SOFTWARE MULTI-SOURCING RISKS MANAGEMENT FROM VENDOR'S PERSPECTIVE: A SYSTEMATIC LITERATURE REVIEW PROTOCOL

[1]Muhammad Yaseen, [2]Siffat Ullah Khan, [3]Asad Ullah Alam

[1]Institute of Information Technology, Kohat University of Science And Technology, Pakistan,
[2]Department of Software Engineering/Computer Science and IT, University of Malakand,
[3]Software Engineering Research Group (SERG_UOM), University of Malakand, Pakistan

ABSTRACT

Context- Software multi sourcing is an important paradigm in global software engineering. It is a kind of outsourcing practiced by many organizations by giving their software development work to multiple vendors in developing countries to get high quality software development at low cost. However multi sourcing is not a risk free business. Vendor organizations need to address a number of factors for successful outcomes of the multi sourcing relationships. Multi sourcing risk management (MRM) is one of the key areas to be addressed by vendor organizations for successful outcomes of multi-sourcing relationships.

Objectives- This research seeks to explore MRM in the context of multi sourcing relationships from vendors' perspective. The objective of this project is to identify the critical risks and best practices by reviewing the literature in a systematic way.

Method- Systematic Literature Review (SLR) is used to identify the critical risks and best practices in MRM. SLR based on a structured protocol, and is therefore, different from ordinary literature review.

Expected Outcome- We have developed a SLR protocol for the MRM, and currently we are in the process of implementing the protocol. The expected outcomes of this review will be the identification of critical risks and best practices to be addressed by vendor organizations for mitigation and avoidance of risks in the context of MRM relationship.

Keywords- SLR; MRM; Software Development Multi-sourcing; Client-Vendor Relationships

INTRODUCTION

Offshore software development outsourcing (OSDO) or software outsourcing is modern software engineering paradigm in the context of global software development, aiming at developing high-quality software in low-wage countries at reduced cost (S. U. Khan, 2011; Lago, Muccini, & Ali-Babar, 2008). Software development outsourcing is a contract-based relationship between client and vendor organizations in which a client contracts out all or part of its software development activities to one or more vendor, who provide agreed services in return for remuneration (Babar, Verner, & Nguyen, 2007; Kern & Willcocks, 2000). Software outsourcing can be categorized into many types based on relationship in terms of the number of vendors and clients involved. In simple outsourcing relationship there is one client involved with a single vendor in the relationship, whereas in multisourcing multiple vendors are involved with a single or multiple clients. In this research we seek to explore multisourcing as a relationship in which a client outsource software development project to multiple vendors. In other words the software is developed in modules by different vendors. Multi-sourcing will need wider internal management which has the capability to accommodate several suppliers at one time. Software multi-sourcing consists of an array of flexible sourcing solutions corporations can draw on to help them improve their business performance (B. Huber, 2008). Multi sourcing is preferred comparatively because it has many advantages for customers, for example, it creates a competing environment and decreases to

maximum extent the risk of project failure, and enhances the quality of the software. Moreover there are other compulsions. In uni-sourcing one party perform its promise whereby, in multi-sourcing more than one party held responsible in case of project failure.

Although multisourcing offers many benefits including rapid and cheaper software development. However it is not free of challenges. Different vendors have different work styles, cultural and language differences and delay by a single vendor can cause delays in the delivery of the overall project. Apart from this software integration is another challenge.

New approaches and skills are required to effectively manage risks in multi sourcing and increased volume and complexity of relationships between the various parties involved in multi sourcing deals. The detailed study will give a ground to find in depth understanding of the different factors for the efficient management of the multisourcing risks faced by the vendors. The different factor will help the multisourcing vendors to understand the criteria for the better management of the risks involved. This may lead to software development multisourcing vendors and clients for the long term and successful multisourcing relationships.

The main objective of this research is to gain an in-depth and more thoroughly understanding of MRM in the context multisourcing relationships from vendors' perspective. The expected outcomes of the review will be the identification of critical risks/challenges to be addressed by vendor organizations for enhancing MRM in multi sourcing relationships.

To understand multi sourcing risks management from vendors' perspective, following research question were formulated:

RQ1: What are the risks, as identified in the literature, in software multisourcing relationship?

