Software development process evolution and paradigm shift - a case study of Malaysian companies

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A B S T R A C T

Due to the consequences of global software development (GSD), the traditional approaches of software development evolved into lightweight agile methods. The agile methods got overwhelming response from software development companies due to their obvious support to GSD. In this regard, limited research work has been presented on software process evolution and process paradigm shift in context of GSD. Most of the work presented on GSD mainly focus on the companies in Europe, America, Australia and other western countries. Existing research work highlight the standard benefits and challenges of GSD but do not investigate its effect on software development processes and associated reasons causing the affect particularly in Malaysian software development companies. The research work presented in this paper addresses this issue and investigates the effects of GSD on software processes, software process evolution and paradigm shift and finds the current software processes being used in Malaysian companies. Also, it further determines the GSD factors and reasons behind the change and selection of a software development process. GSD factors affecting the software processes have been termed as challenges. Structured interviews have been conducted to collect qualitative data from industry professionals involved in GSD. General inductive approach has been used for qualitative data analysis and findings. The results show that after GSD, Malaysian companies are mostly following agile methods. The traditional and ad-hoc approaches used before GSD have been replaced by the lightweight agile methodologies. Few of the companies are still following ad-hoc approaches mainly due to size of the project and company as most of the Malaysian companies are small and medium size. The research is significant that it provides clear insight into software process paradigm in Malaysian companies. The outcome of the research provides foundations for the standardization of software processes, process improvement, selection and quality enhancement approaches in Malaysian companies.

1. Introduction

Software is a generic term for various kinds of programs used to operate computer, related devices, machines and various applications, designed for the ease of front-end users [1]. Since past two decades, global software development (GSD) phenomena is occurring whereby software development teams globally distributed at different locations are involved in software development projects outsourced to offshore companies to develop a software for a company or individuals [2-6].

The global software development (GSD) helps software companies to use the global resources such as skilled labour and technology effectively which are dispersed in different time zones and locations [7]. The software companies are following the GSD phenomena to decrease the project cost and increasing the productivity and quality of software [2]. Cost saving, large pool of skilled but cheap manpower and software development using different time zone (24/7) are the main benefits behind the increasing interest of software development companies in GSD, particularly in outsourcing [8-13]. The availability of latest communication and interaction tools either asynchronous (email) or synchronous (instant messaging, telephone, Skype audio/video calls) are also the main motivators for the software companies to get benefits from outsourcing and GSD [14-15].

Despite the benefits of GSD, numerous issues associated with GSD have also been reported [16-22], prominently communication, coordination, collaboration, management related issues and complexity of the project due to geographical, temporal and cultural distances [7,18, 21, 23]. More adversely, misunderstanding of the requirements and time zone difference as delayed team response are the severe problems faced by the software development teams leading to the delay in projects [9, 18, 24-26]. Since, the development of a good quality software demands highly professional and expert software engineers and/or programmers, GSD has made it more difficult by doing it at different locations. The distant teams require synchronous communication and coordination. A number of strategies and solutions to deal with these GSD issues have been presented in [8, 20, 25, 27-29] but still more research contribution is required to address these challenges.

GSD directly affected the conventional practices of software development which eventually are substituted with agile methods. The software companies widely adopted the agile methodologies considering them as the best practices for GSD based projects [3, 21]. Agile methods provide the disciplined practices and procedures for the software development in any specific environment of a company [3, 23]. According to a global survey conducted by Versionone [88], about 80% of the companies are following agile processes in their software development environments. These aspects of GSD have been investigated widely but most of these studies have been accomplished in context of Europe, United States (US), Finland, Netherland, India, China and Pakistan, but not Malaysia. A few of the studies carried out in context of Malaysia [30-37] have not properly investigated the effects of GSD in Malaysian software companies (MSCs), their impact on software development processes, GSD factors or challenges and causes behind process paradigm shift. Rather, GSD has been discussed in a very general way at superficial level. The impact of GSD on Malaysian software industry, challenges being faced and solutions to meet the challenges have not been well addressed. Also, it does not discuss the reasons and GSD factors in relation to the change of software development processes and practices in MSCs. For better quality software, it is imperative to follow standard processes and practices of software development. In this regard, it is necessary to understand the existing software process paradigm in Malaysian software companies, factors responsible for change in processes and process selection criteria.

The research study presented in this paper addresses these limitations and investigates the impact of GSD on software process in Malaysian software development companies. It provides deep insight into the effects of GSD and the current software development processes being used by the MSCs. Furthermore, the main factors of GSD and the causes in the selection and/or behind the change of software practices in MSCs have been identified. An initial study in this regard has been presented in [34].

The research study is qualitative. Data has been collected through structured interviews conducted with experienced IT professionals working in Malaysian software companies. Those companies have been selected which are working on outsourced software development projects and processes. General inductive approach has been used for qualitative analysis of respondents' data. Coding, categorization and analysis of data have been performed through NVivo software. GSD factors also termed as challenges, changes in software development practices as a result of GSD, causes behind the change, current software development practices in Malaysian companies, and dominant software processes and

methodologies in Malaysian companies are the findings and main outcome of the present research work. The research is significant that it provides groundwork to standardize and improve the software development processes in Malaysian companies. The results of the research would contribute to construct a process selection framework to provide guidelines to Malaysian companies on selecting a process according to their requirements. Ultimately, the local companies would have more capacity to produce standardized and good quality software products.

2. Existing Work

Global Software Development (GSD) started during late 1990s and got overwhelming response [9-10, 13]. GSD has changed the entire software process paradigm and developed connections among countries having different behaviours, social values and different culture [7]. As a result of GSD, many companies have outsourced [7] their projects because of low cost, good quality product and increased productivity from business point of view [2, 8]. The companies can save money with GSD, for example, a project manager working in the USA or Europe withdraw a one month salary equivalent to the 3 month salary of a project manager working in low wages countries and having the same skills and expertise. Therefore, projects can be completed with 3 times lesser cost by practicing GSD. Consequently, companies can have access to the large pool of skilled labour from low wages countries and can also help to improve the skills of team members by sharing their expertise [7, 11-13]. However, GSD includes many risks and challenges dealing with them requires companies to adopt new processes resulting into the process evolution and paradigm shift.

The evident risks and challenges of GSD are related to communication, interaction, collaboration, diversity and complexity of projects, management related problems, cultural and temporal distance [3-4, 7, 9-10, 18, 20-21, 30-31]. According to [31], requirements can be changed at any time during the project but it becomes more difficult to change when the project is developed at distributed locations. Sriram et al. [3] have attributed common reasons of project failure to the lack of proper requirement gathering and understanding, and frequent changes in project. Conversely, the requirement factor also plays the main role in the success of project [6, 63]. Furthermore, researchers have also identified some other GSD challenges such as delay in project deadlines, project hidden cost, misunderstanding of requirements, losing trust with client and lack of synchronous communication [2, 18, 24, 27-28, 32-35]. The delay in responses due to time zone difference affects the GSD projects [36] and as a result the projects could be delayed and have more chances to lose the client's trust. Moreover, integration is also considered as a big problem in GSD projects that also affects the project deadline and might increase the project cost [21]. The majority of the researchers agree that the communication, collaboration and integration are the main challenges in GSD [12, 21], [23] and projects would be successful if collaboration, communication and coordination processes are well managed with the teams and clients [21, 28]. A number of studies provide solutions to minimize the GSD challenges and risks [8, 16, 27, 29] but still it needs to be addressed properly when related to specific culture, environment or community.

In order to deal with the GSD challenges, companies have adopted new software practices and processes to get the desired benefits from it as lack of communication, complexity in integrations and misunderstanding of requirements can cause extra time and cost to the project [37]. Therefore, the main purpose of following the suitable development process is to produce quality of work within time and budget [26]. Subsequently, software companies switched the existing processes with agile processes to meet the market competition, client expectations and get the benefits of GSD. Versionone's survey shows that about 80% of the world companies have adopted agile methods. The agile methods are considered as to be the better software development processes in order to minimize the difficulties faced in development environment and GSD based projects. Agile methods have deliverables for the client during each phase [3] and also help to minimize the challenges which are faced in GSD. Agile methodologies provide the key features such as less documentation, quick releases and short builds, visibility to the client throughout the project development, risk identified in early stages, speed to market, cost control and testing for each build of the project [21, 28], 38]. Eventually, agile methods have become popular and have been adopted as well by majority of the software companies overcoming the GSD challenges and risks.

