Change Management in Cloud-Based Offshore Software Development: A Researchers Perspective

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DOI: 10.1007/978-3-031-21388-5_17

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Abstract. Cloud based Offshore Software Development Outsourcing (COSDO) concept is complex and comes with various challenges, specifically related to the Requirements Change Management (RCM) process. This study aims to investigate the success factors (SF) that could positively influence RCM activities in COSDO firms and to propose a theoretical framework for the investigated aspects. A systematic literature review (SLR) method was adopted to investigate SF. Finally, based on the investigated factors, we developed a theoretical framework that shows the relationship between the identified factors and the implementation of the RCM process in the COSDO domain. The findings of this study could help researchers and practitioners address the key issues of the RCM process in COSDO organizations.

Keywords: Systematic Literature Review (SLR), Change Management, Success Factors

1 Introduction

A software development phenomenon, COSDO spanned social, geographic, and temporal borders among its members [5]. More than half the software development industry has adopted COSDO [6–8] because of its financial characteristics. 20% of client software development organizations re-appropriate their improvement activities to vendor associations to benefit from COSDO phenomena, as revealed in a Standish Group study [9]. As a result of the lower development costs, the availability of a skilled labor, and better market access, there has been a noticeable rise in offshore software development outsourcing [9]. Despite this, the COSDO team also deals with questions that aren't commonly seen in a collocated setting [10-11]. Their inability to effectively carry outgrowth exercises, is a result of communication and coordination issues [5,12]. The poor requirement change management could cause system decline [17-19]. Standish

Group led a survey of thirteen thousand programming projects and featured that 18% of the tasks were flop because of poor management of requirements change [11, 20].

Models of management that may effectively implement the RCM cycle have been created based on various requirements. [1]. Niazi et al. [21], for instance, established a model for RCM utilizing the CMMI level-2 specialized practice known as SP 1.3-1. A request, validation, implementation, verification, and update are all steps in the model's lifecycle. Research undertaken with RCM experts yielded insights into the model's design based on the existing empirical data. RCM problems faced by industry practitioners have been addressed in another study by Keshta and colleagues [15]. Initiate, validate, verify, implement, update, and release are the six primary steps of the Keshta et al. paradigm [15]. However, the model does not allow the execution of RCM operations in large organizations that are internationally scattered [15]. It does, however, provide a detailed guideline on how to make the requested adjustments to the criteria. In overseas software development concept, Akbar et al. [31] develop a change management model in offshore software development domain (Fig. 1). They cover important aspect of change management in overseas software development, but communication aspects does not fit well with this model. Using these models and frameworks, members of the team may more easily adapt to changing requirements, create high-quality products, cut down on development costs, and meet customer expectations [20, 21]. The RCM cycle has only been included into the collocated and offshore software development environment by these models and frameworks, but COSD issues have been completely ignored [1, 15].

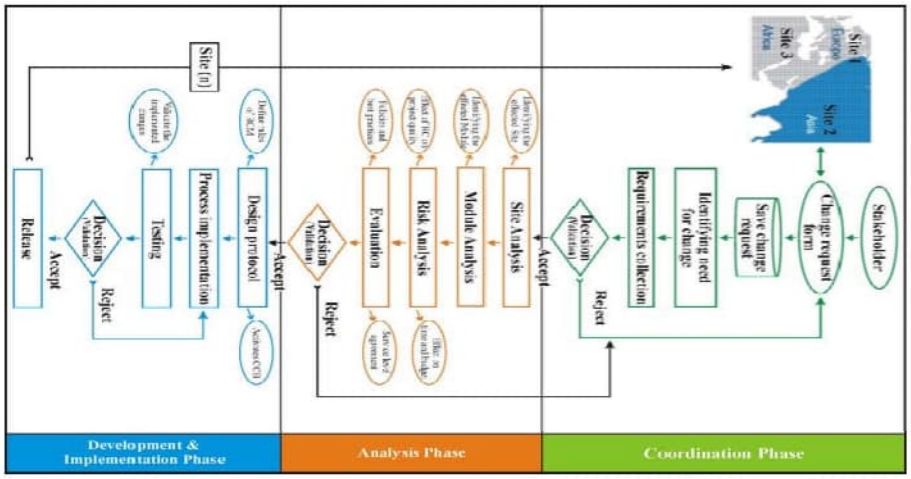

Fig. 1: Change management in outsources software development [reference]

