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Recommended Citation

Saleem, Nazish; Mathrani, Sanjay; and Taskin, Nazim, "Investigating Critical Success Factors of Project Management in Global Software Development: A Work in Progress" (2019). *CONF-IRM 2019 Proceedings*. 3.

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Investigating Critical Success Factors of Project Management in Global Software Development: A Work in Progress

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Abstract

Global software development (GSD) business model has gained recognition over the years for achieving competitiveness in the global market. However, its implementation is not easy due to its complex nature and the various challenges it faces. Project management is a vital area in software development with significant impact to the GSD process. Companies adopt GSD without knowing its implications which lead to failure of their project management processes. Existing project management practises do not address the core issues of GSD, which makes the process more intricate. This research paper investigates the project management practices in GSD and identifies its critical success factors with the development of a framework that will facilitate software companies to implement GSD successfully.

Keywords

Global software development, project management, critical success factors

1 Introduction

Global software development is a promising paradigm and is becoming a norm for most of the software companies, more so with the incorporation of latest technologies such as mobile technologies, cloud solutions and advanced collaboration tools into businesses (Lesser & Ban, 2016). The inspiration behind embracing GSD is to attain highly skilled resources at reduced cost, and achieve fast delivery and competitive advantage (Jain & Suman, 2015). In GSD, more technical resources are accessible at lower costs, which is the major reason behind its growth. It enables software engineers to collaborate over cultural, temporal, geographical and linguistic distances that supports acceptance in GSD (Lesser & Ban, 2016; Niazi, 2016). Essentially, GSD is a business model, in which development teams achieve substantial benefits that include cost saving, fast turnaround and skill diversity while operating across national boundaries (Jain & Suman, 2015; Khan & Khan, 2017). Although GSD delivers significant reimbursements for software development companies, it also faces some severe challenges. Major challenges are related to communication, coordination and control which are caused by different kinds of distances including geographical, socio-cultural, temporal and organizational distances (Babar & Lescher, 2014; Jain & Suman, 2015; Jan, Dad, Amin, Hameed, & Shah, 2016). Due to these challenges, GSD turns exclusively different from co-located software development. Despite GSD having established a stable

identity since the last decade and its usage is progressing, its survival still depends on overcoming these challenges.

Achieving project success is a major concern for both vendor and client organizations in any type of collaborative software development model. The definition of project success has evolved over time with respect to perception of different stakeholders. According to the traditional viewpoint in 1970's, a project is considered successful if it is completed within a predefined time, cost and quality standards based on consideration of project managers (Davis, 2014; de Carvalho, Patah, & de Souza Bido, 2015). However, in later views till 1990's, technical aspects of the project associated with the client company were taken into account in defining success based on internal stakeholders concerns about project success. After 1990's, both internal and external stakeholder's perceptions were considered for project success. However, in the current era, project success depends on four parameters that include predefined success criteria by stakeholders, collaborative working relationship, flexible project manager, and owner's interest in project performance (Davis, 2014).

According to a report by Standish group published in 2014, 31% projects did not reach to completion due to cancellation and 53% projects completely failed due to poor cost estimates (Clancy, 2014). Majority of the reasons for software project failure are related to project management practices. (Lehtinen, Mäntylä, Vanhanen, Itkonen, & Lassenius, 2014). In the case of GSD as well, most projects fail due to inappropriate project management practices (Jain & Suman, 2018; Niazi, 2016). Consequently, success of a GSD project is closely related to the successful enactment of project management practices as well as organizational and human aspects that need to be explored in a GSD context (Jain & Suman, 2018).

Project management is a challenging domain of software development that includes several methods, processes, techniques and knowledge areas (Jain & Suman, 2018). Project management practices are not same across all countries, for example preferred method of communication is face-to-face or phone calls along with written backups in developed countries like Australia, United States, United Kingdom and Canada, while in developing countries like India, Pakistan and Bangladesh, where communication is managed through status updates at fixed intervals (Khilkhanova, Tsay, & Umpleby, 2010). Additionally, diverse working habits, e.g., values, quality standards, terminology and type of hierarchy are observed within different corporate cultures which lead to different project management practices in different countries (M. Niazi et al., 2016). In case of global software development, project management becomes more intricate due to a multitude of challenges that require developing a framework in order to address the project management issues (Jain & Suman, 2018; Niazi, 2016).

