



Effectiveness of Scrum Methodology in the management of software development projects

فعالية منهجية سكروم في إدارة مشاريع تطوير البرمجيات

by

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ABSTRACT

Framework: Management of the software development project changes daily and increases day to day. Major benefits that attract firms to develop software some are a reduction on cost, delivery time reduction, the quality improvement well definition of the process, resource allocation and improvement in documentation. However, several problems have been documented in different methods of software development projects. But these problems can be solved by the use of agile practices. SCRUM is an agile methodology used to manage and control work during the development stages. The present documentation presents the comprehensive outward look of the effectiveness of scrum in the management of software development projects. This research aimed at exploring the extent to which this method is more effective than other methods. The focus of this paper is on the effectiveness of the stated method in accordance with real-life examples.

Aims and Objectives: In the scope of the dissertation investigation has been done on the effectiveness of the scrum methodology in the management of a software development project. Investigation of other project management challenges faced, different scrum practices used by organizations in software development. Moreover, benefits achieved and challenges faced during the implementation of the method in the organizations in order to address the management challenges of software development projects.

Methods: literature review was carried out to understand different managerial problems in software development projects and how scrum methodology is being used to overwhelm the issues. The research was conducted using semi-structured interviews with ten managers from ten

different software organizations and an online survey with sixty (60) participants. Collected data from the literature was analyzed using qualitative data analysis technique. MS Excel and IBM statistical tool SPSS was used in the input of data and its analysis. Quantitative data collected from 200 participants have been analyzed using statistical tools, the inclusion of the SPSS software

Results: By a result of the study, the effectiveness of SCRUM practices was identified. Seemingly, the challenges of the SCRUM inclusion was highlighted. The used quantitative analysis offered accurate and ideal results that were meaningful in drawing conclusions concerning the SCRUM application.

ملخص

الإطار: إدارة مشروع تطوير البرمجيات يتغير يوميا ويزيد يوما بعد يوم. الفوائد الرئيسية التي تجذب الشركات لتطوير البرمجيات بعضها هي تخفيض التكلفة، تقليل وقت التسليم، التعريف الجيد لتحسين الجودة للعملية، تخصيص الموارد وتحسين الوثائق. ومع ذلك، تم توثيق العديد من المشاكل في أساليب مختلفة لمشاريع تطوير البرمجيات. ولكن هذه المشاكل يمكن حلها عن طريق استخدام الممارسات رشيدة. سكروم هو منهجية رشيدة تستخدم لإدارة ومراقبة العمل خلال مراحل التطوير. تعرض هذه الوثائق المظهر الخارجي الشامل لفعالية سكروم في إدارة مشاريع تطوير البرمجيات. يهدف هذا البحث إلى استكشاف مدى فعالية هذه الطريقة أكثر من الطرق الأخرى. تركز هذه الورقة على فعالية الطريقة المذكورة وفقا لأمثلة من واقع الحياة.

الأهداف والغايات: في نطاق البحث أطروحة قد تم القيام به على فعالية منهجية سكروم في إدارة مشروع تطوير البرمجيات. التحقيق في تحديات إدارة المشاريع الأخرى التي تواجهها، وممارسات سكروم مختلفة تستخدمها المنظمات في تطوير البرمجيات. وعلاوة على ذلك، فإن الفوائد التي تحققت والتحديات التي واجهتها أثناء تنفيذ الأسلوب في المنظمات من أجل التصدي لتحديات إدارة مشاريع تطوير البرمجيات.

الأساليب: تم إجراء مراجعة الأدبيات لفهم المشاكل الإدارية المختلفة في مشاريع تطوير البرمجيات وكيف يتم استخدام منهجية سكروم للتغلب على القضايا. أجري البحث باستخدام مقابلات شبه منظمة مع عشرة مدراء من عشر منظمات برمجيات مختلفة ومسح على الإنترنت مع 60 (60) مشارك. تم تحليل البيانات التي تم جمعها من الأدب باستخدام تقنية تحليل البيانات النوعية. تم استخدام الأداة الإحصائية MS Excel و IBM SPSS في إدخال البيانات وتحليلها. وقد تم تحليل البيانات الكمية التي تم جمعها من 200 مشارك باستخدام الأدوات الإحصائية، وإدراج ومساعدة برنامج SPSS

نتائج سكروم: نتيجة لهذه الدراسة، تم تحديد فعالية ممارسات سكروم. على ما يبدو، تم تسليط الضوء على التحديات من إدراج قدم التحليل الكمي المستخدم نتائج دقيقة ومثالية كانت ذات مغزى في استخلاص استنتاجات بشأن تطبيق سكروم.