In order to fill this knowledge void, we will design a model for measuring the maturity of software requirements changes and implementations (SRCMIMM). Based on the idea of leaving maturity models in many elements and domains that could affect the RCM program in COSDO environment, the proposed model (SRCMIMM) will be developed. In this article, we have covered the first stage toward the construction of the model, which is the preliminary phase of discussing the success elements of RCM. We followed

the step-by-step process of systematic literature review to conduct this study and report on RCM's success factors [26]. Understanding the success aspects of change management can assist the experts in addressing the essential areas of requirement change prior to implementing the RCM method. These research questions were formulated to address the issue under consideration:

[RQ1]: *What are the key success factors for RCM in COSDO, reported by researcher?*
[RQ2]: *What would be an example of a hypothetical RCM success factors framework?*

2 Research Methodology

Research questions
In section I, we talk about the research questions formulated to perform this study.

Systematic literature review (SLR) process
Considering Chen et al. [27] study, we have selected the most appropriate digital libraries. The selected digital repositories include: "IEEE Xplore", "ACM Digital Library", "Springer Link", "Wiley Inter Science", "Google Scholar" and "Science Direct". There are variety of ways to search in digital libraries. Using RCM and COSDO research publications, phrases from study questions and their alternatives we came-up with a list of synonyms for search terms. The primary keywords and their alternatives were concatenated utilizing the Boolean "OR" and "AND" operators to process the search strings.

In next steps we have performed the quality assessment along with inclusion and exclusion criteria. By conducting the QA check, we examine that according to the AQ checklist, 70% of the selected studies score more than 80%. the detailed results are given at: https://tinyurl.com/m7z4fzwp.

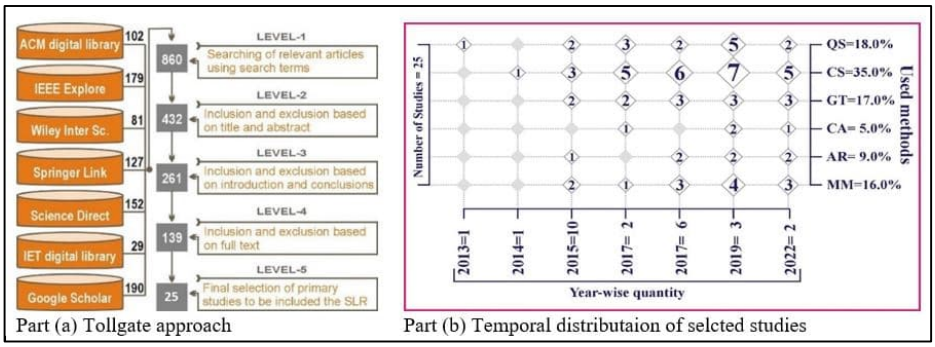

Fig.2 Literature selection and temporal distribution

Finally 25 essential studies were shortlisted from total of 860 articles by following the five periods of the tollgate approach (Fig. 2). The Fig. 2 also shows the temporal distribution of selected studies along with research methodology used in those studies. The most common used methods are case studies (CS= 35.0%) and mixed method (MM=

16.0%). List of the selected studies along with quality score is given at: https://tinyurl.com/m7z4fzwp, and each study makes identical with 'SP' to introduce them as SLR primary studies. From 25 primary research, a list of success factors (SF) was compiled. According to the primary studies, the research questions of this study were evaluated. The result is given in Table 1.

3 Results and Discussions

This section presents the findings of the SLR.

3.1 RQ1 (Identified Success Factors)

Using the detailed guidelines provided in section 2 of the SLR technique, our team has conducted an in-depth analysis of the chosen 25 primary studies and identified ten success factors for RCM. Table 1 lists the identified success factors with frequency distribution.