A wide range of studies (Jain & Suman, 2018; M. Niazi et al., 2016) talk about the challenges and success factors in GSD, however there are less evidences that discuss project management success and frameworks in this business model. There are a lot of studies that also propose solutions to various issues in GSD, especially related to virtual team, culture, requirement, knowledge and process improvement (Jan et al., 2016; Niazi, 2016). However little research has been conducted that addresses the project management process comprehensively in a GSD environment and development of a framework for the process. Project management is a significant field in software development and it becomes more vital due to challenges of GSD. Therefore, it is necessary to explore this area so that its essentials could be found which make project management more demanding (Jain & Suman, 2018; Niazi, 2016). There would be numerous factors which have strong influence on project management. So it is really worth to find out those factors which must be evaluated for

successful project management in a GSD context. Additionally, current research mostly considers the vendor perspective and less number of studies have evaluated both client and vendor perspectives. In the GSD environment, client and vendor companies operate at various levels such as country, company and team levels, therefore could face different issues at these levels. Countries differ in their policies and regulations and companies can have diverse organizational structures. Additionally, teams may differ in their structure which could lead to project complexities. In literature, there are some studies that have explored GSD challenges only at the technical and non-technical levels (Mishra & Mishra, 2011). Therefore, it is significantly important to investigate challenges and critical success factors at a broader level which provide the justification for this study.

The purpose of this study is to undertake an empirical assessment to identify critical success factors (CSFs) for project management success in global software development through a qualitative and quantitative evaluation which will lead to the development of a framework for this business model. The research questions addressed in this study are: 1) what are the CSF'S for project management in vendor companies involved in GSD? 2) What are the CSF's for project management in client companies involved in GSD? 3) Is there any variation of critical success factors for project management between client and vendor companies in GSD? 4) How could these critical success factors be grouped at the country, company and team levels in GSD? 5) What are the antecedents and consequences of critical success factors for GSD at the country, company and team levels?

2 Literature review

2.1 Challenges and benefits in global software development

Global software development is a prevailing trend since last several years and research in this field has uncovered that many software companies despite their sizes and project types, desire to globalize their business in order to achieve strategic and economic benefits with improved product quality (Babar & Lescher, 2014; Jain & Suman, 2015; M. Niazi et al., 2016). Major advantages of GSD include less time to development, cheap cost, nearer proximity to local market, access to large pool of competent developers, code modularization and improved record of communication (Jain & Suman, 2018). These potential benefits are difficult to achieve due to various challenges in GSD on technical, cultural, political, and social levels (Herbsleb & Moitra, 2001) which are due to geographical, temporal, socio-cultural, linguistic, and organizational distances (Jain & Suman, 2015). Global software development is a wide domain that not only involves different teams but different companies and countries as well. One study (Herbsleb & Moitra, 2001) on GSD reported that physical separation of teams results into diverse challenges at both technical and non-technical levels. Technical challenges are mostly related to configuration management, incompatible data formats, version management, software integration and architecture of system components. Non-technical challenges are related to culture, communication, collaboration, coordination, team dynamics, trust, distance, time difference, knowledge management, project and process management (Herbsleb & Moitra, 2001; Mishra & Mishra, 2011). It is important to understand the GSD challenges at different levels in order to define solutions for inherited issues in GSD (Herbsleb & Moitra, 2001; Mishra & Mishra, 2011).

2.2 Client and vendor perspective in global software development

Companies in GSD are mostly client and vendor companies, although in some cases one company could operate from its different locations as well. Client companies get benefit in terms of cost savings and vendor companies from favourable governmental policies and tax

aids. Moreover, these companies become more proficient of utilizing communication infrastructure in their home environment (Jain & Suman, 2015) and outsource their technical work to vendors with shared risks keeping focus on their core business processes. For example, a bank outsource its technical processes a more skilled workforce while keeping its focus limited to core processes (Khan, Niazi, & Ahmad, 2010). Vendor companies add value to the supply chain by learning more skills required by clients over a period of time. Regardless of these benefits, most of the client and vendor companies fail in GSD due to inappropriate management processes and inadequate preparation (M. Niazi et al., 2016). Factors such as trust, relationship, risk and culture management are significantly important for both client and vendor companies.

2.3 Local versus global software development

According to a study conducted on local and global software projects by Standish group, GSD projects failure ratio is greater than the local software projects (Holtkamp, Lau, & Pawlowski, 2015). Several studies also show that about 40 percent of GSD projects have failed (Jain & Suman, 2018) and major reasons behind this failure are high coordination cost, culture misunderstandings, lack of face-to-face communication, experience in GSD, requirement understanding, common language and standard process (Abrahamsson, Salo, Ronkainen, & Warsta, 2017). All these issues cause mistrust, frustration and misunderstandings which lead to rework, defects, delays and poor acceptance level (Jain & Suman, 2015).

