Mora, M., Gomez, J., O'Connor, R. V. and Gelman, O., A Risk-based MADM Model for Selecting Free-Libre Open Source Software Tools in the Domain of IT Service Management, 16th Symposium on Decision Technology and Intelligent Information Systems, Germany, August 2015.

A Risk-based MADM Model for Selecting Free-Libre Open Source Software Tools in the Domain of IT Service Management

Dr. Manuel Mora, Autonomous University of Aguascalientes, Mexico
Dr. Jorge Marx Gomez, Oldenburg University, Germany
Dr. Rory V. O'Connor, Dublin City University, Ireland
Dr. Ovsei Gelman, CCADET, Universidad Nacional Autónoma de México, México

Abstract

The availability of free-libre open source software (FLOSS) has stimulated their organizational implementation in many countries. The main attractiveness for it is the free-cost license of usage regarding with acquisition of COTS (components of the shelf) commercial software, among other factors such as: maturity status, available technical community support, popularity, and compliance to international standards. However, not of the all FLOSS tools released from such FLOSS development projects achieve the expected qualities, and thus organizations interested in using them must conduct a careful evaluation-selection process. With this in mind, several evaluation-selection frameworks for FLOSS have been reported in the literature and some studies have identified a set of organizational factors associated to successful and failed utilizations of FLOSS tools in organizations. In this research, we elaborate a FLOSS Evaluation-Selection model by combining both sets of literature on FLOSS evaluation models and FLOSS implementation models. This model is implemented with a MADM (Multi-Attribute Decision-Making) risk-based mechanism. We illustrate this model with the evaluation-selection of a FLOSS tool in the domain of Information Technology Service Management (ITSM). Hence, this paper contributes to our body of knowledge with the provision of a simplified evaluation-selection model for FLOSS tools derived from two core sets of FLOSS literatures, under an innovative risk-based approach.

Keywords: *free-libre open source software, FLOSS evaluation, FLOSS implementation, MADM, IT service management*

Introduction and Research Problem

FLOSS tools are license free-cost tools that become a viable alternative to commercial ones for small organizations (Nagy et al., 2010). According to Watson et al. (2008), the FLOSS phenomenon breaks typical barriers on acquisition and distribution costs, as well as physical and legal frontiers through its simple access via Internet. Thus, their high availability has stimulated their organizational implementation in several developed countries (David et al., 2003). Main attractiveness for it is the free-cost license of usage regarding with acquisition of COTS (components of the shelf) commercial software, among other factors such as: maturity status, available technical community support, popularity, and compliance to international standards (Spinellis & Giannikasa, 2012). However, not of the all FLOSS tools released from FLOSS development projects achieve the expected qualities, and thus organizations interested in using them must conduct a careful evaluation-selection process (Nagy et al., 2010). Thus, the evaluation-selection of FLOSS tools presents a problem to Information Technology (IT) managers. A wrong selection of a FLOSS tool, from the usual extensive variety of them that is available- will produced negative effects as any failed IT implementation. For this aim, several evaluation-selection frameworks for FLOSS have been reported in the literature (Nagy et al., 2010; Aversano & Tortorella, 2013). Some of them are simple composed for 5-7 single factors and others are complex with over 60 evaluation items. Additionally, other studies have identified a set of organizational factors associated to successful and failed utilizations of FLOSS tools in organizations (Dedrick & West, 2003). In this research, thus, we elaborate an evaluation-selection model combining both core literatures (FLOSS evaluation models and FLOSS implementation models), through an innovative risk-based approach (Stoneburner et al., 2002). The FLOSS evaluation-selection model is implemented with a Multi-Attribute Decision-Making (MADM) mechanism (Yoon & Hwang, 1995). We illustrate this model with the evaluation-selection of a FLOSS tool in the domain of ITSM (Gallup et al., 2009). Hence, this paper contributes with the provision of a simplified evaluation-selection model for FLOSS tools derived from two core set of FLOSS literature, under an innovative risk-based approach.

