

Selection Criteria for Open Source Software Adoption in Malaysia

Khadijah Chamili, Yusmadi Yah Jusoh, Jamaiah H. Yahaya and Noraini Che pa

Abstract— Nowadays we can see open source software (OSS) product dumping in market as an alternative to traditional closed source software or proprietary software, particularly in office environment. Well function at reasonable price or seamless free of charge is believed to help small or large organization to increase productivity while saving. Study found that proprietary software is widely used at public sector agencies until this date. This is the biggest challenge for Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) on leading open source software (OSS) initiative in Malaysia. The adoption of OSS among potential users in public sector agencies is still low and need to increase as formulated under The Malaysian Public Sector Open Source Software Master Plan. Lack of confidence and user's perception on OSS product contribute to this scenario. To build confidence among potential users, we are suggesting the selection criteria should be outlined to assist the selection of OSS product in the future. Through this study, the selection criteria are proposed for ease of understanding, comparison and improvement in the future. It comprises of three dimensions: system quality, information quality and service quality which tailored to the criteria build from literature study, standard for software quality and guidelines from MAMPU. In addition, internal criteria are also suggested into the selection criteria to ensure that the inner constraints are included.

Index Terms—Adoption, open source software, quality factors, selection criteria

I. INTRODUCTION

Open source software (OSS) is software where the source codes (the language in which the program is written) is freely distributed with the right to modify the code, and on the condition that redistribution is not restricted, and indeed is obtainable for no more than the reasonable cost of production [1].

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There were over 100,000 ongoing OSS projects based on SourceForge repositories alone with many more on others such as CodeHaus, Tigris, Java.Net and Open Symphony [2]. There are several success stories such as Apache, Firefox, Linux and MySQL used by huge number of people worldwide. Even in this great success stories, there are several areas where OSS was not adopted, such as desktop environment and office applications [3]. Many potential users still not adopting OSS in their working environment.

Reason why lack of confidence among OSS's potential user is because of the user's biased perception on OSS characteristic [5]. Most of the OSS characteristics are: no professional supports, lack of documentations, longevity where the availability of future releases depends on community efforts and low quality code for immature products [2].

These characteristics falls under "information quality" and "service quality" which are two (2) major items which satisfy D&M IS Success Model [4]. The bias perception makes potential users distrust to adopt OSS products widely and stay in their territories. Based on D&M IS Success Model "intention to use" or adoption of any software products are influenced or affected by three major quality dimensions: "information quality", "system quality" and "service quality" [4].

In this study, "information quality" is referred to code quality, "system quality" is implies to software quality and "service quality" is implies to user's expected support or service received. These three major dimensions have strongly correlated to "intention to use" (adoption) and "user satisfaction" which finally positively contribute to users and provider "net benefit" such as money and time consuming.

In this paper, we try to list all possible OSS characteristic which related to ISO standard for comparison, better understanding and future enhancement for other researchers. We also proposed an additional quality characteristic that is the internal constraint which should also be considered when making any decision on OSS adoption. Hopefully the suggested selection criteria might help to build users confidence to any OSS product in future adoption.

The rest of the paper continues as follows: The next section introduces the open source software adoption in Malaysia; the following section discusses the state of the art of the OSS related models; this is then followed by introducing the proposed selection criteria; the final section concludes the paper and the plan for future works.

II. OPEN SOURCE SOFTWARE ADOPTION IN MALAYSIA

Open Source Software initiative was launched on 16th July 2004 under The Malaysia Public Sector Open Source Software Master Plan Phase II. It has entering self-reliance phase, phase III (2010 – onwards) where the ultimate goal is when agencies are competence to develop and implement OSS solution independently. However, until end of 2010 [6], statistic shows that only two OSS solution area which are desktop and infrastructure solutions contribute the biggest number of OSS adoption in Malaysia public sector agencies. Another four OSS solution areas which are application, workload consolidation, high performance computing and distributed enterprise are still at low number of adoption.

In pursuing Public Sector adopting OSS, Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) has lead many OSS initiative such as produced frameworks, policies and guidelines of OSS implementation [7],[8]. This implementation guideline was proposed by Public Sector agencies to use Open Source Maturity Model (OSMM) model by Navica and Cap Gemini or any other quality assessment model in order to evaluate OSS product. However the evaluation exercise proposed by this document is not supported by any assessment toolkit to assist public sector in making decision on choosing the right OSS product [8]. It's quite tedious work where assessment activity is done manually by agencies especially to assess quality of code programming. Using an assessment toolkit may assist and finally increase number of OSS adoption among public sectors agencies as well as to achieve OSS objectives [1].

There are many ways to built confidence among OSS potential users. Based on The Malaysian Public Sector Open Source Software Master Plan, there are eight (8) initiatives has been established. There are: Promotion & Awareness, Certification Body, Communication & Collaboration, Policies/Guidelines, Training, Knowledge Bank, Research & Development and Technical Support [1]. However there are still lack of evaluation methodologies and tools to support potential users on selecting the right OSS products which meet user's need and comply with the "information quality", "system quality" and "service quality".

