A Study on Global Software Development (GSD) and Software Development Processes in Malaysian Software Companies

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***Abstract*— Software development processes have been tremendously changed since last two decades. Due to GSD or IT globalization, traditional practices of software development have been replaced by lightweight methodologies; global software industry has been reshaped and has taken new direction. Software companies are struggling to cope with these changes to stay competitive in the international markets. The companies need to understand these changes, their consequences and how to accommodate them. A lot of new processes and approaches of software development have been introduced. It is difficult for companies to select an appropriate process suitable for their project and environment as well as for addressing the challenges associated with GSD. Therefore, it is required to identify the GSD factors that bring change in software processes and also play role in the selection of a suitable process. In this context, the present study has been conducted on Malaysian companies. Therefore, it is necessary to understand the software processes currently being used by the Malaysian companies; how GSD affects these processes and what is the change in processes after GSD. The present study finds the answers of these questions to help in understanding the current software development trends in Malaysian software companies. It will contribute to formulate a process selection framework for Malaysian companies.**

***Index Terms*— Agile; Companies; Factors; Global software development; Processes.**

I. INTRODUCTION

The global software development (GSD) also termed as IT globalization [1] received overwhelming response from the software industry and became popular practices since early 2000 [2, 3]. Due to IT globalization, software development companies tend to use global resources and time zones based development practices to achieve higher level of productivity and efficiency [3]. The resources such as sophisticated communication tools either synchronous like telephone and instant messaging (IM) [4] or asynchronous like email [4, 5] and the latest technologies for faster development for cross site communication have become available over the past years. It motivates the companies to invest in GSD [6].

Software companies want to produce better quality software with less development cost and increased productivity from business point of view [6]. GSD has made it easier for the companies to achieve these goals. A number of benefits associated with GSD have been reported in research studies such as reduced development cost [1, 6-9], tax incentives [6], time zone effectiveness (follow-the-sun) [1, 7-10], closer to market and customer [1, 6, 8, 9], modularization of work [8], shared best practices between teams [8, 11] and large pool of skilled labor [1, 7, 8, 11].

The consequences of GSD appeared directly on the software development processes and as a result, lightweight agile methodologies have received good response from software development companies [3, 12]. Among others, SCRUM and XP have appeared as two more popular methodologies during recent years [4, 12]. Their characteristics such as less documentation, short iterations, quick releases and sprints, incremental approaches, communication support, and importantly their support to GSD environments are the main factors behind it [3, 13]. These methodologies provide output to the client at every phase of the development [3].

Agile methodologies provide best practices and set disciplined processes for the software development companies in specific environment [3, 13].

In addition to the benefits of GSD that organizations are enjoying, there are also some inherent challenges in terms of communication and collaboration [1, 3, 10, 12-16], cultural difference [1, 9, 14, 15], mismatched practices and processes, attitudes and values [17], time zone difference [9, 15], project diversity and complexity [15], tool support [14] and management practices [6, 14]. One of the biggest challenges faced in GSD environments is communication [12, 13]. Various studies propose solutions and strategies to reduce or eliminate these challenges [6, 14, 18, 19]. However, these issues further need to be addressed properly as some limitations still exist at certain levels. It needs to study these challenges in detail in order to guide the software development companies in a proper way so that these companies could improve their software processes. In this regard, majority of the studies are conducted in United Kingdom (UK), United States (US), Europe, Japan, China and India [8, 15, 19] but very few are carried out on Asian countries particularly Malaysia [20-23]. These studies do not properly highlight the effects of GSD on software processes and practices rather discuss GSD environments in a more general way. In Malaysian context, a few studies have been presented that do

not discuss GSD factors in relation to the change in software process paradigm from traditional to lightweight processes, and current software development processes and process selection criteria. The present study covers this research gap by investigating how GSD affected the Malaysian software companies, what are the factors behind it and what processes are currently being used. The outcome of this study would contribute to propose a framework for Malaysian companies that will provide guidelines on the process selection criteria and suitability of a particular software process to the project and requirements.

II. Literature Review

The concept of global software development (GSD) evolved since late 1990s [3] and became common during early 2000 [1-3]. It brought drastic and quick changes in software development trends and developed connections at cultural, political, social, economic, and business levels among the nations.

