Risks Identification in Global Software Engineering

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Abstract

We have chosen an area in Global software engineering as the domain and we have focused on the challenges that are faced by the companies when they start working with global software development. We also have focused on the mitigation techniques and the tools which are used to crack the challenges. Our research approach or the methods we apply to find the results, expected outcomes and our potential contribution towards the knowledge is also presented in this paper.

Keywords

Global Software Development, Systematic Literature Review (SLR), Survey

1. Background

In the modern era, globalization has become a house hold term in the software development organization. The development of software is no longer confined to large companies, but also to the smaller companies [8]. Because of limited access skilled labor and limited time to market, every organization have started to look for globalized partners and start development projects in different countries [8][4].Every organization has developed a keen interest in implementing globally distributed projects to gain tremendous benefits [2]. The traditional teams are replaced by the globally distributed teams which enable the organization in handling more number of projects simultaneously [12]. The term global software development refers to the development where the participating teams are located at different geographical locations [3]. These teams may be working under the same organization or different organizations depending upon the project or the scenario in which it could be developed.

Global software development is also referred to as Global Software Engineering (GSE) or Distributed Software Development (DSD). Global software development acts as one of an essential principle and drivers of software engineering with respect to educational, research and business perspectives [9]. GSD helps an organization to achieve many benefits like access to large skilled labor, time zone effectiveness, closer proximity to the customer and market, decrease in the development costs and so on which are essential for the development of an organization. The inclusion of global development into the organization brings in more number of human resources to a project. So this helps in increasing the number of experts working for the project which in turn helps in enhancing the quality of the final product.

The mode of operation between the teams in global software development can be of four types. Offshore Insourcing refers to the teams which belong to the same organization, but are located at different countries. Onshore Insourcing refers the teams which belong to the same organization and are located at the same country. Offshore outsourcing refers to the teams which belong to different organizations and located in different countries. Onshore outsourcing refers to the scenario where the teams work under different organizations, but are located in the same country. Many benefits like reduced development costs, access to large skilled labor pool, innovation and shared best practice, closer proximity to the market and the customer, modularization of tasks and so on are achieved through global software development [11][7][4].However, these benefits are not achieved fully [7].

There are many challenges that arise due to global software development. In comparison with collocated software development, global software development enhances the problems and challenges that arise in a project [5][14]. The challenges mainly arise due to three aspects: communication, coordination and control. These factors are mainly responsible for the success of any global software development project. However, due to many factors like geographical and temporal distance, cultural differences, collaboration problems, socio-cultural distances, linguistic barriers, working diversities and so on, the factors communication, coordination and control are affected. This brings down the overall performance of a global software development project and leads to the failure of many such projects. Therefore, risk management or addressing the challenges in GSD is an important aspect for the development of an organization.

The fact that no organization could successfully reap the benefits of global software development fully has driven us in considering this topic. Considering the importance of mitigating the challenges that occur in global software development, we are motivated to choose this topic. After going through various literatures, we could identify the need to present the challenges and their mitigation techniques. Many researchers have contributed in this area regarding the problem which we have addressed. Some of the contributions regarding this particular area are Agerfalk et al [16] in their literature have designed a framework which provides a structure to identify the challenges in global software development which are related to communication, coordination and control. They also have discussed about the impact of geographical, socio-cultural and temporal distance on each process.

Alejandro Lopez et al [13] in their literature have performed a research on the challenges that occur due to the application of requirements engineering on global software development. They have formulated a repository of various risks and mitigation techniques including some of their suggested mitigation

techniques to overcome these challenges Christof Ebert et al [9] have performed a research on the challenges that are identified in GSD projects. They have presented the top ten risks and mitigation techniques and validated them by their application in an industry. Fabio Q.B da Silva et al [6] in their literature have performed a research on identifying the challenges that occur in distributed software development projects and identified some tools to overcome them. An "evidence based DSD project improvement model" [6] has been suggested to formulate effective solutions for the challenges.

Helena Holmstrom et al [10] in their research have focused on managing the challenges in global software development projects. They have presented a case study by an empirical survey on some of the software organizations and identified the challenges related to geographical, temporal and socio-cultural distances and presented some solutions. Indira Nurdiani et al [15] in their research have formulated the challenges in global software development and their mitigation techniques. They have formulated a couple of checklists- one for the challenges and the other for their mitigation techniques. These checklists were validated through follow up enquiry.

After going through these literatures, we could identify the research gap in this area. We could find that there was not much research done in order to present the challenges and their mitigation techniques in a prioritized manner along with the tools. This research gap was also presented as a future work in the research conducted by Indira Nurdiani et al [15]. With the help of the literature review, we could identify the research gap and formulate our research questions.

2. Challenge and Problem Focus

The main goal of this thesis is to provide a check list which consists of challenges/risks, mitigation techniques/practices in a prioritized order and the tools that are used to implement these mitigation techniques.