In this regard, most of the research studies conducted mainly focus on companies in US, Europe, Finland, Netherland China, Pakistan and India but very few have been conducted in South East Asia region, particularly Malaysia [39]. Although, few studies have been conducted in Malaysia such as [32, 39, 40-41, 44, 69-70] but these studies do not discuss the affects and factors of

GSD in relation to the process evolution and process paradigm shift from conventional approaches.

A study conducted in Malaysia presented the software development practices and development methods being used in software development industry [32]. The study indicates that the use of software development practices in Malaysia is differing from one another. A few of the IT companies are following their own development processes and some of them are not using any particular software process, while a few are following the best industry software practices. However, the focus of the study is on general software processes as well as the proposed framework does not provide proper guidance to the MSCs in selection of software development processes. The study does not properly address the factors and reasons related to GSD for the use of development processes and practices. Also, the study is not conducted in context of GSD. In 2005, [44] published a survey on the software practices in MSCs and found challenges related to the adoption of suitable standards, and the issues such as late delivery, quality work and over budget. In-addition, Baharom survey also reported that one third of the Malaysian companies are not using any software practices.

Likewise, Ahmad et al. [40] have also identified the current software development practices monitoring the processes followed by MSCs. Most of the MSCs are not following any development process in the development of software product. In-addition, the ratio of the latest software practices in MSCs is still low which results in the failure of projects. In a study on existing software process improvement (SPI) practices in Malaysian SMEs, [39] found that inadequate knowledge and lack of resources are the key factors for the implementation of SPI at low levels in Malaysian SMEs.

The improper guidance and lack of information, complexity and cost related issues in MSCs are the main causes behind the hindrance in adoption of well-defined software practices especially in small medium size enterprises (SMEs) [41]. However, some initiatives have been taken to introduce the suitable software improvement standards and processes in Malaysia leading towards the project success. Malaysian government is also striving [66, 72] to export good quality software and services to the international market maintaining good standards of development to attract international companies. According to an annual industry report of 2015 [71], the MSCs are growing significantly, earning billions of dollars from foreign investment. It is necessary to investigate the GSD effect on MSCs, identify GSD related factors and causes, and determine criteria for selecting a software process. In this regard, the present research work has been conducted to address these issues. The present research study identifies the factors and their causes related to GSD in context of process change and their rules of selection.

3. Research Methodology

The present research study aims to determine the effects of GSD in MSCs and how the development processes have changed in MSCs due to GSD. It also highlights the need to identify the factors related to GSD and causes behind the change and selecting a software process in MSCs. The present research study has been conducted on MSCs working in GSD based environments and practicing outsourcing.

Qualitative research approach is followed in the present research study. In qualitative research data is in non-numerical such as text, arguments and phrases that provide in-depth understanding and clear picture of a particular study or phenomena [62]. In qualitative research, data is collected without defining or deriving the categories, however, categories can be derived after the data collection process [53]. Being based on interpretivist and inductive approach, it rejects the practices of quantitative methods [45, 62]. The qualitative methods have received criticism on reliability and validity of qualitative data and biasness. However, biasness can be eliminated by conducting study designed using a proper protocol focusing on validity and reliability of the methods for data collection and analysis. Validity is associated to the genuineness and integrity of the data while reliability is the permanency and reproducibility of the data [42]. Different techniques and steps for testing the qualitative data, its validity and reliability have been proposed in [42, 78, 84-85]. Many researchers have suggested different steps claiming the validity of the qualitative data such as (a) clear definition of the research process, and (b) clearly stated steps followed to be reused by other researchers. In accordance with it, present research work has clearly mentioned its entire research design.

In qualitative studies, interviews, focus group, observations and document analysis methods are mostly used [62, 48]. In the present study, structured interviews have been conducted for the data collection. The interviews could be face-to-face, audio/video calls and/or telephonic, whereby, face-to-face interviews, a most preferred method, is adopted in the present study [89]. The interviews are more appropriate when limited information is known for the particular phenomena or

requires in-depth information [59, 79]. The interviews are widely used to explore the views, perceptions, beliefs, motivations and experiences of the people [49, 59]. Interviews could be structured, semi-structured and unstructured [55, 59, 73, 89]. For structured interviews, the questions are prepared before the interview having little variation, and asking the same questions from each participant [89]. Partial pre-planning is made in case of the semi-structured interviews with open-ended questions set to collect the desired information besides some unexpected information that is also received during the interview [68, 89]. Further, unstructured interviews are not pre-planned set of questions rather than it depends on social interaction [50]. However, in unstructured interviews researcher has a clear plan regarding the purpose of the interview [77]. Unstructured interviews help to discover the views, beliefs and behaviour of other people to determine the new kind of information [55].

3.1 Data Collection

In the present research work, the open ended, structured questions have been set for the interviews. The interview questions have been derived based on the study of the existing literature. Pilot study with 6 interviews was conducted to refine the questions. The interviewees were professional IT experts, managers working in MSCs and few professors expert in software engineering field. For data collection, more than 215 Malaysian software companies were contacted but only 45 software companies responded. As most of the software companies refused to make appointment for the interview because of their busy schedules, emergency meeting calls, company privacy policies and tight projects deadlines. Later, 9 interviews were excluded due to the irrelevant, incomplete and inappropriate information given by the respondents. Total 36 interviews have been conducted from different MSCs in Malaysia. Qualitative data collected through interviews provided better understanding on the effects of GSD in MSCs and detailed answers on how the development

processes have been changed in MSCs. Qualitative data analysis help to derive reliable and better results. 19 out of 36 interviews have been conducted online through email and telephone while remaining 17 interviews were face-to-face. The interviewees were experienced professionals working on software development projects in software development companies in Malaysia.

3.2 Data Analysis

The present research work applies general inductive approach (GIA) for analysing qualitative data collected through structured interviews. Using GIA, the results can be derived through the interpretation of raw data without applying any data analysis methodology or coding techniques [62, 86]. Results could be in the form of concepts, model or theories. The GIA is less complicated, quite simple and straightforward as compared to other traditional data analysis methodologies such as narrative analysis and grounded theory approach. Mapping the findings with research questions meeting the research objectives is easy with GIA [86]. The key objectives and features of GIA helpful in data analysis are [62, 86] as follows.

1. Summarizing the raw text data.

2. Establishing strong relations among the summary of the results derived from raw data and research objectives.

Furthermore, it also ensures relations are transparent and the links reflect the research objectives. It makes it easy for other researchers to easily understand it. Based on the processes and experience evident in the text data, it develops a framework, model, theory or concept. Fig. 1 shows the overall inductive coding process.

This approach is used by many authors for analysing qualitative without realizing it as typical "general inductive approach" [46, 51]. Unlike grounded theory approach, coding process in GIA is more direct and no separate coding technique is applied, whereby, open, axial and selective coding techniques are used in grounded theory approach [82, 86].
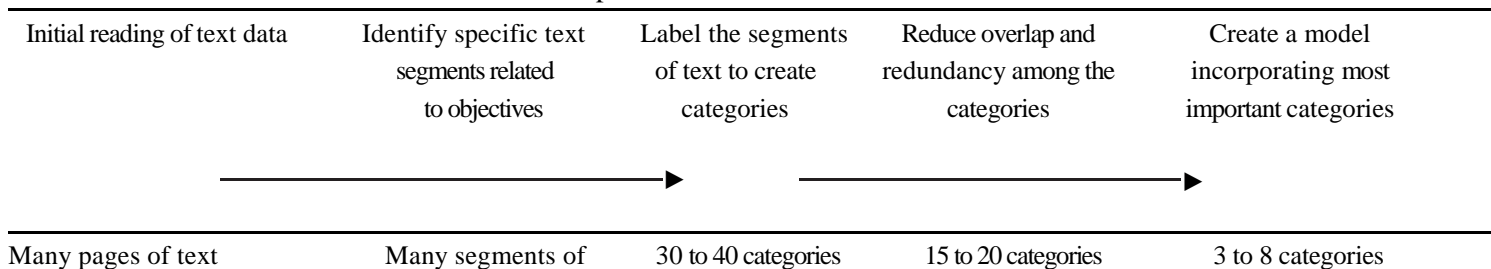
Initial reading of text data	Identify specific text segments related to objectives	Label the segments of text to create categories	Reduce overlap and redundancy among the categories	Create a model incorporating most important categories
Many pages of text	Many segments of	30 to 40 categories	15 to 20 categories	3 to 8 categories

Fig. 1. Coding in GIA [48]

In the present research work, the collected data has been managed and analysed using NVivo which is popular qualitative data analysis tool. The results have been derived qualitatively which are considered more reliable as compared to quantitative results because the data were collected through face-to-face interviews from experienced professionals working on real projects that is hardly possible in quantitative approaches.