RQ2: What are the real-world practices for efficient management of software multi sourcing risks?

OSDO is a famous and innovative business strategy adopted by many organizations in developed countries by outsourcing their software development work to low-wages countries (S. Khan, Niazi, & Ahmad, 2009). OSDO offers many benefits, to client organizations in the developed countries, including access to skilled sound human resource; high quality software development and low cost offshore resource options. Cheaper resource options help client organizations to reduce their baseline costs; this involves the downsizing of more expensive onshore resources to be replaced with cheaper offshore resources (Chua & Pan, 2008). However OSDO is not a risk free activity. Many research articulated that many companies that have tried outsourcing have usually failed to realize the expected outcomes (Bradstreet & Bradstreet's, 2007). We extended our research on IT multi-sourcing success by looking at the human behavioral dimensions that are relevant to multi sourcing risk management from vendors to clients. Multi-sourcing will need wider internal management which has the capability to accommodate several suppliers at one time. Software multi-sourcing consists of an array of flexible sourcing solutions corporations can draw on to help them improve their business performance (Bill Huber, 2008). Multi-sourcing risk management plays a key role in the success of global software development. Although outsourcing usually begins with a single project, the indispensable need for coordination comes when there are multiple outsourcing service providers.

According to the study of Hubber (2008), that companies choose multi-sourcing

essentially because no single service provider can fulfill all the services required by a large organization. According to Sophie Pochard (2003) that managers must undertake a general review of all the possible solutions to manage risk disruptions in dual sourcing.

Alam and Khan (2011) have articulated that proper risks management will lead to success in the context of offshore software outsourcing relationships. Multi-sourcing decisions become important to many companies when they have outsourced something to a single supplier and face a situation in which they can either outsource more to the same supplier or to another supplier (Swift, 1995).

This research will accompaniment work previously done in these studies. A number of studies, as mentioned above, have shed light on the importance of multi sourcing risk management in the context of outsourcing success. However, nobody has used Systematic Literature Review (Kitchenham, 2007) approach for the identification of critical barriers/Risks (CRs) and best practices for MRM that are important for the success of offshore outsourcing project.

DISCUSSION

A. Previously, no systematic literature review (SLR) has been performed on this topic. We have used a SLR process (Kitchenham & Charters, 2007) as the main approach for data collection because a SLR is a defined and methodical way of identifying, assessing and analyzing published primary studies in order to investigate a specific research question. Systematic reviews differ from ordinary literature surveys in being formally planned and methodically executed. They are intended to be independently replicable, and so have a different type of scientific value than ordinary literature surveys. In finding,

evaluating and summarizing all available evidence on a specific research question, a systematic review may provide a greater level of validity in its findings than might be possible in any one of the studies surveyed in the systematic review.

The major steps in our methodology are:

- Determine the search strategy
- Perform the search for relevant studies
- Perform the study selection process
- Apply study quality assessment
- Extract data and analyze the extracted data

1) Constructing Search terms

Details on the course of these steps are described in the following subsections.

The following detail will help in designing a search strings relevant to our research questions.

Population: Multi sourcing vendors

Intervention: Risks

Outcome of relevance: Best practices for multi sourcing risk management in the context of offshore software outsourcing relationships.

Experimental design: Exploratory study, case study, experts' opinions

An example of the research question containing the above detail is:

RQ1:   [What   are   the   risks] **"INTERVENTION"** to be addressed by vendors for [Enhancement of multi sourcing risks management] **"OUTCOME OF RELIVENCE"** In the context of [Multi sourcing] **"POPULATION"**

1.1.   Search string
1.2.   Trial search

A trail search will be conducted using the following search string using ACM and IEEExplore digital libraries.

((Risks OR barrier OR obstacles OR hurdles OR "risk analysis" OR "critical factors") AND ("Offshore software multi-sourcing"

OR "IT multi sourcing" OR "IS/IT multi-sourcing"))

The paper(s) retrieved through this search string will be used as a guide for the development and validation of the major search terms.

2)   Identifying search string

The following search strategy is used for the construction of search terms.