Although GSD has set its foundation however practices, tools, strategies to implement a successful global software development program are not standardized. In co-located software development, several different process models such as Waterfall, Rapid Application Development and Spiral are followed for the development of software product while in GSD there is still lack of standard approaches to develop software products (Abrahamsson et al., 2017). In the beginning of GSD, companies tried to use traditional software process models like Waterfall which resulted into higher failure rate of distributed projects. Later, Agile methods were applied in distributed projects however these methods could not solve all problems related to GSD (Alsahli et al., 2017). This is due to the fact that agile methods and sequential approaches like waterfall are designed for co-located software development and these do not consider distance and their associated challenges in GSD (Abrahamsson et al., 2017). This is the main reason that these processes do not provide satisfactory results when applied to GSD. GSD is intrinsic with such challenges which must be addressed to achieve project success. Software development processes which are applied for co-located software development, including sequential and agile methods, also need to be tailored, improved or require new frameworks to meet GSD requirements (Jain & Suman, 2015). Therefore there is a need to develop new processes or modify existing processes to support GSD (Jain & Suman, 2018; Niazi, 2016).

2.4 Project management in global software development

Project management has always been a burning issue amongst the software development community. Researchers have suggested to pay close attention towards project management activities because project and project management success both are equally important for the business success (M. Niazi et al., 2016). In case of GSD, project management becomes more complicated due to intricacy of GSD distances (temporal, socio-cultural, geographical, organizational) (Colomo-Palacios, Casado-Lumbreras, Soto-Acosta, García-Peñalvo, & Tovar, 2014; Jain & Suman, 2018). It is significant for an organization to achieve and maintain a high success rate to sustain in the global market. Therefore, an exceptional project

management is necessary. There are several studies e.g., (Iftikhar, Alam, Musa, & Su'ud, 2017; Khan & Khan, 2017; Yaseen, Baseer, & Sherin, 2015) which talk about the success of GSD which depends on the requirement change management, process improvement, developing relationship between client and vendor, software integration and use of tools in managing GSD projects.

Project management in GSD is a less researched area, as few numbers of studies are conducted that specifically address project management in this domain (M. Niazi et al., 2016). One study concluded that every organization either client or vendor should be aware of identified challenges prior to the adoption of global software development (M. Niazi et al., 2016). Another research revealed that there are nine success factors which are important to address for successful project management in GSD (Niazi, 2016). Although a significant amount of research has been completed in several areas of GSD including knowledge management, virtual team management, communication, risk management, task allocation and effort estimation, unfortunately researchers have not much emphasized on the development of a project management framework compiling important knowledge areas for GSD (Jain & Suman, 2018).

Recently, one study proposed a framework based on the project management challenges that include communication, coordination, control and collaboration due to temporal, geographical, socio-culture and organizational distances. Major contribution of this study is compiling knowledge areas that are required for effective project management in GSD. This framework covers five knowledge areas – feasibility and risk management, virtual team management, knowledge management, scope and resource management, and performance management –based on PMBOK (project management body of knowledge) and emphasises that managing these areas is essential for effective project management in GSD (Jain & Suman, 2018).

3 A critical success factors framework for project management in global software development

Although the project management framework by Jain & Suman 2018 considers knowledge areas based on PMBOK and takes challenges into account with respect to four distances related to communication, coordination, control and collaboration, this framework does not consider the most important factors for project management in GSD. Communication is a core issue in GSD which is not addressed in the existing framework. Moreover, scope and resource management are considered as a single knowledge area. Scope, cost and schedule management have been included in this knowledge area while requirement management, which is also an important concern for project management in GSD, is missed out in this framework.

In this paper, a new framework is proposed based on the CSF's extracted from literature focusing on studies with practitioners having industrial experience. The project management framework developed by Jain & Suman sets the foundation for this new framework as it was the first formal project management framework in GSD. The existing framework is extended to include additional knowledge areas such as communication management, resource management (scope, cost, and schedule) and scope management (requirements) separately because requirement management is significantly important in GSD. Moreover, human resource management is also added that includes virtual team and stakeholders as shown in shown in Figure 1. This figure includes the important knowledge areas of project management for GSD under which CSF's extracted through literature and industrial experience will be listed.