NVivo provides help to reduce manual tasks and ease to manage and organize the qualitative data. Coding is performed in "Nodes" container. One node contains the information of a particular question or concept. The collected data of present research work has been grouped in the same way such that each single answer of each questions is stored under one node. By storing the information of a question in one node provides help to easily understand and easily compare the data in order to summarize and derive the results. However, NVivo only provides the platform to manage and easy handling of the qualitative data but the interpretation of data totally depends on the researcher's skills that how the researcher interprets it [44]. NVivo is just a computer software that provides ease to manage the data [47]. The complete working of NVivo software is available at different sources in the form of tutorials and videos [52, 56, 58, 60-61, 67, 74-76, 81, 87]. The interviews questions have been divided into two main sections described as follows.

3.2.1 Demographic data

This section has number of questions to get the information of the respondents and company profile. Respondents' background contains the information related to the current position and level of experience. The company profile contains the questions related to the company location, number of staff, types of projects and number of years involved in GSD practices.

3.2.2 Software process trends and GSD factors

This section includes the open-ended (structured) interviews questions. It comprises of the information about the trends of development processes in MSCs before and after GSD. The analysis of data for this section has been elaborated with the help of screenshots of the interview answers captured from NVivo. Detailed reasons are also presented to explain that why particular development process is followed in MSCs. Moreover, in particular, this section presents the list of GSD factors causing evolution in the software development processes in MSCs.

4. Results and Discussion

Total 36 interviews have been conducted from the software development companies operating in Malaysia. The analysis of interviews has been presented in the following section w.r.t two main sections of interview questions.

4.1 Demographic Data

In this section, answers of questions assess the qualification of the respondents, their experience level and the organization's profile. Also, it provides information to the researchers about the locations of the software companies in Malaysia.

4.1.1 Designation and experience of respondents

The level of experience w.r.t the number of years of the interviewees is shown in Fig. 2. The majority of the interviewees were highly experienced professionals as can be seen in Fig. 2. The results indicate that 28% of the participants have experience between 10 to 15 years and 1 to 3 years respectively. 22% of the participants have experience in software development between 5 to 10 years, while 14% of the interview participants have 3 to 5 years of experience. Only 8% participants have more than 15 years of software development experience.
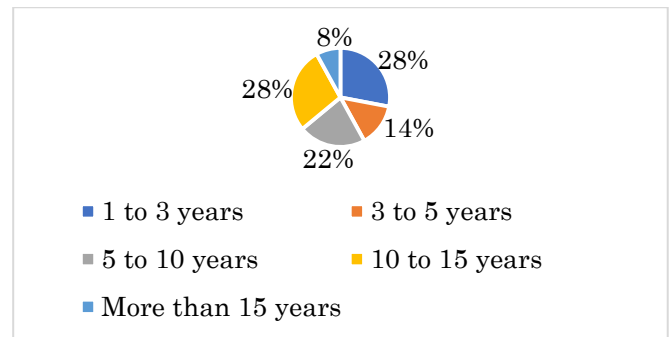

Fig. 2. Software development experience

Fig. 3 shows the respondents' designation in the software development companies. Majority of the respondents are highly experienced as 39% of the interview participants are software engineers while 33% of them are senior software engineers. 14% of the respondents are highly experienced holding the project manager/technical manager position. It is illustrated in Fig. 3.

4.1.2 Location and profile of companies

The respondents of the present research work are mostly from Selangor, Penang and Kuala Lumpur as shown in Fig. 4. These locations are considered as the main hub for business activities and most of the international companies are running their business from these

locations [70], [43]. Results show that 30% of the respondents are from Kuala Lumpur, 28% from Penang, 22% from Selangor and 17% are from Ipoh. Rests of the results are shown in Fig. 4.
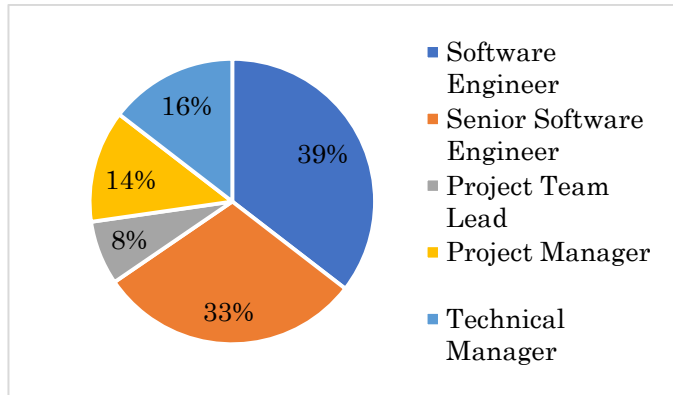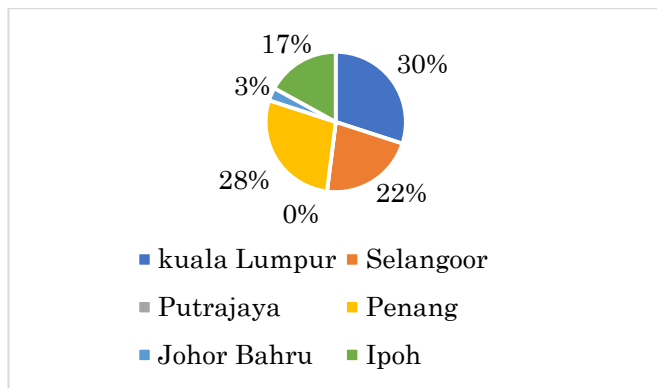

Fig. 3. Designation of respondents

Fig. 4. Company location

Most of the respondents belong to small and medium companies. It is found that most of the software companies in Malaysia are small and medium in size as also mentioned in [39, 41, 64]. Fig. 5 indicates that 36% of the companies have less than 20 employees; and 31% of the companies have between 20 to 50 employees. 14% of the companies' employees are between 50 to 100 and more than 200.
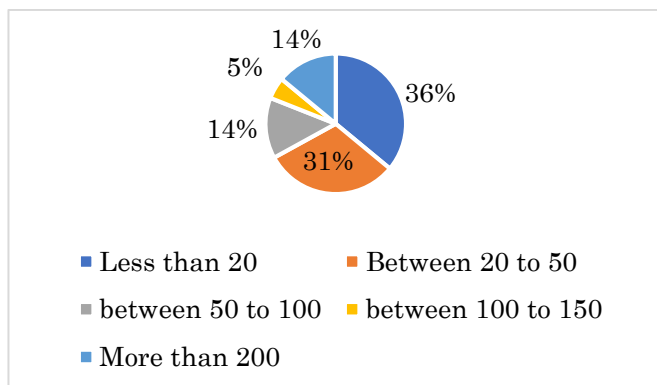

Fig. 5. Number of staff

Table 1 shows the organization level or size of the company with respect to the number of staffs in a company [54, 65, 80].