Theoretical Background

Relevance of IT Service Management Process Implementation. Large and medium sized organizations implement Information Technology Service Management (ITSM) Process Frameworks (mainly ITIL v2, ITIL v3, ISO/IEC 20000 or MOF 4.0) with the aim to provide organizational value through the delivery of IT services under a cost-effective management of IT capabilities and IT resources (Gallup et al., 2009). However, the implementation and finally operation of an ITSM Process Framework demands the investment of financial, human and other organizational resources. In particular, the utilization of software tools is suggested for coping with the inherently complexity of the ITSM process administration (caused by the required utilization of multiple processes, interrelationships and data) (Brenner, 2006). However, while large and medium sized organizations can afford commercial tools from a wide offering, the involved costs preclude it for small organizations. Thus, the availability of FLOSS tools becomes a potential feasible alternative for small organizations.

On FLOSS Evaluation Framework and FLOSS Implementation Model Literatures. For evaluating and selecting FLOSS products, several frameworks have been reported (Nagy et al., 2010; Aversano & Tortorella, 2013). These models consider factors such as (Nagy et al., p. 151): *the availability of training, documentation, third party support, integrated software and other professional services, community size, community age, and lines of source code, with different weights for each factor, to estimate the maturity of open source software.* These frameworks, thus, consider not only the software per se but additional factors (developer community, general user community, organizational attributes). In the period from 2003 to 2013, twelve FLOSS evaluation frameworks have been posed: Capgemini Open Source Maturity Model, Navica Open Source Maturity Model (OSMM), Open Business Readiness Rating (OpenBRR), Method for Qualification and Selection of Open Source Software (QSOS), Open Business Quality Rating (OpenBQR), QualiPSo—Quality Platform for Open Source Software, OpenSource Maturity

Model (OMM), A Quality Model for Open Source Selection (QMOSS), Qualoss, Software Quality Observatory for Open Source Software model (SQO-OSS), IRCA Model, and the Evaluation Framework for Free/Open Source Projects (EFFORT). In the same period (2003-2013) also several FLOSS implementation models have been posed (Dedrick & West, 2003; Li et al., 2013). For instance, Dedrick and West (2003) investigated the reasons for implementing FLOSS in 10 organizations through a qualitative data-grounded theory-building method. As theoretical lenses for collecting and organizing data, they used a TOE framework (technology, organization, and environment) (DePietro et al., 1990). Factors such as: no licenses costs, new business opportunities, functionality, ease of use, and compatibility, were found enablers for successful FLOSS implementations. In turn, lack of internal expertise in FLOSS tool, and lack of external support were found as inhibitors for successful FLOSS implementations.

On Risk-based MADM Approach. A MADM mechanism is a procedure for making preference decisions (e.g. evaluating, prioritizing, and selecting) over a set of available courses of action, where each one is associated usually conflictive levels of attributes (Yoon & Hwang, 1995). A MADM risk-based approach can be defined as a decision-making mechanism based on conflictive attributes whose assessment of the courses of action are based on the levels of risk exposition. A risk exposition can be defined as the net expected damage on an asset of interest exercised on an asset's vulnerability by considering jointly the likelihood of occurrence and the impact. This joint consideration is combined usually by a qualitative scale of low, moderate and high risk exposition (Stoneburner et al., 2002).

