located at the center of this figure.

can use, modify, and redistribute freely under the condition of licenses bundled with software. Many of FLOSS are equipped attractive functions for users and they have potential capacity to be commercial software products. However, there is always a possibility that the software quality of FLOSS cannot satisfy appropriate level as commercial product. For example, it can be considered hard to use for novice users due to lack of install-function to install software into different environment, non-Japanese messages shown by non-internationalized software prevent average Japanese users from operating the software easily, and so on.

In our project, we have established the reference model of work process to develop FLOSS-based software products, which has several steps starting with searching FLOSS, screening, evaluating, and applying internationalization including localization, if needed. We designed not only the reference model but also implementation of the system environment that can be used to support the work process of software development. In addition, the framework for operating these systems efficiently was considered. These services can be provided to ICT-enterprises in Okinawa prefecture by Ryukyu software business support center so that the ICT-industry in Okinawa will be vitalized and be activated.

B. Overview of the Project

This framework is expected to help the ICT-enterprises in Okinawa to acquire material as the basis of software product development, several data, and other resources. ICT-enterprises in Okinawa can put extra effort only to develop additional functions that are considered to be needed in order to suit it as their software product. This framework supports ICT-enterprises to accelerate their software development much rapidly and efficiently, that results in an establishment of effective software business infrastructure in the local ICT-industry.

A basic concept of the project is shown in Figure 1. It also illustrates a series of validation processes, an overview of supporting system, and an image of acceleration of software development by participants from the ICT-industries in Okinawa. The whole validation process contains screening, evaluating, testing, internationalizing, and localizing.

III. Support System and Reference Model of Product Development

The system environment for the FLOSS-based software product development and the reference model are explained in this section.

A. Support System for FLOSS-based Software Product Development

Ryukyu software business support center provides its working guidelines for FLOSS-based software development, and members of the center can use the supporting system for their development activities, which is implemented in the center.

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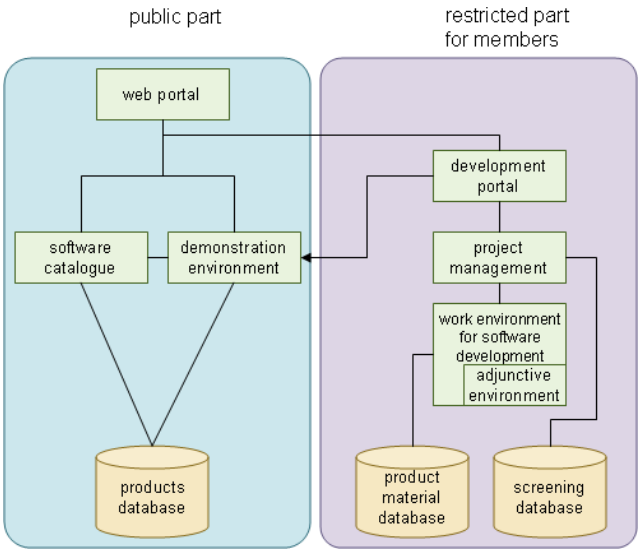

Figure 2. An overview of the software development support system provided by the Ryukyu software business support center.

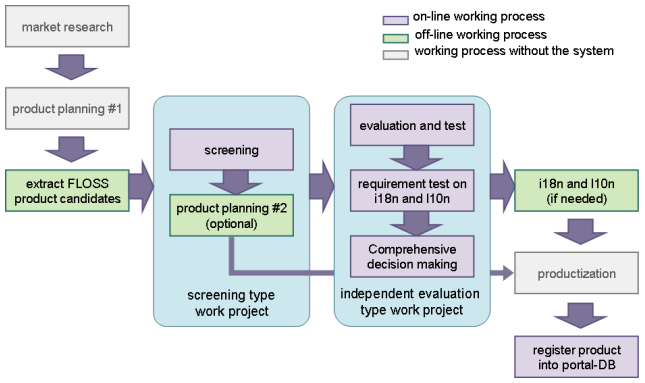

Figure 3. Work steps in the FLOSS-based software product development project, begin with marketing process and end with registering materials into portal database.

An overview of the system is shown in Figure 2. The system is roughly divided into two parts. The public part of the system shown in the left half of the Figure 2 can be accessed by everyone via the Internet and the restricted part of the system shown in the right half of the Figure 2 can be accessed by authorized members, which are ICT-enterprises in Okinawa prefecture. In either case, user has to access "the web portal" at first.