Table 1

Level/Size of company

Number of Staff	Organization Level
Between 0 < 5	Micro
Between 5 to 30	Small
Between 30 to 75	Medium

The results of the present research work also help to understand the level of maturity level of MSCs in context of GSD. The analysis of the results show that MSCs involved in GSD practices are quite mature and practicing GSD since long but still a large number of companies have also newly started GSD. Fig. 6 illustrates that 36% of the participant companies have spent less than 2 years in GSD practices while 22% have spent 3 to 5 years in GSD. 28% of the companies have been found quite experienced in GSD with 5 to 10 years of experience. The detailed results obtained are shown in Fig. 6.
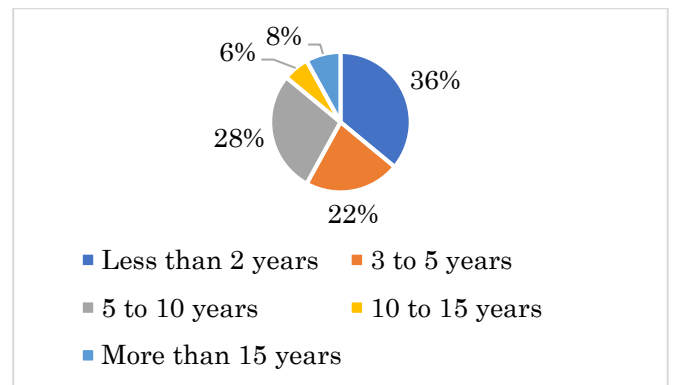

Fig. 6. GSD experience

4.1.3 Trends of development processes and GSD factors

In this section the results are explained according to the stated objectives of this study. This section includes the results of the open-ended (structured) interviews describing the effect of GSD, the use of recent and old trend of development processes followed in MSCs. In-addition, the results also describe the reasons of the change of software development processes in MSCs. Further, GSD factors causing a change in a software process or impacting selection of a process have also been described. Lastly, suggestions and

recommendations have been presented as suggested by the interviewees to address the GSD related issues.

4.1.4 Pre-GSD software development processes

The knowledge about the software development process being followed before GSD help to understand the trend of conventional practices in MSCs. The development processes are categorized into three main categories; (a) traditional methodologies (waterfall, spiral model, incremental and iterative model etc.), (b) lightweight methodologies (agile and SPL etc.) and (c) ad-hoc approaches (that don't follow any process).

All these categories have sub-categories which are labelled with the names of the development processes. So information related to one development process has been stored under one category which is called as coding in NVivo as shown in Fig. 7.
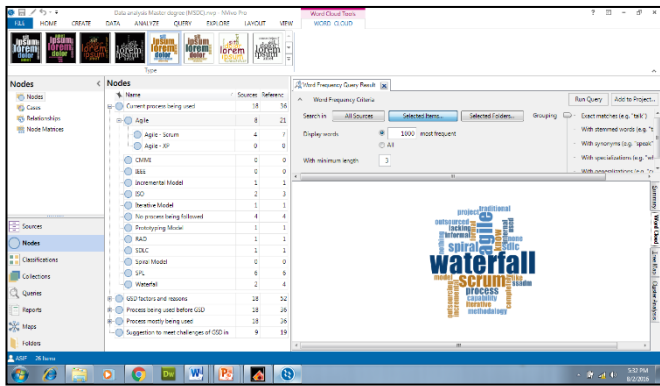

Fig. 7. Query on processes before GSD

For example, a question about the use of development processes, supposedly, answered as agile is mapped under agile category. It helps at the time of comparison and summarization of the data and to draw conclusion. The word clouds chart in Fig. 7 shows the words frequently stated by the respondents that help to understand the phenomena of the use of development processes before GSD in MSCs. Visualization techniques are used to explain and easily understand the concepts, trends, theories and themes.

It is found that traditional methodologies were mostly being used in MSCs before GSD. Total 8 respondents mentioned following the waterfall model, while 3 of the companies are following spiral model in their organization environment. According to [44], mostly waterfall model is used and spiral model is rarely used by the Malaysian software companies. Somehow, the results presented in [44] are similar with the present research work results.
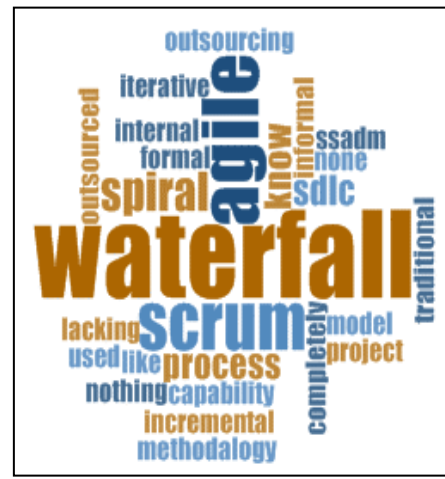

Fig. 8. Software development processes before GSD

1 out of 36 respondents' companies used incremental and iterative model respectively. Subsequently, 2 respondents companies were following the software development life cycle (SDLC). However, none of the respondent companies are using the Rapid Application Development (RAD), Prototyping model, CMM/CMMI and ISO standard in Malaysia before GSD. Since, [44] also stated that none of the company in Malaysia is using the CMM standards.

The lightweight methodologies were also used in MSCs before GSD. 10 of the respondent companies were using agile methods while 5 out of these 10 companies were using the Scrum. The similar figure has also been reported in a survey in [39] that the software companies in Malaysia have mostly adopted agile methods. Although, the survey is not particularly conducted on the companies involved in GSD rather on small and medium size software companies. However, [39] survey is also support the results of present research work.

Ad-hoc approaches were predominantly being used in MSCs before GSD. It means that the software companies are developing the software without using any development process or standard. 11 out of 36 participant software companies were using ad-hoc approaches. Baharom et al. [44] support these results as at that time a high percentage of companies are following the ad-hoc approaches in Malaysia. Baharom et al. [44] stated the reasons also to use these ad-hoc approaches in Malaysian companies are time cons, over process, unnecessary, small level projects, lack of knowledge and lack of resources. Almomani et al. [39] also support the results of current research work as mostly companies are not using any development process due to time consumed, lack of staff and lack of

support as well as companies considered that the development processes are not necessary for software development.

4.1.5 Post-GSD software development processes

The software development processes have been evolving rapidly in Malaysian organizations as a result of GSD as discussed earlier in literature review. The analysis of the results help to understand the trends of current software development in MSCs as a result of GSD, and how MSCs address the issues related to GSD. The word cloud chart as shown in Fig. 9, created based on the words frequently stated by the respondents, help to understand the phenomena of the adoption of processes for developing software after GSD in MSCs. The reasons for the adoption of software processes after GSD are shown in Fig. 10. The categories, sub-categories and steps related to draw the word cloud charts have been explained in section 4.3.1.

Fig. 9. Processes after GSD

Fig. 10. Reasons for processes after GSD

Further, Figs. 11, 12 and 13 show the steps to draw word cloud charts for Figs. 9 and 10 respectively. The analysis of results shows that a huge turnover has been observed in the software practices trends. Most of the MSCs have adopted the lightweight methodologies and deprecated the traditional methodologies. Most of the interviewees, 21 out of 36, stated that they are following agile method as an effect of GSD and to deal with the GSD challenges. One of the project team leads stated "better visibility and faster development" are the two main reasons behind using the agile methods. Further, a project manager added that agile methods are used so that 'Managers can see the progress of projects and developers do the tasks with the given priority'.
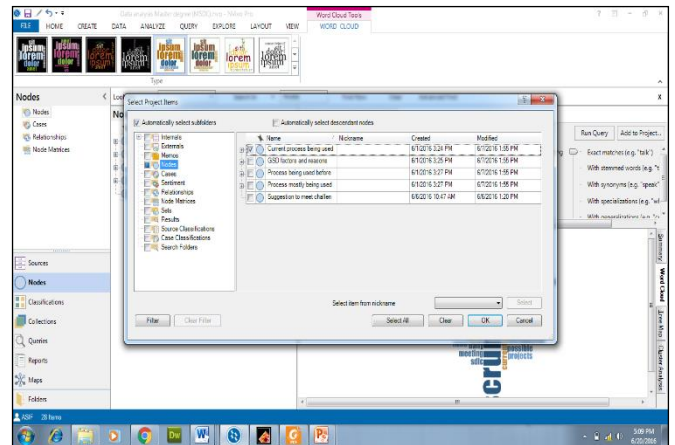

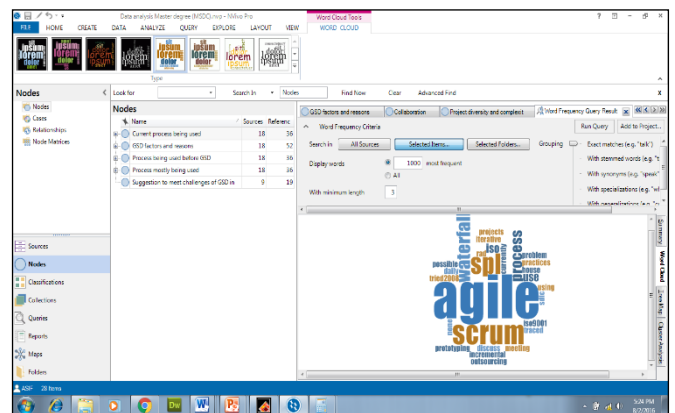**Fig. 11.** Post-GSD software processes query