III. STATE OF THE ART

A. D&M IS Success Model

This study was based on D&M IS Success Model [4]. This updated model has been found to be a useful framework for organizing IS success measurement. The model has been widely used by information system (IS) researcher for understanding and measuring the dimension of IS success [9]. This model consists of six major dimensions success: system quality, information quality, service quality, intention to

use/use, user satisfaction and net benefit. This model is flexible and can be apply in any information system context where success dimension can be selected and metrics is defined specifically depends on systems being evaluated [9].

The three major dimensions (information quality, system quality and service quality) were adopted to evaluate OSS products which influence the "intention to use" (adoption of OSS products) evaluation criteria. Other two criteria (user satisfaction and net benefit) will excluded because the adoption exercise of software products is the main focus of this study.

B. Other OSS Quality Model

In recent years - since 2003 by Cap Gemini, few studies have been done by some researchers on OSS quality assessment. The quality models were proposed to assess quality and to assist potential users in selecting the right OSS for their needs. Models such as Qualification and Selection Open Source (QSOS) and Open Business Readiness Rating (OpenBRR) have underlines list of selection criteria with some weighting to follows [10],[2].

The models purposely to measure OSS characteristic within these three success dimension: system quality, information quality and service quality. However, it is not presented in a structural way and should binds with some standard such as quality standard IEEE 9126. Adopting the existing quality standard (i.e. IEEE 9126) hopefully the selection criteria will be more constructive and standardize to any other researchers.

Few other models concentrate on OSS communities performance or service such as QualOSS Open Source Assessment Model (QualOSS) and SQO-OSS quality model (SQO-OSS) [11],[12] as well as product assessment. For example, QualOSS more focus on development communities with respect to community sustainability, process maturity and maintenance capacity. However, in this research we are focusing on what services does user's expected from community to ensure that users can evaluate the services given by community rather than to understand development/maturity of OSS community.

To understand what actually users expected (services) from OSS community will allow community improve their services and this is the best way community should learn to develop and grow. Although OSS community is loose community, OSS project cannot be start at early stage without essential team member. With this essential team member (community) where team should understand what users expected from them once software is launch, then people start acknowledge and used their products. This is the starting point that 'contract' has been made between this team and users and people build trust and confidence among each other.

In OSS context, the 'power of creation' is more derived this team at early stage when they decide to create any software to assist and contribute to society. So, the most important thing in this so called 'contract' between users and community is how this 'contract' can be sustainable with understand what should

be supplied and received.

Both “information quality” and “system quality” can be grouped as product quality under ISO/IEC 25010: SQuaRE (Software product Quality Requirements and Evaluation). For “service quality”, few researchers used SERVQUAL model to analyze gap between user’s need (expected service) and perceived service. SERVQUAL proposed 5 dimensions as below:

Tangibles - Appearance of physical facilities, equipment, personnel and communication materials,

Reliability - Ability to perform the promised service dependably and accurately,

Responsiveness - Willingness to help customers and provide prompt service,

Assurance - Knowledge and courtesy of employees and their ability to convey trust and confidence, and

Empathy - The firm provides care and individualized attention to its customers.

These five dimensions will be mapped according to OSS context. For example, tangibles dimension: physical will be replaced with documentation since we are not dealing with any kind of physical facilities and equipment. The personnel were changed into community and support. The changes make the dimensions more meaningful for OSS context. The details of the quality characteristic is listed and discussed in section IV.

It’s difficult to make comparison with one model to another such as QSOS and OpenBRR. In this paper, we try to list all possible OSS characteristic which leads to ISO standard for comparison, better understanding and future enhancement purposes by other researchers.

Thru the literature study conducted, we have discovered that previous models still lack of considering the users constraint while evaluating and selecting OSS product. Issues related to budget constraint and internal staff skills – operating system, language and tools, also should take into account. Although OSS is somehow free license, but in larger scale project, budget and staff skill constraints may influence the organization in selecting the OSS. Therefore, users’ constraint should be included.

IV. THE SELECTION CRITERIA

The quality characteristic in this model are organized in a hierarchy of two levels that we indicate as characteristic and sub-characteristic which are interconnected with three (3) main dimension: system quality, information quality and service quality. The additional dimension is named as other dimension. The additional dimension possibly can be added as preferred by the organization to contribute in the evaluation criteria. Both characteristic and sub-characteristics are considered to contribute in some way or another to each of these dimensions it belong to. To ensure that these quality characteristics are ranked accordingly, we also put measurement for each of sub-characteristics.

In order to define the hierarchy of quality characteristics and

the measurement, we referred mainly from four main sources: 1) D&M IS Success Model, 2) related work on F/OSS quality model, and 3) general standards for software quality, such as ISO 25010 [13] and 4) Malaysian Public Sector Open Source Software Initiative: OSS Implementation Guidelines [8]. The suggested scale for each selection criteria are 1 as “unimportant” and 5 as “critical” to be classified by the user.

The suggested selection criteria differ from D&M IS Success Model as information quality involves the code quality, system quality is referred to software product characteristics and service quality implies to expected support from software provider. These criteria’s may contribute to the success of software product adoption among potential users.