Among others issues, delayed deadlines and loosing trust of the client [15-18, 24], limited overlapping working hours and lack of synchronous communication have become more complex. Asynchronous communication affects the project scope, project coordination and time management [25]. Various studies show that one of the common reasons of project failure is lack of requirements [3]. Requirements are considered as most important factor for project success [2, 23]. However, agile methodologies provide flexible approaches to manage business requirements [3, 14]. [19] describes that misunderstanding requirements is also a big challenge that can be overcome by asking follow-up questions from the product's owner. Agile methodologies being famous for face-to-face communication can be helpful in addressing such issues. However, it is hardly possible in distributed projects and is the biggest challenge in GSD [19]. Frequent builds, short iterations, continuous integration, and close communication and cooperation between the client and developers [3, 12, 14, 19] are among other factors of popularity of agile methodologies.

IT globalization directly affected the software development processes. Client wants to see the progress of the development of his product on weekly basis (shorter delivery times) [3, 26] so he sets high expectations from the development companies. Agile methodologies are good in such projects because these methodologies provide output to the client during every phase of the development [3] and are helpful to minimize the communication and integration problems. A number of studies report that communication, collaboration and integration are the biggest challenges in GSD [7, 12, 13]. Agile methodologies help to overcome these challenges by their attractive characteristics such as daily and weekly meetings among team members and clients, less documentation, short iterations, quick releases and sprints, and incremental development [12, 19]. Another technique also reported is software product lines (SPL) [13, 17]. Although, agile and SPL both share some common goals such as reduced time to market, cost effectiveness and increased product quality but both use different techniques to get desired benefits [13].

Different studies propose solutions to deal with the challenges of GSD like handling the communication and coordination issues and developing trust relationship among offshore and onsite team members. However, the issues still need to be addressed formally.

A study [2] conducted in Kingdom of Saudi Arabia (KSA) on GSD factors affecting the requirements' understanding proposes some solutions to deal with these challenges. The study shows that requirement understanding is a serious problem in KSA software companies as well as communication and culture are the main challenges faced during requirement understanding process. Furthermore, it is also reported that the maturity level of the companies is low but they use new technologies such as audio and video conferencing during requirements analysis and communication processes.

Most of the studies are conducted in Europe, USA, Japan, China and India [6, 8, 15, 19] while a few in Asian region [20-23, 27-29]. As the goal of Malaysian government [30, 31] is to provide good services in order to capture the international markets therefore, to meet market competition, it needs to produce good quality software that can be achieved by improving software processes and practices.

Another study [23] finds the development methods and software development practices being used in Malaysian software development industry. In this work, software development practices are described according to each process of software development life cycle (SDLC) such as requirements, design, development and testing. Therefore, it is difficult to believe that the framework presented in this study properly provides guidance to the IT companies in the selection of process which can help them to make their processes better in terms of quality and cost. Framework is too general to properly address the challenges of software development and their solutions.

Similarly, [28] has conducted a study on software process improvement in Malaysia along with application tools to assist the implementation. Study reveals that lack of awareness, cost, and complexity are the main obstacles for Malaysian companies whereas, particularly small and medium size enterprises (SMEs) have problems in implementation of software processes.

In a survey, [27] identifies current practices of monitoring the software development process in Malaysia. The study shows that mostly software development organizations in Malaysia do not use any methodology for monitoring the status of software projects. Also, the ratio of latest methodology used in organizations is still low and as a result it causes project failure. The study also shows that monitoring is important for project success as monitoring mechanism helps the project managers to see the project progress and help them to manage the resources as well as planning the project.

[20] conducted study on the use of software development activities, tools, programming languages and techniques, and the problems that occur during the development process. The findings show that most of the software companies in Malaysia are still facing the problems of standards, quality, late delivery and over budget.

[29] in a survey to determine the adoption of current practices of software process improvement (SPI) and related problems among small and medium enterprises (SMEs) in

Malaysia found that implementation of SPI is still at very low level in Malaysian software SMEs. Lack of resources and adequate knowledge are the main reasons for implementation of SPI. However, data sample size is small and study is not conducted in context of GSD. On the other hand, it also does not provide information about GSD factors that are responsible for change in software process paradigm and process selection criteria. The study presented in this paper addresses these issues and investigates the effect of GSD on Malaysian software companies along with the GSD factors behind to change the process and what processes are currently being used by these companies.

III. RESEARCH METHODOLOGY

The present study is conducted on Malaysian software development companies which are involved in project outsourcing. Qualitative research methodology has been followed and semi-structured interviews are conducted from software development companies in Malaysia. Table 1 shows the interview questions other than the demographic questions. GSD factors as given in question 2 have been identified from the literature based on which interview questions are designed.