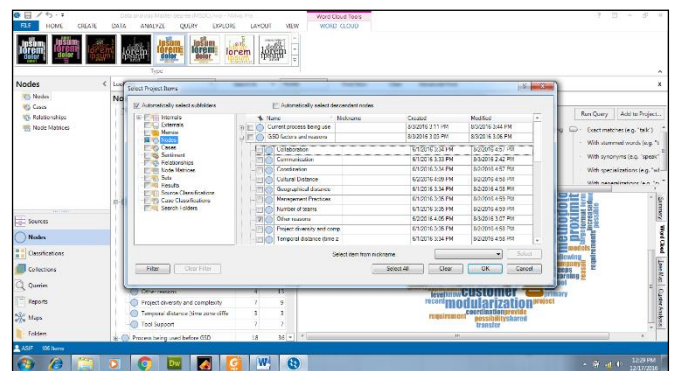**Fig. 12.** Post-GSD software processes

Fig. 13. Query for reasons to use the software processes after GSD

The majority of the respondents agreed that the MSCs have migrated from conventional approaches to the lightweight methodologies because of the faster development and better management and visibility of the project. Since, the main aim of agile methods is to provide the disciplined and best practices for the development of software [3, 23].

However, 7 out of 21 participants particularly mentioned that 'Scrum method' is mostly being used in the company as a result of GSD. A number of authors have also reported that software companies are mostly following the Scrum method because it provides frequent communication and delivery of each development phase (short iteration) [3, 20-21, 28]. One of the participants stated that "we use Scrum because we have Daily Meeting to discuss what we currently doing and possible problem we traced (Software Engineer)". According to a senior software engineer, 'we've been using SCRUM in-house, and then we tried to use it in some outsourcing projects and it really works in terms of managing project resources and tracking project status'. The researchers have been asked a follow up question that why agile methods are particularly being used. The detailed answers from the participants are presented as follows.

1. 'Companies use agile because of small team and for better visibility and faster development.' (Project Team Lead)

2. 'Easier to manage' (Project Manager/Technical Manager)

3. 'Agile provide a faster and better development methodology for the team. However not all projects can be in Agile, some still done through waterfall' (Project Manager/Technical Manager)

4. 'We use SCRUM, because it was the first alternative to an informal process, and because we know SCRUM is better than other models' (Senior Software Engineer)

5. 6. "As far as agile is concern, it helps this company. There are many potential benefits and issues that can arise from GSD. The most frequently cited issue is communication problem, so agile help to sort out the communication problem.' (Software Engineer)

'Cost savings, reduced time to market, proximity to market and customer, improved resources allocation' (Software Engineer)

The analysis of these data shows that agile methods are mostly used in MSCs because of better visibility of the project, better communication, faster development and better management as well as easy to manage resources. In-addition, the MSCs have adopted agile methods to overcome the communication, cost and quality related issues. In a survey on software trends conducted on other countries, (Versionone) describes that 80% of the software companies have implemented agile processes, Similar trends have been observed in the Malaysian companies. Moreover, a majority of the software companies believe that agile methods help to control and reduce the chances of project failure [83].

As an effect of GSD and process paradigm shift as a result, the waterfall model is not commonly used in MSCs as it was frequently used before GSD. The GSD practices have drastically dropped the graph of using traditional methodologies as only 4 participant companies are using waterfall model after GSD. According to a project manager respondent, the reasons for rejecting the waterfall model are "primary due to the user requirements that keep changing". In-addition, only 1 respondent from each company stated that their companies are still following the incremental and prototyping models, software development lifecycle (SDLC) and rapid application development (RAD). An experienced System Analyst described the reason of using RAD as "the changes of format on application are too frequent. Rapid prototyping are required to meet such requirement". Since, some MSCs are still following the traditional approaches like RAD, incremental and prototyping models because of frequent changes that companies consider these methods provides the best solutions to deal with them. Further, 3 out of 36 respondent companies were following ISO standards due to GSD as opposed to pre-GSD period whereby Malaysian company were not following the ISO standards.

Like traditional methodologies, the trend of using ad-hoc approaches have also been declined due to GSD as only 4 such participant companies are found involved in this practice. One of the senior software engineers explained the reason for using ad-hoc approaches that "we don't use any process because we are small and medium size Software Company. Also, projects are not enterprise level they are medium level. That's way we don't use any process." Further, one of the project managers/technical managers also stated that "because project are small and medium level that is the reason to not following any process". Such a small number of

Malaysian software companies are using ad-hoc approaches because of their small and medium sizes. Another reason the interviewers stated that 'the software development projects are also small and medium level, therefore, using a proper development process is wastage of time'.

4.2 GSD Factors

This section presents the GSD factors which are important to be considered during the selection of a software development process. The list of possible GSD factors was given to the respondents during the interview so that they could easily select the GSD factors. However, if respondents want to mention other GSD factors apart from the list provided, an option was also given in the questionnaire. In addition, the personal experiences of the researchers were also recorded as it could be helpful in the selection of software development process. Fig. 14 shows the GSD factors mainly responsible for change in software process and their selection. Alternatively, these factors have been termed as challenges of GSD. Fig. 15 and 16 show the process to draw the word clouds chart for Fig. 14.
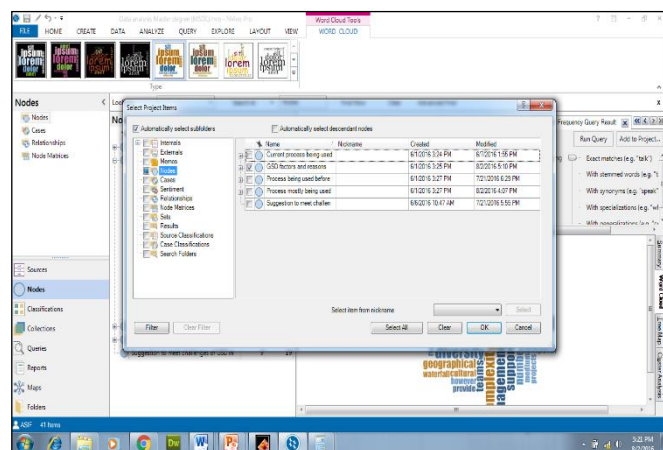

Fig. 14. GSD factors

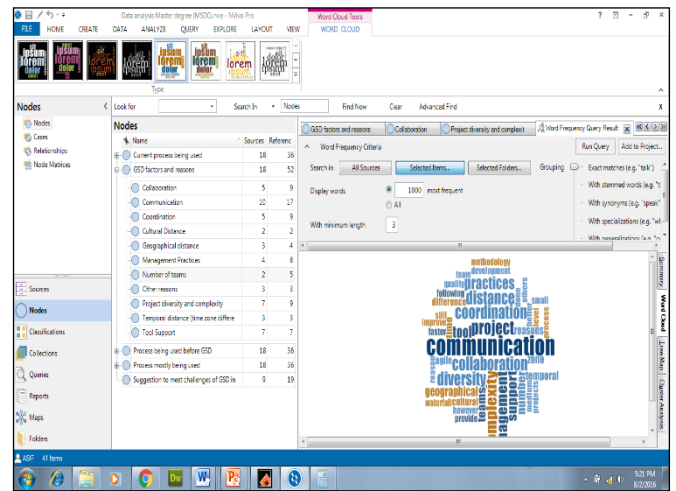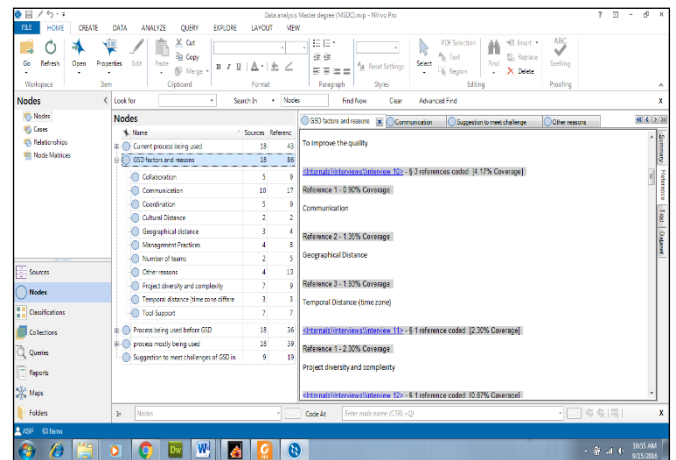**Fig. 15.** Query for GSD factors

Fig. 16. GSD factors

Fig. 17. Participant responses for GSD factors

From the analysis of results, the communication factor is predominantly mentioned by the respondents as the reason behind the change of software development process. 17 out of 36 participants stated that communication is the key factor in the selection and behind the change of the development process. The lack of communication is one of the main challenges faced in GSD based environments [2, 3, 6-7, 10, 18, 20, 23, 32]. The studies were conducted in different countries and describe that MSCs in those countries are also facing the communication issue as the main problem due to GSD.