To achieve this goal, we have formulated three research questions. These questions help us in proceeding towards our goal and drive us in addressing the research gap.

R.Q.1: What are the challenges/risks that occur in global software engineering?

R.Q.2: What are the practices/mitigation techniques that are present to minimize the above risks in a prioritized order?

R.Q.2.1: What are the practices/mitigation techniques present used to overcome the challenges?

R.Q.2.2: What is the prioritized order for these mitigation strategies/ techniques?

R.Q.3: What are the tools that are to be used for the practices/mitigation techniques?

R.Q.2 was divided into two sub questions where the first research question helps us in identifying the mitigation techniques/practices present to overcome the challenges and the second research question drives us to prioritize these mitigation techniques/practices.

Motivation for these questions is that every software organization tries to achieve maximum product development in the global software development scenario and reap the benefits. But this is not achieved due to many challenges. A lot of research is going on regarding this area and this issue. There is need for an effective approach to overcome these challenges so that it helps the organization in achieving more benefits. The existing methods or literature have only spoken about the challenges and mitigation techniques or the tools or only the challenges. We could see that an effort to present the challenges, mitigation techniques and tools that are required for these mitigation strategies in a single paper that too in a prioritized way. This has motivated us in working in this area with an idea to provide the challenges, mitigation strategies and tools in a single area. After going through various literatures, we could see that some researchers have formulated their end-results in the form of a checklist or a repository is an effective way to present the results.

This helps the observer or the reader to easily recognize and understand the results. Therefore, we have intended to formulate a checklist which consists of the challenges, their mitigation strategies and the tools required to implement these techniques in a prioritized way.

3. Research Method/Approach

To crack the research questions R.Q.1, R.Q.2.1 and R.Q.3, a Systematic Literature Review (SLR) suggested by kitchenham [1] is performed, to gather the papers which address the issue related to our research questions and we have to perform snowball sampling on these papers. This ensures that no papers are left in the literature which addresses the issue. We extract the data from these papers and formulate a checklist which consists of challenges, mitigation techniques and tools.

To answer the research question R.Q.2.2, we present the checklist which was formulated in the previous step in a survey. We present the checklist to a large sample of people who work in various organizations. The respondents will be asked to vote on the mitigation techniques which they feel would be beneficial for the organization. Individual votes of each technique are recorded and the overall votes of a particular mitigation technique are summed up. The mean score of each mitigation technique 'T' is calculated using the formula

$$\text{Mean}_{(\text{Mitigation technique T})} = \frac{(\text{Summed up votes received by T})}{(\text{Total votes polled})}$$

Based on the Mean votes of each mitigation technique, they are prioritized. After prioritizing all the mitigation techniques for a challenge, the checklist is updated with the prioritized mitigation techniques and then presented in the following manner.

Challenges – mitigation techniques/practices in prioritized order- tools.
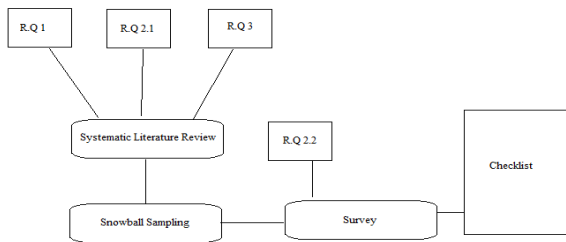
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Figure1: Research Methodology

The validation of this checklist could be left as a future work as it is very difficult to validate this checklist within the time constraint of our thesis, which is 20 weeks.

3.1 Motivation

A Systematic Literature Review is performed to answer the research questions R.Q.1, R.Q.2.1 and R.Q.3 because we have to know about the state-of –art in global software development. SLR is "a means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest" [1]. This thesis is intended to collect all the challenges, mitigation techniques and tools available in literature for which, SLR is the best suited method. After the SLR, we also have planned to perform snowball sampling on the obtained paper from the SLR to ensure that no data present in the literature is missed. In the other hand to answer the RQ2.2 research question we have selected Survey, which is well suited for this case.

The basic idea of this thesis is to prioritize a list of mitigation techniques, and this can be best performed either through an experiment, interview or survey. But through our readings, we could see that experiment is confined to a fixed scenario and interviews, in spite of bringing effective results, takes more time to commence when we consider a large number of samples. As we need to take more samples to generalize the results, and are constrained towards the duration of our thesis, we are motivated to use a survey to answer this research question.

4. Goal/Results

Expected outcomes of this proposal is checklist, which contains

- List of challenges/risks in global software development.
- List of mitigation techniques/practices that are used to overcome the challenges in prioritized order for each challenges/risk.
- List of tools used by the each mitigation techniques.

4.1 Potential contribution

- An overall view or idea on the present challenges in global software development and their mitigation strategies can be obtained.
- This checklist thus formed can be used as a guide for new software organization which plans to work with globalized projects.
- Checklist can be used as the tool by the organizations to manage the risks due to global development projects in effective manner.

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