4 Future plans and contribution

Global software development is a model that faces several challenges and is important for companies to know its core issues with possible solutions. An effective project management in GSD can achieve major requirements for a successful implementation of this business model.

In future, this research will identify critical success factors related to project management in GSD by using a mixed-method approach with both qualitative (interviews) and quantitative (survey) research methods using two levels of analysis – client and vendor operations and country, company and team level operations. In the first phase of the research, CSF's will be evaluated through literature and interview-based case studies with client and vendor participants of identified companies, to capture their operational experiences. In the second phase, these CSF's will be examined through a global questionnaire survey to gather different country, company and team context insights from a vendor and client perspective of participants from different global regions. A list of CSF's will be developed through a cross analysis of findings from both phases of research. Variation of these factors between client and vendor companies will also be investigated. Finally, the antecedents and consequences of these factors in GSD at different levels of operations (country, company, and team) will also be identified.

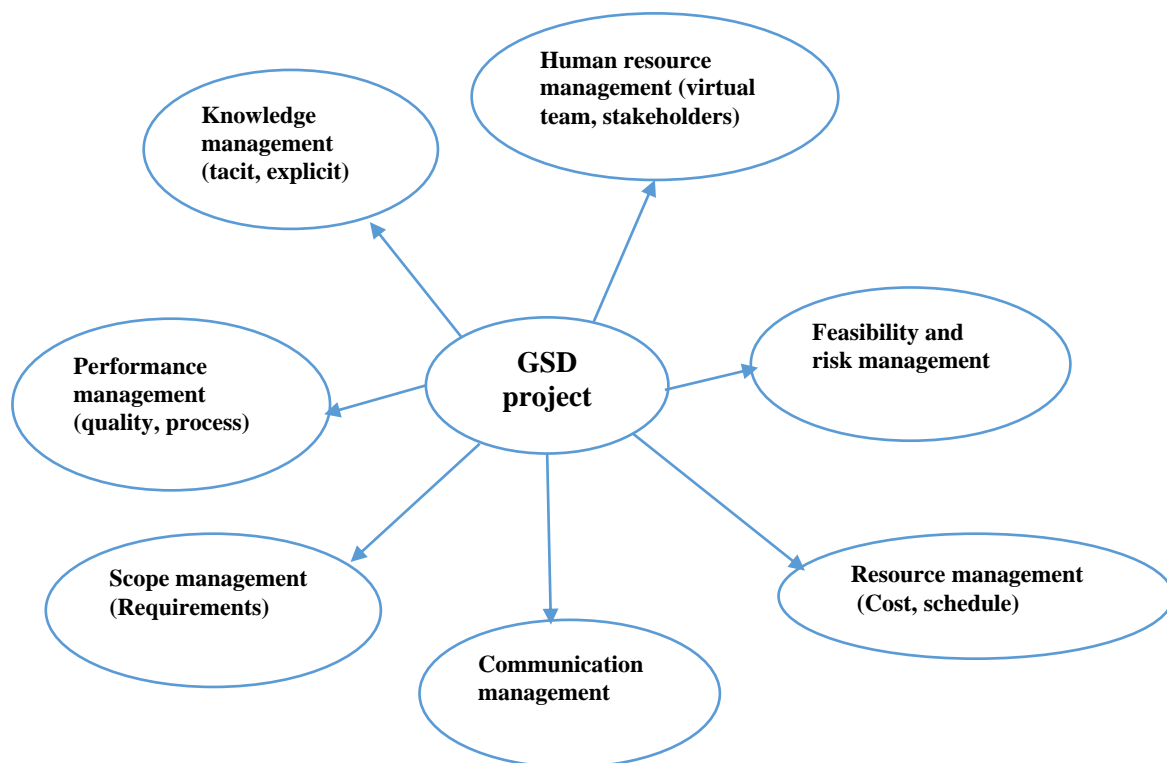


Fig 1: Critical success factors framework for project management in global software development (Adapted from Jain & Suman 2018)

This research aims to contribute to the current knowledge in three ways. Firstly, it will identify CSF's for project management in GSD and will group these factors at the country, company and team level. It will help companies to understand their project management practices at different operational levels prior to start of GSD. Secondly, this study will examine variation of critical success factors between client and vendor companies, which will

help client and vendor companies to focus only on those factors related to them. Thirdly, this study will develop a project management framework based on the critical success factors and relate those factors under different knowledge areas. It will also identify the project management practices which are only related to GSD and those which exist in both GSD and PMBOK. All these findings will be helpful for academia and industry practitioners to understand specifications and implementation of project management in GSD.

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