Main content of the public part consists of a catalogue and demonstration function for software products which are developed and offered by ICT-enterprises in Okinawa. The information provided only by the software catalogue is considered insufficient to present a whole image of software; thus demonstration system is prepared so that user can figure out usability of the software as a practical manner. Optionally, software can be exhibited by operation movies.

Restricted part of the system helps ICT-enterprises to develop their software products which can be registered into the software catalogue. Firstly users have to log into "development portal" and then carry on process management, member assignment and progress management, using the project management function that is implemented within the restricted part of the system. For the practical work in software development process, developers can use working environment for their software product development. For the evaluation, internationalization, and localization process, users can access adjunctive environment provided as a function of the system. Results of development are registered into product material database. After the registration of product materials, if some ICT-enterprises proceed with additional development by themselves and decide to make a sale of the software as their own products, they can register their products into the product catalogue and demonstration environment and they will be public to the consumer.

B. Reference Model of Work Process

Participants in the FLOSS-based software product development project execute tasks up to the work steps shown in Figure 3.

Before starting the software product development process, a person in charge conducts market research to make clear that what type of software is required and what type is not required. This market survey is conducted on a regular basis to catch up with market trends. The result of the market research would be used for deciding what area should be focused on and which software should be tailored as a software product by each enterprise. This decision is made in the first product planning step. Next step is to extract FLOSS-based product candidates. To find the candidates, FLOSS repositories such as SourceForge.net will be explored. In this step, at least five or more FLOSS projects should be selected, because these candidates will be filtered at the following steps and will be dropped depending on results of successive evaluations.

The software quality of each candidate is roughly estimated in the screening process, from the standpoint of development stability, the number of current users, activity of its community, and so on. In this step, every evaluation is judged by their information delivered from the website of the candidate projects. Note that FLOSS installation and/or source-code analysis are not required. These practical evaluations are performed in the subsequent evaluation step. The second product planning step that is optional will be conducted. In this step, what problems will be faced with in the process of making FLOSS into software products is discussed. The decision whether this action is taken or not is depending on business strategies of ICT-enterprises. From a practical perspective, this step will be started after the screening process, and it will be being performed simulta-

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neously with the other subsequent processes.

The FLOSS candidates filtered by the screening step are subjects of evaluating-and-test step. In this step, software quality and license condition are investigated in details. Especially in desktop applications, localization is an important issue for the end-users. If FLOSS is not internationalized nor localized for Japanese, it is not familiar with Japanese users. Validating whether the software is internationalized and localized for Japanese or not is very important for the Japanese users. This work will be done in testing requirement for the internationalization and localization step.

Finally, development process will be shifted into comprehensive decision making phase. In this step, possibility of the attractive software products with the candidates is examined based on the results of the sequential steps of screening, evaluating, and considering the needs of internationalization and localization. The results are registered into the database if the candidates have some possibilities to make a business contract. In a practical sense, the development requires several developing steps on the internationalization and localization for the Japanese users. After that, considering the second product planning step, developed software products can be published via the web portal in the public part of the system.

IV. Evaluation of the System and Operation

For the purpose of validating the efficiency of the system and reference model of operation, preliminary test-run was designed and conducted from the middle of December 2010 to the end of February 2011.

The trial validation was conducted along with following steps:

1) Interviews with key persons in higher educational institutes in Okinawa
2) Workshop on the overview of the test-run
3) Workshop on the practical work in the marketing step
4) Workshop on the practical work in the screening step
5) Workshop on the practical work in the evaluation-and-test step
6) Workshop on the practical work in the internationalization and localization step
7) Briefing session on how to operate the Protex IP to check licensing issues

A. Implementation Structure of the Validation

The trial had twenty two participants from eight companies that are the member companies of this project. All participants were divided into five groups in order to evaluate the proposed system and the working model.

There were two types of groups; the one was single-membered group and the other one was hybrid group. “Single-membered” represents that all the members in the group work for the same company and they work in the same office. On the other hand, the members in the hybrid group were gathered from different companies. In addition, designers in charge of each step of the reference working model were participated in the training phase of the trial validation, as lecturers teaching the details of each procedure.

The reason why these two types of working groups is because the Ryukyu software business support center is located in the rural area of Okinawa and it is far from Naha, the central region of Okinawa prefecture. Thus many of engineers will use the system remotely, and sometimes they will work in cooperation. The hybrid group can be considered as an emulation of practical use of the functions provided by the support center.

