

Empirical study of open source software selection for adoption, based on software quality characteristics



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ABSTRACT

Currently, open source software (OSS) products have started to become popular in the market as an alternative to traditional proprietary or closed source software. Governments and organizations are beginning to adopt OSS on a large scale and several governmental initiatives have encouraged the use of OSS in the private sector. One major issue for the government and private sector is the selection of appropriate OSS. This paper uses new internal quality characteristics for selecting OSS that can be added to the dimensions of DeLone and McLean information systems' model. Through this study, the quality characteristics are organized in a two level hierarchy, which list characteristics and sub-characteristics that are interconnected with three main dimensions: system quality, information quality and service quality. These characteristic dimensions are tailored to the criteria having been built from literature study and standard for software quality and guidelines. This paper presents case study results of applying the proposed quality characteristic on eight different open source software that are divided between open source network tools and learning management systems.

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1. Introduction

Open source software (OSS) is software tool that operates under an open source label whose source code should be available and modifiable. In OSS, the software suite must contain the source code or be available at a freely accessible location, where it may be adapted to individual customized requirements and pass on the modified format. Some OSS may reserve re-distribution rights but in other cases it might be free. A distributor or developer might charge for services including special training, installation, programming and technical support, etc. In general, the term OSS refers to software that is freely available, widely accessible and reusable [1], where reusability implies that source codes can be modified to make them work as their users require. In general, developments in information and communication technology support the existence of OSS strongly.

Throughout the world an increasing number of people are using OSS with an open source code, where it generally operates securely and reliably in a stable and cost-effective manner. The increasing popularity of OSS has dramatically changed the software industry in recent years. OSS is often seen as a possible solution to some of the challenges presently faced by many software communities, especially among developing countries. Such challenges include controlling piracy, exerting a greater level of control over acquired

software and dealing with broader policy perspectives that pertain to the development of a national domestic software industry.

OSS does not use the same mechanism of development as proprietary software. From a policy perspective, an 'open source' can be defined as a software-licensing model where the software's source code is made available, subsequently modified, redistributed and added-to, although often with certain restrictions. In addition, a range of benefits under commercial arrangements may be made available, such as, updates, training and ancillary software services [2,3].

OSS are usually, though not exclusively, developed by the collaborative efforts of a group of people who contribute components to the final version of the software. Software companies may also produce programs for the open source community. Proprietary or commercial software is developed under commercial rules and policies, in other words, it is licensed for a fee to a customer in binary, object or executable code (either directly or through channels). The company that writes the program usually provides updates, training and other services required by its users so that the software works efficiently.

The software's source code might be made available to a certain number of its users through a special license or an alternative agreement but often remains unavailable to the general public and may not be copied, changed or modified except in a manner provided for under the terms of a prior agreement. The European Union recommended that OSS should be used preferentially; the doubters were made to realize that OSS with its freely accessible

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source code is not just the toy of enthusiastic computer science students but systems designed by professionals for professional use. The many organizations that use open source products include, NASA, Daimler–Chrysler, SONY, Boeing, Sixt, IKEA, the World Council of Churches and the National Association of German Skilled Crafts. Moreover, companies, such as, Hewlett–Packard, Siemens Fujitsu, IBM and Compaq are now selling computers with Linux pre-installed operating systems. These companies make it clear this operating system is just as competitive as any proprietary operating system, such as, Solaris or Windows NT [4].

Each software model (open source software and Commercial Software) represents a viable business strategy for their companies as well as supporting and providing their customers with real advantages. Solutions that the software offers are being continually updated with providers concentrating and improving on a variety of emerging issues and problems, such as, addressing reliability, security and information flow control issues. In fact, OSS has surprised many in the industry by acquiring a good reputation for its reliability, efficiency and functionality [5].

The main objective of this study is to discover criteria that help organizations in their selection, development and evaluation of OSS. In particular, this study aims to identify the most relevant dimension, i.e. system quality, information quality or service quality, which derive or motivate users and IT decision makers in selecting their OSS products. The contribution of this work is based upon the literature study and standard for software quality and guidelines to understand all possible selection criteria or quality characteristics used by potential users to evaluate OSS products for adoption. To achieve the objective of this study, it is necessary to investigate empirically the selection process and quality characteristics of OSS in different application domains. This new empirical knowledge about open source software selection for adoption refers to the qualitative analyses of software quality characteristics.