Table 1
Interview Questions

Questions
1. What are the processes/methodologies currently being used in your company to meet the challenges/effect of GSD?
2. Select from the options below, the possible reasons/GSD factors behind the change/modification in process(es) as mentioned in answer of Q1?
□ Communication
□ Coordination
□ Collaboration
□ Geographical distance
□ Cultural distance
□ Temporal distance (time zone difference)
□ Project diversity and complexity
□ Tool Support
□ Management Practices
□ Number of teams
□ Other (Reasons):_____
3. What are the processes/methodologies that your company considers are more suitable for them?
4. Before outsourcing projects, what were the processes mostly being used in your company?
5. Suggest how software development companies in Malaysia can meet with the challenges of GSD to produce better quality software and compete in international market.

Qualitative approaches in similar works have been used in a number of studies and are presented as proven techniques of data gathering and analysis [2, 8, 15, 19, 32]. The results obtained through qualitative techniques are considered more reliable because data is gathered from real projects and through face-to-face communication which is hardly possible in quantitative techniques.

Interview question are designed based on the identified GSD factors and processes from the literature. Interviews are conducted from IT professionals such as project managers, team leads, senior system analyst and senior software developers working in Malaysian software companies. So far ten interviews have been conducted from ten companies. We called more than 60 software development companies (doing project outsourcing) in different states of Malaysia for data collection. Fifteen companies were agreed initially but later on five companies refused because of run time meeting calls. The response rate is quite low because of busy schedules of the professionals working in the companies due to their deadlines and targets. The privacy policies of the companies are also one of the big constraints in data gathering process due to which most of the respondents are also not willing to answer the questions. The duration of each interview is from one to two hours [2, 15, 19] along with follow up emails to resolve the confusions. The study is in progress and more interviews are being conducted which is time consuming process.

IV. RESULTS

The analysis of data gathered through ten interviews show that 90% of the respondents agree that software development processes in their companies have been changed due to global software development. Out of these 90%, 70% mentioned that they have adopted agile methodologies, 10% are still using waterfall and remaining 10% are using RAD. Majority of the Malaysian software development companies have been shifted to agile methodologies because of the "*better visibility and faster development*" as mentioned by a project team lead. According to a project manager, "*Managers can see the progress, and developers do the tasks with the given priority*." A senior software engineer commented that "*We use SCRUM, because it was the first alternative to an informal process, and because we know SCRUM is better than other models.*"

40% out of 70% respondents stated that agile methodology provides an easy way to manage projects and tasks. Also, it helps to share best practices among team members, improved resource allocation, improved task modularization, reduced coordination cost, increased team autonomy and track formal record of communication.

It is obvious that Malaysian software companies also prefer agile methodologies for their software development environment and most of the managers and team leads prefer them. Therefore, its true as [19] reported that agile methodology is mostly used in distributed environment, because it solves most of the problems that appear due to GSD.

Malaysian companies also have problems with collaboration and communication processes [1, 3, 10, 12-16]. In question about GSD factors, 90% of respondents reported collaboration problem, 80% reported communication problem, 70% reported management practices as main problems while 30% reported mixed problems.

The initial results show that GSD has also affected

Malaysian software companies and these companies have adopted new family of agile processes because of fast development, easy to change the requirements, frequent communication and cost saving factors. Although, software companies adopted lightweight methodology but still they are facing communication and collaboration issues. It is needed to improve our management practices for better processes and quality of work. Based on these results from initial interviews, we can state that Malaysian software companies have also been directly affected by GSD like other countries and as a result their process paradigms have been changed. Agile methodologies are mostly being followed by the software development teams due to their smart approach to meet the challenges of GSD and latest software development trends.

V. CONCLUSION

Malaysian software development industry is also greatly affected by the GSD. The present study helps to understand this effect. The initial results show that the study is successfully achieving its objectives. GSD factors have been identified and their effect on software development processes has successfully been determined. Malaysian companies have shifted their processes to the lightweight agile methodologies but still it is hard for them to select a process suitable for their projects and for addressing GSD challenges. Agile methodologies have appeared as better alternative to the traditional approaches and have been proven effective. The software companies irrespective of their size are using agile methodologies to meet the challenges of latest trends in software development arising due to GSD. The present study would contribute to formulate a framework for selecting a suitable process in this context for Malaysian software development companies. The proposed framework would help in selection of a good process suitable according to their requirements to produce quality software.

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