Table 1. Identified success factors

S.No	Success factors	Frequency (N=25)	Percentage of occurrence
SF1	Management support	12	48
SF2	Strong relationship with practistioners	13	52
SF3	Information sharing	15	60
SF4	RCM expertise	10	40
SF5	Roles and responsibilities	8	32
SF6	Effective RCM leadership	11	44
SF7	RCM process awareness	16	64
SF8	Skilled human resources	14	56
SF9	Standard and procedures	11	44
SF10	3Cs (communication, coordination, control)	18	72

SF1 (Management support, 48%)
Organizational management must support and commit to requirement change management efforts during the system development process [SP4]. Khan et al. [SP23] emphasized the importance of involving both upper and lower management in the RCM process. For prerequisites and change management, Lavazza [SP10] said that the management's involvement and commitment could be helpful. The following hypothesis has been developed based on the given discussion.
Hypothesis (H1): Management support has a positive association with RCM process in COSDO.
SF2 (Strong relationship between practitioners, 52%)
Effective communication and coordination between team members in a dispersed context are two key indicators of strong working relationships [SP25]. Strong relationship assist towards team, risk and system quality management [SP4]. The following hypothesis has been developed based on the above discussion:

Hypothesis (H2): Strong relationship between the practitioners could positively impact the RCM activities in COSDO environment.

SF3 (Information sharing, 60%)

Dispersed team members' ability to exchange program-related information has been identified as a critical component of the RCM's success [SP25]. Data management, coordination and knowledge integration for change management can be simplified with proper information exchange [SP2]. As a result, we believe that information exchange could have a favorable effect on COSDO's RCM efforts.

Hypothesis (H3): The RCM process in a COSDO context benefits from the sharing of information among the team members.

SF4 (RCM expertise, 40%)

According to Damian et al. [SP3], the level of RCM expertise is defined as the ability of RCM practitioners to successfully and efficiently implement requested requirements modification. According to Khan et al. [SP25], the RCM process's success is dependent on the practitioners' skills level. In order to successfully complete the project activities, the RCM team members must have the necessary skills and knowledge [SP11, SP25]. As a result of this, our working hypothesis is as follows:

Hypothesis (H4): RCM expertise has a positive association with the RCM process in COSDO.

SF5 (Roles and responsibilities, 32%)

According to Williams et al [SP2], assigning roles and tasks to the appropriate team members is critical. Furthermore, according to Firesmith et al. [SP5], the roles and duties of the team members must be clearly defined, which is essential for controlling and managing misconceptions during the execution of RCM process activities.

Hypothesis (H5): Roles and responsibilities allocation process positively correlate with RCM activities in COSDO.

SF6 (Effective RCM leadership, 44%)

Management of change control board (CCB) should have suitable leadership talents and knowledge to assess and deal with change demands, according to Ahmed et al. [SP17]. You'll be able to quickly and effectively respond to the certain modification request [SP10, SP16] because of your leadership qualities. COSDO's RCM process relies heavily on strong leadership to move forward. Therefore, we come up with the following theory.

Hypothesis (H6): Effective RCM leadership has beneficial influence on RCM process in COSDO environment.

SF7 (RCM process awareness, 64%)

According to Mavin et al. [SP20], organizational management must promote RCM team members for training and certification. By conducting workshops and seminars, you may successfully convey the RCM practices, and this will help encourage your employees. This is why we came up with the following theory.

Hypothesis (H7): Successful change management in the COSDO context necessitates familiarity with the RCM methodology.

SF8 (Skillful human resources, 56%)

The significance of skill human resources has been shed light in different research studies [SP3, SP7, SP8]. Minhas et al. [SP21] described that, the practitioners should have

expertise and good skills in the computer programming and task the management areas. They further referenced that people with an appropriate skill are the foundations of distributed software development. Therefore, we hypothesize that:

Hypothesis (H8): Key to the success of COSDO's RCM implementation is a well-trained workforce.