(a)   Use the research questions for the derivation of major terms, by identifying population, intervention and outcome;

(b) For these major terms, find the alternative spelling and synonyms;

(c) Verify the key words in any relevant paper;

(d) Use the Boolean operators for conjunction if the database allows, in such away, to use 'OR' operator for the concatenation of alternative spelling and synonyms whereas 'AND' for the concatenation of major terms.

(e) The modified form of Search Strategy for Research Questions, if required.

The fifth step is included from SLR paper (Alam & Khan, 2011).

Results for a) RQ1: offshore software multi sourcing, vendor organization, risks, multi sourcing management

RQ2: offshore software multi sourcing management, risks, vendors, practices

Results for b)

RQ1:

Software multi sourcing: ("offshore software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT multi sourcing")

Vendor(s): (vendor OR vendors OR service-provider OR developer)

Risks: (risks OR barrier OR obstacles OR hurdles OR "risk analysis" OR "critical factors" OR "risk mitigation" OR "risk avoidance")

RQ2:

Software multi sourcing: ("software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT multi sourcing" OR "CBIS multi sourcing" OR "computer-based information system multi sourcing")

Vendor(s): (vendor OR vendors OR service-provider OR dealer OR trader OR marketer OR seller OR developer, businessperson OR hawker OR huckster OR peddler OR travelling salesperson)

Risks: (risks OR barrier OR obstacles OR hurdles OR "risk analysis" OR "critical factors" OR "risk mitigation" OR "risk avoidance")

Practice(s): Practice OR solution OR exercise OR best practices OR advice OR implementation initiatives

Results for c) Software multi sourcing, risks management, software outsourcing vendor's organizations, practices

Results for d)

RQ1:

((multisourcing OR multi-sourcing OR "Offshore software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT multi sourcing") AND (vendor OR vendors OR service-provider OR developer) AND (risks OR barrier OR obstacles OR hurdles OR "risk mitigation" OR "risk avoidance"))

RQ2:

((multisourcing OR multi-sourcing OR "offshore software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT multi sourcing") AND (Practice OR solution OR exercise OR best practices OR advice OR implementation))

Result for e)(("Offshore software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT

multi sourcing") AND (risks OR barrier OR obstacles OR hurdles OR "risk analysis" OR "critical factors" OR Practice OR solution OR exercise OR best practices OR advice OR implementation))

*3)   **Search Term Break up***

We will first use the search strings RQ1 and RQ2 mentioned in (d) as our search terms. As some of the databases don't allow the lengthy search strings we will split the search term into smaller sub strings and will do separate search for each of these search strings. Finally we will summarize the search results by removing the redundancy. It should be noted that while using IEEExplore digital library, the search strings mentioned in (d) will be used with a technique that it should be put in the pane instead of text-boxes provided in the advance search.

The breakup of the RQ1 and RQ2 are mentioned in the form smaller strings mentioned below.

Search string1

(("Offshore software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT multi sourcing") AND

(Risks OR barrier OR challenges OR obstacles OR hurdles OR "risk analysis" OR "critical factors" OR "risk mitigation" OR "risk avoidance"))

Search string 2

(("Offshore software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT multi sourcing") AND (Vendor OR vendors OR service-provider OR developer))

Search string 3

(("Offshore software multi sourcing" OR "information system multi sourcing" OR "information technology multi sourcing" OR "IS multi sourcing" OR "IT multi sourcing")

AND (Practice OR solution OR exercise OR best practices OR advice OR implementation))

*4)   **Resources to be searched***

We will try to search the papers from the following digital libraries/databases IEEExplore, ACM Portal, ScienceDirect (www.sciencedirect.com), CiteSeer Digital Library (citeseer.ist.psu.edu), SpringerLink, Google Scholar

*5)   **Search Constraints and Validation***

B. We will search all published papers related to our research questions and will not put any date boundaries. A prior search was conducted using the following set of major terms and we found certain relevant papers in ACM and IEEE Xplore digital libraries.

((Risks OR barrier OR obstacles OR hurdles OR "risk analysis" OR "critical factors") AND ("Offshore software multi-sourcing" OR "IT multi sourcing" OR "IS/IT multi-sourcing")).

The papers, identified through this string, were used for the validation of our final search strings.