The MADM Risk-based Evaluation-Selection FLOSS Model

Based on the FLOSS evaluation framework and FLOSS implementation model literature, we posit the convergence of both ones through a risk-based approach (Stoneburner et al., 2002). For fostering a practical utilization of it, we posit to generate a FLOSS success implementation value tree which can be operationalized through an MADM decision-making model. With this MADM model, ITSM practitioners interested in evaluating two or more FLOSS alternatives, will assess the overall estimated success implementation value of each alternative by evaluating the risk-based attributes. A decision value tree structure is a hierarchy of elements of an overall expected objective (highest level), a set of related preferred sub-objectives (intermediate level), and a set of related attributes (lowest level) used as the measurement dimension against each course of action (e.g. an alternative action) will be assessed in a decision-making process (Buede, 1986). Attributes are also known as performance measures, figures of merit, metrics or criteria. Consequently, the set of courses of action (alternatives of action) are not included in a decision value tree structure. We conducted a hybrid approach for elaborating the value hierarchy performing the following steps: (i) to state the overall top objective (top-down approach); (ii) to identify sub-objectives from the top objective if required, and to repeat this step if required for each sub-objective (top-down approach); (iii) to iteratively complete the full hierarchy of attributes (also called criteria) by using the initial list of attributes in the lowest level of the hierarchy, which will be logically associated to the set of previous identified sub-objectives (lowest level) (top-down and bottom-up approaches); (iv) to refine the initial list of lowest level attributes based on the literature recommendations on non-ambiguity, comprehensiveness, directionality, operationability and understandability (Keeney & Gregory, 2005); and (v) to assess the value tree hierarchy on completeness, operationability, decomposability, lack of redundancy, and size (Buede, 1986). After several iterations by applying the previous process, the authors arrived to the following value hierarchy showed in Figure 1.

GOAL	SUB-GOALS	ATTRIBUTES
BEST (MINIMUM OVERALL IMPLEMENTATION RISK) FLOSS TOOL	FINANCIAL RISKS	• New business opportunity
		• Switching costs
	ORGANIZATIONAL RISKS	• Training
		• User involvement
		• Top management support
	END-USER RISKS	• Functionality
		• Usability
		• Quality
		• Usefulness
	TECHNICAL RISKS	• Maturity
		• Interoperability
		• Community support
		• Documentation
		• Security
		• Technical environment

Fig. 1 Value Hierarchy for FLOSS Evaluation-Selection AHP Mechanism

This value hierarchy was implemented in MADM mechanism by using an academic version of the Criterium Decision Plus tool. The Figure 2 shows the MADM implementation with illustrative data of three ITSM FLOSS tools (ITOP, IDOIT and OTRS). The Figure 3 shows the overall illustrative results for this evaluation.

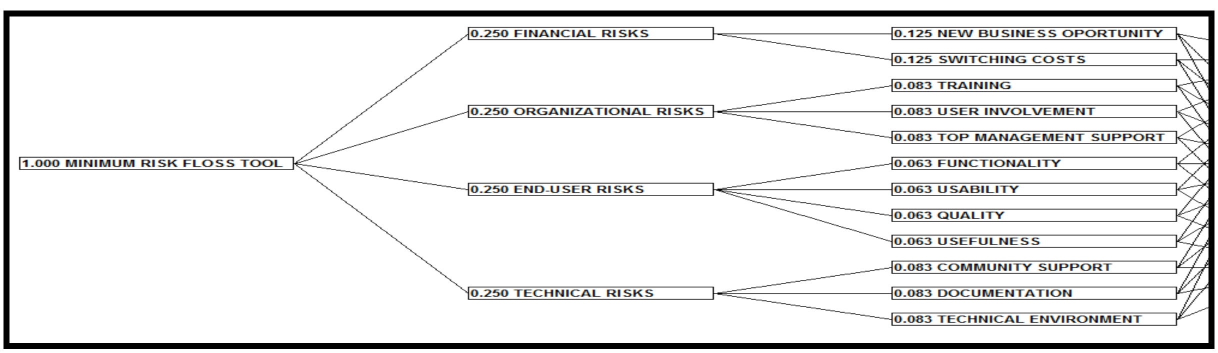

Fig. 2 MADM Implementation of the Value Hierarchy for FLOSS Evaluation-Selection Case

Mora, M., Gomez, J., O'Connor, R. V. and Gelman, O., A Risk-based MADM Model for Selecting Free-Libre Open Source Software Tools in the Domain of IT Service Management, 16th Symposium on Decision Technology and Intelligent Information Systems, Germany, August 2015.