Furthermore, the results show that in addition to the communication, the coordination and collaboration, diversity, complexity and management of a project are also the main GSD factors in MSCs. One third of the respondents stated that these factors are the main GSD factors after communication affecting the change or selection of the development process. The problems related to coordination and collaboration have also been described in several studies as the main challenges faced in GSD [6-7, 20-21, 23, 32, 36, 57]. In fact,

communication is not only the main issue but coordination and collaboration are also the big challenges that must be addressed properly in the organizations environment. The remaining factors or challenges related to GSD are cultural differences, temporal distance and geographical distance. Number of teams are however, not the main issues in MSCs as stated by the respondents.

Like other countries, Malaysian software companies also have the main problem with communication, collaboration, coordination, diversity and complexity of a project. These GSD factors have been found as the main reasons for selection and change of a software development process in MSCs. Moreover, the researchers and authors also agree that companies can complete the projects successfully with close communication, and good collaboration and coordination among teams and project stakeholders [2, 21, 28].

4.3 Recommendations to Address the GSD Problems

The respondents of the interviews recommended to meet the challenges of GSD to develop a good quality software and delivering project on time as follows.

1. 'More flexible and robust process, do not tied to traditional ways of software development' (Project Manager/Technical Manager)

2. 'It suffers from key challenges on both the client and the vendor sides. The issues of communication, coordination and establishment of trust are the prime concerns on both parties.' (Senior software Engineer)

3. 'Keep it simple and lean' (Software Engineer)

4. '(1) Provide training for workers, (2) Keep updated and (3) Provide benefits to motivate workers to take up the challenges' (Software Engineer)

5. 'Better Communication and Better Coordination' (Software Engineer)

6. 'Better Communication' (Software Engineer)

7. "Reviews the problems and find the solution among some experience user' (Software Engineer)

8. 'Improve programming skill and learn more multi languages.' (Software Engineer)

9. 'Coming up with creative and useful software. This can help to attract more foreigner companies for Malaysia.' (Software Engineer)

The suggestions of the IT professionals indicate that MSCs can address the problems raised by GSD by improving communication, coordination and development processes. Using a simple software development process may increase the productivity rather than being over processed which causes the project delay and increases the complexity. Moreover, discussing problems with some experts help to resolve the problems associated to GSD. Initiatives such as training of employees on the latest tools and technologies is very effective in meeting the international standards and produces good quality software. Fig. 18 shows the responses to address the GSD related issues.
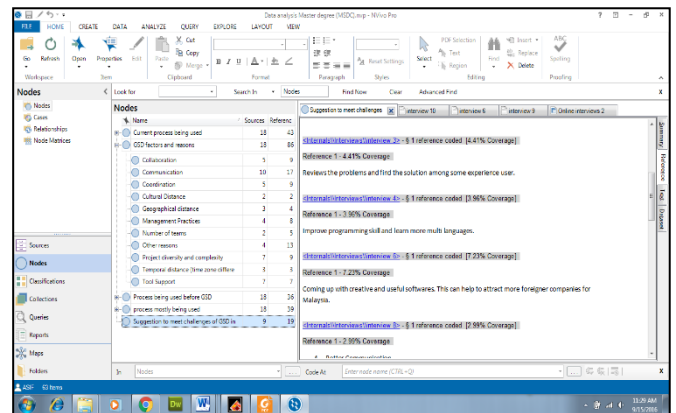

Fig. 18. Suggestions of the respondents

5. Conclusion

Table 2 presents the overall summary of the results derived from the data interpretation and data analysis. The summarized results of the present research work successfully help to achieve the objectives.

The results show that Malaysian software companies are greatly affected by the GSD. Traditional and ad-hoc approaches mostly followed in MSCs before GSD have been replaced with the agile methodologies. MSCs consider lightweight agile approaches as more suitable for their software development projects but still companies need a better development process to address the challenges of GSD in MSCs. The main challenges being faced by the companies, also responsible for change or selection of the development process, are lack proper communication, collaboration and coordination processes, weak management of projects as well as their diversity and complexity. It is also found that the other key patterns behind the selection or change of a process are better communication and visibility, faster development, easy to manage resources and projects tasks. However, results also show that some MSCs are still using ad-hoc approaches. The reason behind is the

size of the company which is mostly small and medium as well as the projects are also not big. Therefore, companies consider that the use of software development processes is not necessary. Being over processed also require to have much more resources to implement these software practices. The findings of the present research work contribute in understanding the software development process paradigm shift in Malaysian companies as repercussions of GSD. The selection of suitable process is challenging for small and medium size companies. The factors/challenges related to GSD, and current software development processes as determined in the present study would be used to develop a process selection framework in an extension of this of research work. The framework would help the MSCs in the selection of processes according to their requirements in order to produce the good quality software overcoming their process related issues.

Table 2

Overall analysis summary

Questions	Findings
Effects of GSD	Waterfall model and ad-hoc approaches were mostly being followed before GSD and as a result of GSD lightweight methodologies such as agile methods are mostly being followed.
Main GSD Factors	Communication Collaboration Coordination Project management Project diversity and complexity
Main reasons (pattern)	Better communication Better visibility Faster development Easy to manage Lack of resources Small & medium size projects Small & medium size companies

6. References

[1] H. Computer, (2016). "What is software?", Available: http://www.computerhope.com/jargon/s/software.htm [Accessed 27 Oct 2016].

[2] M. Niazi, S. Mahmood, M. Alshayeb, M.R. Riaz, K. Faisal, N. Cerpa, S. U. Khan, I. Richardson, "Challenges of Project Management in Global Software Development: A Client-vendor Analysis", Information and Software Technology, vol. 80, pp. 1-19, 2016.

[3] R. Sriram, S.K.Mathew, "Global Software Development using Agile Methodologies: A Review of Literature", IEEE Conference on Management of Innovation and Technology, Sunar Bali, Indonesia. 2012.

[4] M.T. Lane, P.J. Agerfalk, "On the Suitability of Particular Software Development Roles to Global Software Development", IEEE International Conference on Global Software Engineering, Banglore, India, 2008, pp. 3-12.

[5] B. Sengupta, S. Chandra, V. Sinha, "A Research Agenda for Distributed Software Development", 28th International Conference on Software Engineering, , Shanghai, China. 2006, pp. 731-740.

[6] M.A. Alnuem, A. Ahmad, H. Khan, () Requirements Understanding: A challenge in Global Software Development", Industrial Surveys in Kingdom of Saudi Arabia, 2012, pp. 297-306.

[7] J. Cho, "Globalization and Global Software Development", Issues in Information Systems, vol. 8, no. 2, pp. 287-290, 2007.

[8] V. Gomes, S. Marczak, "Problems? We all know we have them. Do we have solutions too? A literature review on problems and their solutions in global software development", IEEE 7th International Conference on Global Software Engineering, Porto Alegre, Brazil, 2012, pp. 154-158.

[9] B. Javed, S.S. Minhas, "Process Support for Requirements Engineering Activities in Global Software Development: A Literature Based Evaluation", International Conference on Computational Intelligence and Software Engineering, Wuhan, China, 2010.

[10] Y.H. Shah, M. Raza, S. Haq, "Communication Issues in GSD, International Journal of Advanced Science and Technology", vol. 40, pp. 69-76, 2012.