The proposed model will be used to identify the characteristics considered significant by users and IT decision makers to select and adopt the appropriate OSS product. This research can be used to gain an understanding of the quality characteristics of OSS with the ultimate goal of improving software development practice in industry, particularly of the selection of OSS. This paper provides an overview of open source software and discusses criteria for choosing it while proposing a new internal quality characteristic for selecting OSS that can be added to each DeLone and McLean information system model [6].

2. An overview of open source software

In the 1960s, buying a new computer meant supplying free extra software. Manufacturers were only paid for the computer's hardware. The source codes were freely available and accessible to programmers throughout the world. In 1965 IBM has stopped supplying software source codes with their computers' operating systems. The company started to employ sufficient computer and information technology experts and is able to dispense with external developers.

In 1970s, computer programmers started realizing that they earned a lot of money from software development. The programmers safeguarded their sources of income using license agreements that prohibited or limited users passing software to others. After 1970, freely available software source codes virtually ceased to exist. Software began to be produced behind closed doors [1,7]. All manufacturers started to maintain control over their tools and computer users had to rely and trust the software producers in the event of program code faults, errors or any special modification according to users' wishes or new requirements. In 1984 Richard

Stallman from Massachusetts Institute of Technology (MIT) provided the idea of developing a free program package named GNU. The goal of the (MIT) computer experts was to again enable open cooperation between software developers. According to the father of GNU, software is only free when it can be used by anyone without restrictions or limitations. Richard Stallman provided the GNU General Public License (GPL) for protecting the software's freedom. The term 'free' has many meanings in the English language. Because of that for several interested companies the title 'free software' sounded very much like 'free toy'. Many companies were hesitant or shy to have any operating system initiatives that were generously given away to everyone [8,9].

3. Criteria for selecting OSS

This study is based on the DeLone and McLean Information System Success Model (see Fig. 1), which has been used as a useful framework for measuring the organizational abilities of information systems. This model is widely used for understanding and measuring the dimension of information system success [10–12]. The original model of DeLone and McLean consisted of six major success dimensions: system quality (software quality), information quality (source code quality), service quality (expected and received service quality), intention to use (adoption), user satisfaction (process of discovering user satisfaction level) and net benefits (economic evaluation in terms of money and time consumption).

The modified model covers a wide range of system features [13]. Its quality characteristics of information system success with the new sub-characteristics (internal quality characteristics) for each information system model dimension are based on:

3.1. System quality

System quality implies the desirable characteristics of the OSS product, including availability, reliability, performance, usability and functionality.

- **Availability** of software services and any release of new software's version with new added features. The software's new version release at the targeted or expected time with mainly new functionality. The availability of any books, websites, forums and blogs written about this software available in market.

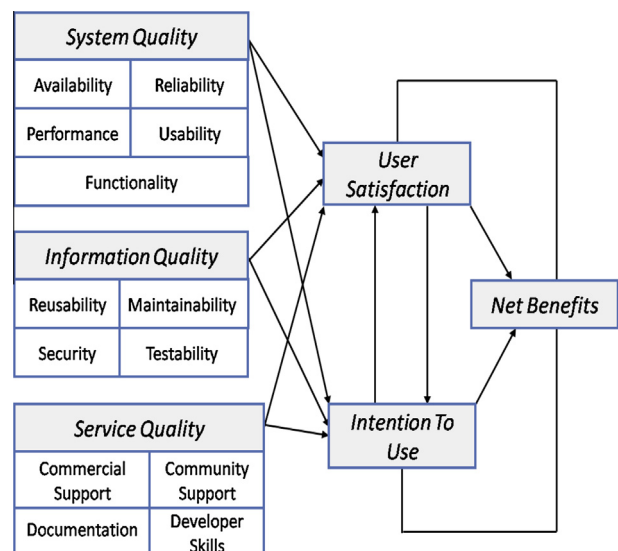


Fig. 1. D&M IS success model with added components of each dimension.

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