SF9 (Standard and procedures, 44%)

According to Khan et al. [SP25], it is critical to use the correct standard and method when implementing RCM process activities. The members of the team should adhere to the established guidelines, frameworks, and standards. Additional research by Khan et al.[25] suggests that the RCM programme may fail because of the lack of established RCM models and standards. Consequently, we hypothesize that:

Hypothesis (H9): Formal RCM standards and procedures have positive association with change management program in COSDO.

SF10 (3Cs "communication, coordination, control", 72%)

Knowledge transfer between distributed team members and the method they use to better contact are referred to as 3Cs by Khan et al. [SP23]. Both coordination and control depend on the communication. Strong communication channels could help the distributed teams to properly coordinate and control the RCM activities [SP3]. Control is "the process of keeping goals, strategies, principles, and quality levels in place" [SP3]. Coordination and control deals with the key components (i.e., budget, time, and quality), that are essential for the execution of the RCM process [SP25].

Hypothesis (H10): 3Cs "communication, coordination, control" has a positive association with the RCM process in COSDO.

3.2 RQ5 (Proposed theoretical framework)

Theoretical framework was proposed for highlighting the association between the independent variables (success factors) and dependent variable (RCM implementation in COSDO) as shown in Fig.3. The hypothetical relationship between the two types of variables (independent, dependent) is briefly discussed in section 3.1. In addition, we come up with total ten hypotheses (H1-H10) to empirically investigate the association of the reported success factors and RCM implementation process. The empirical study will conduct in the future, where we will comparatively analyses the results of SLR and the hypotheses reported in this study.

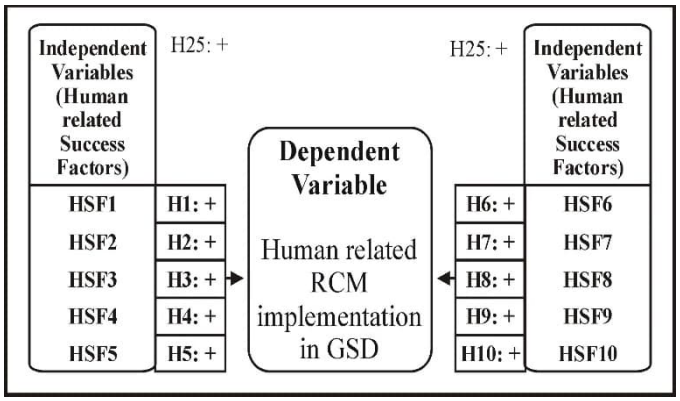

Fig. 3. Proposed theoretical framework

4 Threats to validity

The first author of this study leads the SLR process and extract data. Thus, there is a possibility of biased data collection as the one member can be prejudiced.
But the other authors' participation in the inspection of the SLR results arbitrarily to observe any difficulties that might occur has attempted to reduce the danger in this way. In most recent studies, the key causes of the observed success variables have not been explored, and this could be a threat to the study's internal validity. There is a good chance that specific types of factors are overrepresented in some research. In addition, because the researchers in the 25 primary papers chosen are primarily from academia, it is possible that they lack familiarity with contemporary RCM process methods in the software development business.

5 Conclusion

Increasing number of global software development (COSDO) projects motivated us to scrutinize the success factors that could positively impact the RCM activities in COSDO environment. Conducting SLR, total of 10 RCM success factors were identified, and five of these factors were deemed the most critical. RCM's important success criteria highlight the areas on which an organization must place a heavy emphasis.
Moreover, the identified factors were also presented in the form of theoretical framework considering ten hypotheses we came up with to show the association of the independent variables (success factors) with the dependent variable (RCM implementation in COSDO). The aim of the theoretical framework is to compare the findings of this study (SLR) and the industrial empirical study that will conduct in the future. The comparative study of both data sets (SLR, empirical) will give insight about the available literature and the views of the RCM practitioners working in COSDO industry. In future, we will design a factors based conceptual model to make RCM process successful in COSDO organizations.

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