*6)   **Search Documentation***

The candidate papers will be stored in the form of a table with keeping following records:

(S. No, Name of Database,   Search Strategy, Search Phase, Date of Search, Years Covered, No of Publication Found, Initial Selection Decision, Final Selection Decision

*7) **Publication selection criteria***

This section contains three subsections namely inclusion criteria, exclusion criteria and the selection of primary sources, in order to choose only those search results which are relevant to the research questions. We will o nly consider papers/reports/books relating to offshore software outsourcing. Papers/reports/books relating to near shore outsourcing or onshore outsourcing will be ignored.

a)   ***Inclusion Criteria***

The inclusion criteria we used to determine which piece of literature (papers, technical reports, or 'grey literature' etc.) found by the search string (s) will be used for the data extraction. We will only consider papers related to offshore software development outsourcing with focus on MRM that are written in English. The criteria are listed below:

- Studies that describe factors/motivators for MRM in offshore software development multi sourcing
- Studies that describe multi sourcing risk management from vendors' perspective
- Studies that describe offshore software outsourcing relationships with the focus on MRM
- Studies that describe criteria for a successful multi sourcing management
- Studies that describe issues/barriers in multi sourcing management
- Studies that describe factors affecting the continuation/termination of multi sourcing management

b)   ***Exclusion Criteria***

This section describes the exclusion criteria in order to decide which piece of literature found by the search term will be excluded/ignored. The criteria are listed below:

- Studies that are not relevant to the research questions
- Studies that don't describe offshore software multi sourcing risk management
- Studies that don't describe offshore software multi sourcing relationships with the focus on MRM
- Studies other than offshore software multi sourcing relationships

8) ***Selecting Primary Sources***

Initial selection of the primary sources will be performed by reviewing the title, keywords and abstract. The purpose is to exclude/ignore only those results which have no relevance to the problem/research questions. The primary sources chosen in the initial selection process will be checked against the aforesaid inclusion/exclusion criteria by reviewing carefully through full text of the studies. The source will be sent to the secondary reviewer, for review in case of any uncertainty regarding the inclusion or exclusion decision. The record of inclusion/exclusion decision regarding each primary source will be sustained properly. This will describe the reasons/justification whether or not the primary source has been included in the final review.

9) ***Publication Quality Assessment***

The measurement of quality is performed after final selection of publications. The quality of publications is assessed in parallel at the time of data extraction. The quality checklist contains the following two questions:

- Is it clear how multi sourcing risk management was measured/evaluated in offshore software multi sourcing relationships?
- Is it clear how the CBS (critical barrier factors/ risks) for multi sourcing risk management between clients and vendors were identified in offshore software multi sourcing relationships?

Each of the above questions will be marked/answered as 'YES' or 'NO' or 'Partial' or 'N.A'. A secondary reviewer will score a small subset for validation.

10) ***Data Extraction Strategy***

The data extraction phase will be undertaken by single researchers, they will be responsible for the data extracted. A secondary reviewer will be approached for guidance in case of an issue regarding the data extraction. The inter-rater reliability test will be performed after the data extraction process by the primary reviewer. The

secondary reviewer will select few publications randomly from the list of publication already chosen by the primary reviewer. The secondary reviewer will independently extract the data from the randomly selected publication. The results will then be compared with the results produced by the primary reviewer.

Primary reviewer: Muhammad Yaseen
Secondary reviewers: Dr Siffat Ullah Khan and Asad Ullah Alam

11) ***Data Synthesis***

Due to two research questions, the synthesis will also be categorized into two parts. For the Research Question1, the data will be synthesized by creating one summary table having the columns (S.No, CRs Frequency, Percentages) showing the list of all the CRs along with their frequencies and percentages. The complete detail of every CRs mentioned in the Summary table will be recorded in a separate table which will hold the following the columns (CRs group name, S.No of reference, CRs subgroups, Paper reference/Paper title).

For the Research Question2, the same process will be performed as for the RQ1 mentioned above.

12) Validation of the review protocol

A preliminary draft protocol was submitted for comments to the members of the Software Engineering Research Group at University of Malakand. The protocol was updated as per the reviewer comments.