Table I
THE SCREENING RESULTS OF THE TEST-RUN.

FLOSS	Score in the screening step	Result
magento	41	NG
prestashop	70	OK
zabbix	59	NG
Simple Groupware	51	NG
Open Atrium	55	NG
Concursive	38	NG
]project-open[	60	OK
vtiger CRM	63	OK
ERP 5.0	36	NG

Table I illustrates the results of the screening process during the test-run. Scores were calculated from 0 to 100 in conformity with evaluation criteria in the screening process. At the end of this procedure, the final result was decided to OK if evaluation score is 60 or over. On the other hand, if the final score was under 60, which is the case of NG in the Table I, evaluation process for the FLOSS candidate stopped.

After finishing the test-run, only the “prestashop” shown in the Table I has been reached to the final judgement and the other factors has increased its final score up to 74 points, which results in the conclusion that it has possibility to be a software product sold by the ICT-enterprise in Okinawa. Note that ERP 5.0 got lower score than expected. The reason of the low score is considered that the software has been already famous enough in Japan and there is a company supporting localization and promotion for the software in Japan. That is, ERP 5.0 has already been well-suited for Japanese market and there seems no room for developing in our project. Thus, the score of ERP 5.0 is relatively low.

Participants in this validation process have contributed their comments to improve the reference model and supporting system.

Followings are selected reviews:

- Although there are many difficult points to be not able to make a decision in each process, appropriate advices from instructor help me to solve the questions.
- I did not have opportunities to evaluate the tools pro-

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vided in the evaluation-and-test process, because the period of validation process was too short.
- It can be difficult unless the participants in the evaluation process have enough skills.
- The idea and method to narrow the list down to effective products are considered valuable when we have to struggle with FLOSS projects in the future.

V. Related Work

Many FLOSS and its community evaluation methods have been proposed so far, like Open BQR[1], Open Source Maturity Model (OSMM)[2], method for Qualification and Selection of Open Source software (QSOS)[3,4], Open BRR (Business Readiness Rating for Open Source)[4], SQO-OSS Quality Model[5], and QualiPSo[6]. Evaluation criteria used in our screening process are based on a mixture of the criteria defined in those evaluation methods.

In our evaluation-and-test process, check items are arranged in accordance with the international standard, ISO9126[7] quality standards. As described in this standard, the operator works on checking three categories of the software quality: inner quality, outer quality, and quality-in-use. The inner quality and the outer quality are separately defined as six quality features and twenty seven sub-quality features. Also the quality-in-use is defined as four quality features.

The evaluation-and-test process has an additional function to verify the risk of license violation. According to Monden et al.[8], about ten percent of FLOSS has contained reused code in its source code. To avoid GPL violation, it should be confirmed that the software product does not have any GPL contaminated code. Thus, Black duck software's Protex IP has been introduced in order to make sure of compliance with the FLOSS licenses.

VI. Conclusion

In this paper, the reference model and the system for developing software product based on prospective FLOSS are described. The model and the system are provided by the Ryukyu software business support center in order to transform the structure of the local ICT-industry in Okinawa.

Implementing the system using well-known FLOSS, such as MySQL, Track, PHP, Zend, and Subversion, has reminded us that the FLOSS products were helpful to construct a specific system quickly and efficiently. With the help of these FLOSS products, we could develop the highly practical system in a short development period. The system has also its web-based user interface and it is provided by the combination of Linux, Apache, MySQL, and PHP; that is the LAMP system. The decision to use LAMP stack resulted in quick development and stable operation at present.

In the reference model using the system, working processes for screening and evaluating FLOSS products are needed to be managed by administrators. However, since those processes are complicated enough and there has some room to modify in instruction of the working process, those two working processes have been designed as independent on the system.

Practically, the reference model is described with two documents. One is system operation manual and the other is a guidance document on the reference model. Several methods were discussed and refined through the design of the reference model; it is composed of a method to focus on a specific area in the software classification as market survey, a method to extract FLOSS according to the result of the market survey, a method to apply screening process onto FLOSS candidates, a method to derive evaluation items in accordance with the (sub-) quality features that are suitable to validate the candidate software, and so on.

Regular operations of the Ryukyu software business support center have just started after preliminary discussion phases. The ICT-enterprises in Okinawa prefecture should bring forward their activities on developing their own software products with the help of the functions provided by the center. Promotion on the center's operation remains as our future work.

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