Table 1 shows the quality characteristics based on system quality dimension (the desirable characteristics of software products) and Table 2 consists of the information quality (the desirable characteristic of source code). The service quality dimension in Table 3 is based on SERVQUAL measurement instrument which adapted from the field of marketing and has been recognized as an important component of IS success [4],[14].

TABLE 1
SYSTEM QUALITY DIMENSION

Characteristic	Sub-characteristic	Measurement
Reliability	Maturity	Is the software new in market?
	Popularity	Does this software have numerous user? Any books/website/forum/blog written about this software available in market?
Usability	Availability	Does this software frequently release new software version?
	Learnability	How easy to learn or understand the software without using user manual?
	Operability	Is this software easy to operate?
	Accessibility	Is this software easy to accessed without other third party software or plug-in?
Performance efficiency	User interface aesthetics	Is the user interface is suitable with its software functionality?
	Time behaviour	Is this software easy to install/configure and operate within short time?
Functionality	Resource utilisation	Is this software use minimal/limited resources or can be used with existing resources (e.g : server, operating system)?
	Functional completeness	Does the software meet user’s expectation and requirement?
	Functional correctness	Does the software provide correct output as user’s expectation?
	Functional appropriateness	Does the software function appropriately?

In this study the SERVQUAL measurement was adopted to define expected services received by the users and their expectation from community of OSS. The expected services

possibly based on their previous experience from others software products. By identifying and understanding users expectation might help to list all possible expectation and at the end might build users' confidence to OSS community as providers.

TABLE 2
INFORMATION QUALITY DIMENSION

Characteristic	Sub-characteristic	Measurement
Maintainability	Modularity	Does the code structural and readable? How well is the software designed?
	Modifiability	How easy the system can be customized to meet user's requirement?
	Reusability	How easy to reuse or extent the code for further extension or integration?
	Testability	Is the software error-free?
Security	Confidentiality	How secure data and the software? How confidence that software is free from vulnerabilities?
	Integrity	Does the software have any control mechanism to ensure system integrity?
	Authenticity	Does the software provide level of user's authentication?

TABLE 3
SERVICE QUALITY DIMENSION

Characteristic	Sub-characteristic	Measurement
Tangible	Support	Is there any community or commercial support provided?
	Documentation	Complete documentation provided? Both technical and user manual?
Reliability	Version	Does software version release as targeted or expected time with mainly new functionality?
Responsiveness	Community	How active is the community for the software?
Assurance	Competence	Does the community posses of required skill and knowledge?
	Credibility	Does the development team and community have perform good track record? How many bugs were fixed in last 6 month?
Empathy	Communication	Does the community acknowledge your problems and help in solving it?

Compared to other quality models, the users potential constraints are also included. Such as, what are the characteristic of the product quality and service quality should perceived and what are the internal constraint the user have in

order to adopt any OSS products. The questions such as "do we have internal skill in regard of this language?" or "do we have expert to handle this operating system?". Therefore, the selection criteria of other dimension as shown in Table 4.

TABLE 4
INTERNAL CONSTRAINT

Characteristic	Sub-characteristic	Measurement
Competence	Skill	How many internal technical staff skilled with tools and language used by this software?

V. CONCLUSION AND FUTURE WORK

In this paper, we identified all possible OSS characteristics which referred to ISO standard for comparison, better understanding and future enhancement purposes. We also proposed an additional quality characteristic which is the internal constraint to be included for agency's decision making in OSS adoption. With these hierarchical characteristic of OSS selection criteria might benefit to build users' confidence in OSS product adoption in future.

OSS adoption rate in Malaysian public sector agencies is still low until end of 2010. Therefore, the next step is to apply the suggested selection criteria to understand what is the most quality dimension contributes to Malaysian public sector agencies in order to encourage adoption and implementation of OSS products in their agencies. In other words, the proposed selection criteria may help to identify characteristic consider by the users on adopting the OSS product. Hence, a survey will be conducted to identify the main characteristics for the proposed OSS adoption model.

Recently there are many potential and good OSS products in the market with free license but yet still not popular among Malaysian public sector agencies. What are the constraints or limitation in not adopting these good OSS products? What drive them to rely on proprietary software which cost them hundred thousand of ringgit? To understand this scenario, a survey will be conducted among technical and IT managerial personnel at selected public sector agencies.

The survey is composed of three main components: open source software products adoption/implementation in agency, awareness and open source software evaluation criteria. The objective is to identify the most and relevant dimension (system quality, information quality or service quality) which derive or motivate IT decision maker in choosing their products. The data analysis will help to understand all possible selection criteria or quality characteristic used by these potential users in evaluating OSS product for adoption purposes. The surveyed data and analysis will rank the sub-characteristics identified in this study.

The next task is the prototype development. The prototype will support the OSS adoption process with proposed criteria selection and ranking. Besides the prototype toolkit, few existing OSS code tool analysis will be studied and adopted to

comply with the prototype toolkit. The adoption model and the prototype will be tested and validated by IT personals collaboratively with industry.

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