II. CONCLUSION AND FUTURE WORK

In the area of multi sourcing risk management many studies and research have been done. But for the identification of MRM in OSDO relationships no systematic literature review process has been conducted. In this paper we discussed our study plan in the form of a SLR protocol. We have developed the SLR protocol and currently we are in the phase of its implementation. Our expected outcomes will be the identification of risks

in multi sourcing management faced by vendors in OSDO relationships. For the validation of our SLR outcomes and to find the practices for addressing these challenges we will conduct an empirical study in outsourcing industry.

REFERENCES

Alam, A., U, & Khan, S., U. (2011). *Knowledge Sharing Management in Offshore Software Development Outsourcing Relationships from Vendors' Perspective: A Systematic Literature Review Protocol.* Paper presented at the The 5th IEEE International Conference on Software Engineering, Malaysia.

Ali-Babar, M., Verner, J., & Nguyen, P. (2007). Establishing and maintaining trust in software outsourcing relationships: An empirical investigation. *The Journal of Systems and Software, 80*(9), 1438–1449.

Babar, M. A., Verner, J. M., & Nguyen, P. T. (2007). Establishing and maintaining trust in software outsourcing relationships: An empirical investigation. *The Journal of Systems and Software, 80*, 1438-1449.

Bradstreet, D., & Bradstreet's, D. (2007). Barometer of Global Outsourcing. *Dun & Bradstreet*.

Brereton, P. (2004). The software customer/ supplier relationship. *Communications of the ACM, 47*(2), 77-81.

Chua, A. L., & Pan, S. L. (2008). Knowledge transfer and organizational learning in IS offshore sourcing. *Omega, 36 (2008)*, 267 – 281.

Heeks, R., Krishna, S., Nicholson, B., & Sahay, S. (2001). Synching or Sinking: Global Software Outsourcing Relationships. *IEEE Software, March/ April*, 54-60.

Holmstrom, H., Conchúir, Eoin Ó , Ågerfalk, Pär and Fitzgerald, Brian. (2006). *Global Software Development Challenges: A Case Study on Temporal, Geographical and Socio-cultural Distance.* Paper presented at the International Conference on Global Software Engineering. 3-11.

Huber, B. (2008). Agile Multi-Sourcing: A Critical Business Trend Concepts and Background. *Knowledge powering results*.

Huber, B. (2008). Agile multi-sourcing: a critical business trend, concepts and background. *Houston (TX): Technology Partners International, Inc.*

Jiang, J., Klein, G., Hwang, H.-G., Huang, J., & Hung, S.-y. (2004). An exploration of the relationship between software development process maturity and project performance. *Information & Management* (41), 279-288.

Kern, T., & Willcocks, L. (2000). Exploring information technology outsourcing relationships: theory and practice. *Journal of Strategic Information Systems, 9*(4), 321 350.

Khan, S., Niazi, M., & Ahmad, R. (2009). *Critical Success Factors for Offshore Software Development Outsourcing Vendors: A Systematic Literature Review.*

Paper presented at the The 4th IEEE International Conference on Global Software Engineering, Ireland.

Khan, S. U. (2011). Software Outsourcing Vendors' Readiness Model ,PhD thesis. *School of Computing and Maths*, 381.

Kitchenham, B. (2007). Guidelines for performing Systematic Literature Reviews in Software Engineering. *EBSE-Technical Report*.

Kitchenham, B., & Charters, S. (2007).issue: EBSE 2007-001. *Citeseer*(ISBN: 1595933751.

Lago, P., Muccini, H., & Ali-Babar, M. (2008). *Developing a Course on Designing Software in Globally Distributed Teams.* Paper presented at the IEEE International Conference on Global Software Engineering, ICGSE08.

Nguyen, P., Ali-Babar, M., & Verner, J. (2006). *Trust in software outsourcing relationships: an analysis of Vietnamese practitioners' views.* Paper presented at the EASE.

Oza, N. V., Hall, Tracy, Rainer, Austen and Grey, Susan Grey. (2006). *Trust in software outsourcing relationships: An empirical investigation of Indian software companies,.* Paper presented at the 9th International Conference on Empirical Assessment in

Software Engineering., Keele, UK. Pochard, S. (2003). *Managing Risks of Supply-Chain Disruptions: Dual Sourcing as a Real Option.* Unpublished Master Thesis, Massachusetts Institute of Technology, USA.