[11] E.O. Conchúir, H. Holmström, P.J. Ågerfalk, B. Fitzgerald, "Exploring the Assumed Benefits of Global Software Development", IEEE International Conference on Global Software Development", Brazil, 2006.

[12] T. Nguyen, T. Wolf, D. Damian, "Global Software Development and Delay: Does Distance Still Matter?", IEEE International Conference on Global Software Engineering, India, 2008, pp. 45-54

[13] L. Yu, A. Mishra, "Risk Analysis of Global Software Development and Proposed Solutions", Automatika, vol. 51, no. 1, pp. 89-98, 2010.

[14] J.H. Sharp, D.S. Ryan, "Global Agile Team Configuration, Journal of Strategic Innovation and Sustainability", vol. 7, no. 1, pp. 120-134, 2011.

[15] K. Kuusinen, T. Mikkonen, S. Pakarinen, "Agile User Experience Development in a Large Software Organization: Good Expertise but Limited Impact", International Conference on Human-Centered Software Engineering, LNCS, vol. 7623, pp. 94-111, 2012.

[16] D. Šmite, C. Wohlin, T. Gorschek, R. Feldt, "Empirical Evidence in Global Software Engineering: A Systematic Review", Empirical Software Engineering, vol. 15, no. 1, pp. 91-118, 2010.

[17] N.V. Oza, T. Hall, "Difficulties in Managing Offshore Software Outsourcing Relationships: An Empirical Analysis of 18 High Maturity Indian Software Companies", Journal of Information Technology Case and Application Research, vol. 7, pp. 25-41, 2005.

[18] H. Holmstrom, E.O. Conchúir, P.J. Ågerfalk, B. Fitzgerald, "Global Software Development Challenges: A Case Study on Temporal, Geographical and Socio-Cultural Distance", IEEE International Conference on Global Software Engineering, 2006.

[19] S.U. Khan, M. Niazi, R. Ahmad, "Critical Barriers for Offshore Software Development Outsourcing Vendors: A Systematic Literature Review", Asia-Pacific Software Engineering Conference, APSEC'09, 2009, pp. 79-86.

[20] E. Hossain, M.A. Babar, H. –Y. Paik, "Using Scrum in Global Software Development: A Systematic Literature Review", Fourth IEEE International Conference on Global Software Engineering, Limerick, Ireland, 2009, pp. 175-184.

[21] M. Paasivaara, C. Lassenius, "Could Global Software Development Benefit from Agile Methods?", IEEE International Conference on Global Software Engineering, 2006.

[22] S. Deshpande, I. Richardson, "Management at the Outsourcing Destination - Global Software Development in India", Proceedings Fourth IEEE International Conference on Global Software Engineering, Limerick, Ireland, July, 2009, pp. 217-225.

[23] M.A. Babar, T. Ihme, M. Pikkarainen, "An Industrial Case of Exploiting Product Line Architectures in Agile Software Development", Proceedings of 13th International Software Product Line Conference, 2009, pp. 171-179.

[24] A. Martini, L. Pareto, J. Bosch, "Communication Factors for Speed and Reuse in Large-scale Agile Software Development", Proceedings of the 17th International Software Product Line Conference, Tokyo, Japan, 2013 pp. 42-51.

[25] M. Niazi, N. Ikram, M. Bano, S. Imtiaz, S.U. Khan, "Establishing Trust in Offshore Software Outsourcing Relationships: An Exploratory Study Using a Systematic Literature Review", IET Software, vol. 7, no. 5, pp. 283-293, 2013.

[26] R. Jain, U. Suman, "A Systematic Literature Review on Global Software Development Life Cycle", ACM SIGSOFT Software Engineering Notes, vol. 40, no. 2, pp. 1-14, 2015.

[27] Y.I. Alzoubi, A.Q. Gill, "Agile Global Software Development Communication Challenges: A Systematic Review", Pacific Asia Conference on Information Systems, 2014.

[28] M. Paasivaara, S. Durasiewicz, C. Lassenius, "Distributed Agile Development: Using Scrum in a Large Project", IEEE International Conference on Global Software Engineering, 2008, pp. 87-95.

[29] R. Colomo-Palacios, C. Casado-Lumbreras, P. Soto-Acosta, F.J. García-Peñalvo, E. Tovar, "Project Managers in Global Software Development Teams: A Study of the Effects on Productivity and Performance", Software Quality Journal, vol. 22, no. 1, pp. 3-19, 2014.

[30] A. Lopez, J. Nicolas, A. Toval, "Risks and Safeguards for the Requirements Engineering Process in Global Software Development", Fourth IEEE International Conference on Global Software Engineering, 2019, pp. 394-399.

[31] A.A. Khan, S. Basri, P.D.D. Dominic, "A Propose Framework for Requirement Change Management in Global Software Development. International Conference on Computer & Information Science, 2012, pp. 944-947.

[32] N.K. Kamaruddin, N.H. Arshad, A. Mohamed, (), Chaos Issues on Communication in Agile Global Software Development, IEEE Business, Engineering, and Industrial Applications Colloquium, Kuala Lumpur, Malaysia, 2012.

[33] T. Jaanu, M. Paasivaara, C. Lassenius, "Effects of FourDdistances on Communication Processes in Global Software Projects", ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, Lund, Sweden, 2012.

[34] A.R. Khan, R. Akbar, D.W.H. Ten, "A Study on Global Software Development (GSD) and Software Development Processes in Malaysian Software Companies", Journal of Telecommunication, Electronic and Computer Engineering, vol. 8, no. 2, pp. 147-151, 2016.

[35] S.U. Khan, M. Niazi, R. Ahmad, "Barriers in the Selection of Offshore Software Development Outsourcing Vendors: An Exploratory Study Using a Systematic Literature Review", Information and Software Technology, vol. 53, no. 7, pp. 693-706, 2011.

[36] A. Begel, N. Nagappan, "Global Software Development: Who Does It?", IEEE International Conference on Global Software Engineering, 2008, pp. 195-199.

[37] A. Zafar, S. Ali, R.K. Shahzad, "Investigating Integration Challenges and Solutions in Global Software Development", Frontiers of Information Technology (FIT), 2011, pp. 291-297.

[38] K. Waters, "10 good reasons to do Agile Development", Available: http://www.allaboutagile.com/10-good-reasons-to-do-agile-development, [Accessed on 31-02-2017]].

[39] M.A.T. Almomani, S. Basri, A.K.B. Mahmood, A.O. Bajeh, "Software Development Practices and Problems in Malaysian Small and Medium Software Enterprises: A Pilot Study", 5th International Conference on IT Convergence and Security, 2015, pp. 1-5.

[40] M.A. Ahmad, N.H. Ubaidullah, M. Lakulu, "Current Practices in Monitoring Software Development Process in Malaysia", World of Computer Science and Information Technology Journal, vol. 4, no. 5, pp. 62-67, 2014.

[41] R.Z.R.M. Ali, S. Ibrahim, "An Integrated Development Process Assessment for Malaysia's SME Organizations", Postgraduate Annual Research Seminar (PARS), UTM, Skudai, 2009.

[42] C. Anderson, "Presenting and Evaluating Qualitative Research", American Journal of Pharmaceutical Education, vol. 74, no. 8, pp. 1-7, 2010.

[43] A.L. Asnawi, A.M. Gravell, G.B. Wills, "An Empirical Study: Understanding Factors and Barriers for Implementing Agile Methods in Malaysia", 5th International Doctoral Symposium on Empirical Software Engineering, 2010.

[44] F. Baharom, A. Deraman, A.R. Hamdan, "A Survey on the Current Practices of Software Development Process in Malaysia", Journal of ICT, vol. 4, pp. 57-76, 2005.

[45] A. Bryman, "Quantity and Quality in Social Research", Routledge, Taylor and Francis, London, New York, 2004.

[46] A. Bryman, "Analyzing Qualitative Data," Reprint Ed., Routledge, 1994.

[47] P. Burnard, P. Gill, K. Stewart, E. Treasure, B. Chadwick, "Analysing and Presenting Qualitative Data", British Dental Journal, vol. 204, no. 8, pp. 429-432, 2008.

[48] J.W. Creswell, "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches", 2nd Edition, SAGE Publications, 2003.