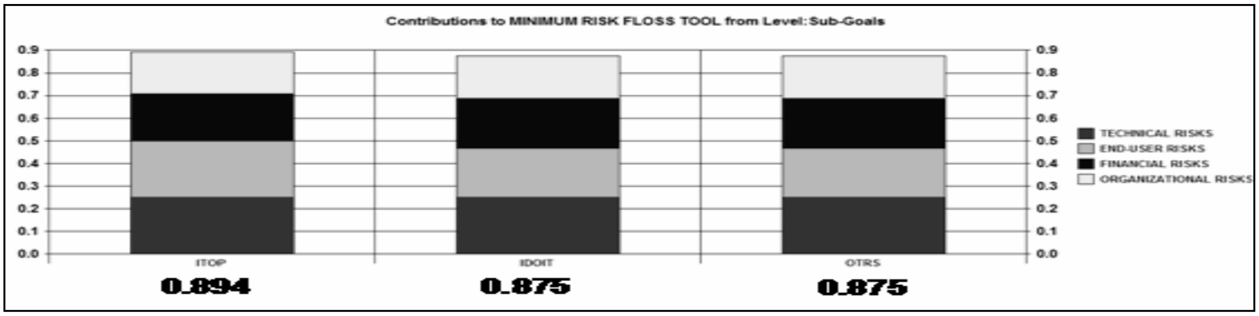

Fig. 3 Illustrative Results for the MADM FLOSS Evaluation-Selection Case

Conclusions

In this research, we have elaborated a Risk-based MADM Evaluation-Selection Model for FLOSS by combining FLOSS evaluation and FLOSS implementation literature. We have illustrated this model with the evaluation-selection of a FLOSS tool in the domain of Information Technology Service Management (ITSM). Hence, this paper contributes with the provision of a simplified evaluation-selection model for FLOSS tools derived from two core sets of FLOSS literatures, under an innovative risk-based approach.

References

Aversano, L., and Tortorella, M. (2013); Quality evaluation of floss projects: Application to ERP systems. Information and Software Technology, (55:7), (pp. 1260-1276).

Brenner, M. (2006); Classifying ITIL Processes; A Taxonomy under Tool Support Aspects, IEEE/IFIP International workshop on Business-Driven IT Management, (pp. 19-28).

Buede, D. (1986); Structuring Value Attributes, Interfaces, 16(2), (pp. 52-62).

David, P., Waterman, A. and Arora, S. (2003); FLOSS-US The Free/Libre Open Source Software Survey for 2003, Stanford Institute for Economic Policy Research, (pp. 1-39).

Dedrick, J. and West, J. (2003); Why Firms adopt Open Source Platforms: a Grounded Theory of Innovation and Standards Adoption, MISQ Special Issue Workshop, (pp. 236-257).

Depietro, R., Wiarda, E. and Fleischer, M. (1990); The Context for Change: Organization, Technology and Environment, in Tornatzky, Louis G. and Mitchell Fleischer, The processes of technological innovation, Lexington, Mass.: Lexington Books, (pp. 151-175).

Gallup, S., Dattero, R., Quan, J. and Conger, S. (2009); An Overview of IT Service Management, Communications of the ACM, (52:5), (pp. 124-127).

Keeney, R. & Gregory, R. (2005); Selecting Attributes to Measure the Achievement of Objectives, Operations Research, 53(1), (pp. 1-11).

Nagy, D., Yassin, A. and Bhattacherjee, A. (2010); Organizational Adoption of Open Source Software: Barriers and Remedies, Communications of the ACM, (53:3), (pp. 148-151).

Saaty, T. (1994); How to Make a Decision: The Analytic Hierarchy Process, Interfaces, 24(6), (pp. 24-43).
Spinellis, D. and Giannikasa, V. (2012); Organizational Adoption of Open Source Software, Journal of Systems and Software, 85(3), (pp. 666–682).
Stoneburner, G., Goguen, A. and Feringa, A. (2002); Risk Management Guide for Information Technology Systems, National Institute of Standards and Technology, (pp. 1-55).
Yoon, K. and Hwang, C. (1995); Multiple Attribute Decision Making, Sage University Paper, (pp. 1-75).
Watson, R. et al. (2008); The Business of OPEN SOURCE, Communications of the ACM, (51:4), (pp. 41-46).

Acknowledgements

This research is developed with the financial support of the Autonomous University of Aguascalientes, Mexico (www.uaa.mx) (Project PIINF14-3), and CCADET-UNAM.