[49] N.K. Denzin, Y. S. Lincoln, "Handbook of Qualitative Research", 2nd Edition, Sage Publications, 1994.

[50] N.K. Denzin, Y.S. Lincoln, "The SAGE Handbook of Qualitative Research", 4th Edition, Sage Publications, 2011.

[51] I. Dey, "Qualitative Data Analysis: A User Friendly Guide for Social Scientists", Routledge, Taylor and Francis, 1993.

[52] H. Dixon, "Qualitative Data Analysis Using NVivo", Available: http://www.slideshare.net/HelenDixon1/qualitative-data-analysis-using-n-vivo, [Accessed on 27-06-2016].

[53] V.S. Erlenmaier, "Event Marketing in Integrated Marketing Communication (IMC) (Professional thesis, Cholula, Puebla, Mexico, Universidad de las Américas Puebla)", Available: http://catarina.udlap.mx/u_dl_a/tales/documentos/bce/erlenmaier_vs/, [Accessed on 15-12-2015].

[54] European Commission, "What is an SME? - Small and Medium Sized Eenterprises (SME) - Enterprise and Industry", Available: https://web.archive.org/web/20150208090338/http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm, [Accessed on 11-02-2016].

[55] U. Flick, "An Introduction to Qualitative Research", 4th Edition, SAGE Publications, 2014.

[56] Flinders University (Ict), "NVivo 10 Introduction", Available: https://www.flinders.edu.au/staff-development-files/computer/NVivo%2010%20Introduction.pdf, [Accessed on 11-02-2016].

[57] Z. Galviņa, D. Šmite, "Software Development Processes in Globally Distributed Environment", Scientific Papers, vol. 770, pp. 7-14, 2011.

[58] G.R. Gibbs, "Qualitative Data Analysis: Explorations with NVivo", Open University Press, 1st Edition, Buckingham, 2002.

[59] P. Gill, K. Stewart, E. Treasure, B. Chadwick, "Methods of Data Collection in Qualitative Research: Interviews and Focus Groups", British Dental Journal, vol. 204,no. 6, pp. 291-295, 2008.

[60] S. Hai-Jew, "Some Types of Data Visualizations in NVivo", Available: http://scalar.usc.edu/works/using-nvivo-an-unofficial-and-unauthorized-primer/types-of-data-visualizations-in-nvivo, [Accessed on 25-06-2016].

[61] A.H. Hilal, S.S. Alabri, "Using NVivo for Data Analysis in Qualitative Research", International Interdisciplinary Journal of Education, vol. 2, no. 2, pp. 181-186, 2013.

[62] I. Jebreen, "Using Inductive Approach as Research Strategy in Requirements Engineering", International Journal of Computer and Information Technology, vol. 1, no. 2, pp. 162-173, 2012.

[63] J.H. Kamaroddin, W.A.W. Ghani, K. Nasir, R. A. Razak, "The Adoption of Software Development Methodologies Among IT Organization in Malaysia", researchgate, 2012.

[64] Y, Khaleel, R. Sulaiman, "A System Development Methodology for ERP System in SMEs of Malaysian Manufacturing Sectors", Journal of Theoretical and Applied Information Technology, vol. 47, no. 2, pp. 504-513, 2013.

[65] M.W. J. Khan, M. Khalique, "An Overview of Small and Medium Enterprises in Malaysia and Pakistan: Past, Present and Future Scenario", Business and Management Horizons, vol. 2, no. 2, pp. 38-49,2014.

[66] Kperak Inc Corporation, "K-Society Vision and Mission", Available: http://www.kperak.com.my/?page=Society, [Accessed on 06-08-2015].

[67] Lane Medical Library, "Qualitative Data Analysis with NVIVO", Available: https://www.youtube.com/watch?v=0YyVySrV2cM, [Accessed on 25-07-2016].

[68] J. Li, "Process Improvement and Risk Management in Off-the Shelf Componenet-Based Development, (PhD Thesis, Trondheim, Norway", Norwegian University of Science and Technology). Available: http://www.idi.ntnu.no/grupper/su/publ/phd/li-phdthesis-22jun06.pdf, [Accessed on 21-09-2016].

[69] Z. Mansor, Z.M. Kasirun, S. Yahya, N.H. Hj Arshad, "A Survey on Cost Estimation Process in Malaysia Software Industry", International Journal on New Computer Architectures and their Applications, vol. 2, no. 2, pp. 381-388, 2012.

[70] S.F.P. Mohamed, F. Baharom, A. Deraman, "An Exploratory Study on Current Software Development Practices in Malaysia Focusing on Agile based Software Development", Science International-Lahore, vol. 25, no. 4, pp. 1095-1101, 2013.

[71] Msc Malaysia, "MSC Malaysia Annual Industry Report", Available: http://www.mscmalaysia.my/sites/default/files/pdf/downloads/2015-MSC-Malaysia-Annual-Industry-Report-final.pdf, [Accessed on 17-05-2015].

[72] Multimedia Development Corporation, Available: http://www.mdec.my, [Accessed on 17-05-2015].

[73] M.Q. Patton, "Qualitative Research & Evaluation Methods", 4th Edition, SAGE Publications, Saint Paul, MN, 2002.

[74] Q.S.R International, "Learning How to Explore and Visualize Your Data with NVivo | NVivo Brown Bag Webinar", Available: https://www.youtube.com/watch?v=Ez7PB6ZIA5I, [Accessed on 21-09-2016].

[75] Q.S.R. International, "NVivo 11 - Getting Started Guide", Available: http://download.qsrinternational.com/Document/NVivo11/11.3.0/en-US/NVivo11-Getting-Started-Guide-Starter-edition.pdf, [Accessed on 21-09-2016].

[76] D. Rowe, "NVivo 10 Coding", Available: https://www.youtube.com/watch?v=4crQbeHKhtk, [Accessed on 21-09-2016].

[77] R.W.J. Foundation, "Qualitative Research Guidelines Project - Unstructured Interviews", Available: http://www.qualres.org/HomeUnst-3630.html, [Accessed on 02-04-2016.

[78] D. Silverman, "Interpreting Qualitative Data: Methods for Analyzing Talk, Text and Interaction", 3rd Edition, SAGE Publications, 2006.

[79] D. Silverman, "Doing Qualitative Research", 4th Edition, SAGE Publications, 2013.

[80] SME Corporation Malaysia, "SME Definitions", Available: http://www.smecorp.gov.my/index.php/en/policies/2015-12-21-09-09-49/sme-definition, [Accessed on 02-04-2016].

[81] Stanford University, "Using NVivo for Qualitative Data Analysis", Available: http://web.stanford.edu/group/ssds/cgi-bin/drupal/files/Guides/UsingNVivo9_0.pdf, [Accessed on 02-04-2016].

[82] A. Strauss, J.M. Corbin, "Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory", 2nd Edition, SAGE Publications, 1998.

[83] S. Sultana, Y.M. Motla, S. Asghar, M. Jamal, R. Azad, "A Hybrid Model by Integrating Agile Practices for Pakistani Software Industry, 2014 International Conference on Electronics", Communications and Computers, Cholula, Mexico, IEEE, February 2014, pp.256-262.

[84] S.J. Taylor, R. Bogdan, "Introduction to Qualitative Research Methods", 3rd Edition, Wiley, 1998.

[85] S.J. Taylor, R. Bogdan, M. Devault, "Introduction to Qualitative Research Methods: A Guidebook and Resource", Wiley, 2015.

[86] D.R. Thomas, "A General Inductive Approach for Analyzing Qualitative Evaluation Data", American Journal of Evaluation, vol. 27, no. 2, pp. 237-246, 2006.

[87] E. Toolis, "Analyzing Qualitative Data Using NVivo: An Introduction", Available: http://csass.ucsc.edu/images/NVivo.pdf, [Accessed on 11-07-2016].

[88] Versionone, "State of AgileAccessed on 11-07-2016/pdf/2011_State_of_Agile_Development_Survey_Results.pdf, [Accessed on 11-07-2016].

[89] M. Woods, "Interviewing for Research and Analysing Qualitative Data: An Overview", Available: http://owll.massey.ac.nz/pdf/interviewing-for-research-and-analysing-qualitative-data.pdf, [Accessed on 11-07-2016].