Dedication

I dedicate this research paper to my wife and children for their unfailing support, understanding, and patience in the entire process. Moreover, to my lecturer Prof. Halim Boussabaine for supportive correction and advice in different areas. Additionally, to for his criticism to ensure am on the track of every aspect. Not forgetting my classmate and friends who devoted themselves to resource seeking and keep me up to speed.

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CHAPTER 1 INTRODUCTION

1.1.Introduction

Agile software development methods have recently reaped attention from experts within the Software Engineering Industry due to its capability to meet customer satisfaction, flexibility, as well as cost efficiency rates. These have enabled software development practices like Scrum, which permit teams to focus on products delivery as well as improving communication in software development. However, with an unpredictable variety of products development stages, it becomes necessary to adopt as well as introduce appropriate management in projects of Software Development framework to restructure the needs of practitioners and increase its competitive significances.

Scrum is an iterative, incremental framework for projects, application development, and products appealed to be appropriate for all project's sizes. SCRUM fixes high management standards to track real-time complications upon the development of a project. In most cases, SCRUM is mainly adopted with organizations that are not successful through using management techniques or traditional technique of development.

Alternatively, Scrum in software development can be achieved by overwhelming the limitations of traditional project management, for instance: tailoring of the project to meet all the customer needs. Nevertheless, project management is the most effective tool in designing quality software together with aggregating the effectiveness of the product design. Thus, SCRUM stands as a tool of a high design standard that meets customer requirement and projects within the Software Development.

This dissertation mainly focusses on an empirical study conducted through questionnaire and interview covering various aspects of both traditional project management and Effectiveness of

Scrum Methodology in the management of software development projects. Specifically, SCRUM because of its wide usage in most industries and its incremental framework for developing and managing software projects. Generally, it recommends a project management framework that emphasizes methodology, management requirements, customers, team, testing as well as documentation. In that, the framework initiative focuses on project managers more so with the traditional mentality to understand their duties and responsibilities in Scrum Software development surrounding. With these methodologies, the managers of software development team will be able to measure the documentation level, requirement management as well as testing to enhance the appropriate application of methodology and Customer's team collaboration.

1.2.Aims and Objectives

Major purpose of this research was to explore the effectiveness of SCRUM in the management of software development. The study explored the influence of various organizational factors from different categorizations. Besides, other objectives of this research were:

- ❖ To identify various management challenges in the management of software development projects.
- ❖ To examine the SCRUM practices in software development projects.
- ❖ To study the importance and encounters confronted by software development firms while executing SCRUM practices to discourse administration challenges in software development projects.

Therefore, to achieve the aims, the study conducted a collection of information from several project supervisors, team leaders and project members of various software development projects

assessing how effective scrum method was in management by identification of different firm factors influencing the success of management in projects. Moreover, the research informs project managers on various organizational factors that increases and alters chances of success. Although the foremost goal of this study was to show the effectiveness of SCRUM in the managing of software development project, but also the success of the method is centered too. Therefore, this study is of importance in the improvement of managerial effectiveness.

1.3 Research Questions

In this paper, much emphasis was given to effectiveness of the SCRUM methodology both analyzing challenges and importance of it in different organizations. Most important research questions were analyzed in chapter 5 of this paper in details. Although, questionnaire contained many questions, three major ones include;

- ✓ RQ 1: What are the project management challenges in software development?
- ✓ RQ 2: Which scrum practices are mostly used in software management in different organizations?
- ✓ RQ 3: What are the main challenges and benefits of implementing scrum practices in software development?

1.4 Problem Statement

Software management in developing a project has always recorded a high rate of failure. According to Gartner Group's survey in 2000, failures in the management project is about 40%. Captivatingly, organizational management factors lead to the failures of the project management method. Conspicuously, the ineffective managerial of projects and resources allocated to the project have always played a fundamental role in catastrophes (Anon., 2001, p.24). Emma and

Koru (2008) state that many types of research indicate the high failure rate in the method of managing projects they have incredibility issues; outcomes are extremely unswerving. Based on information from 2005 and 2007, a report indicates that 15.52% and 11.54% of software development projects were canceled in the respective years. The failure rate of projects in accordance with budget and timing targets was very high. For example, the rate of project failure that was recorded in 2007 was 37% (Emma& Koru, 2008, p.84). additionally, Glass (2005) contradicts on a report of project management failure stating that its subjective, although, he agrees that the rate of such project failure are increasing instantly (p. 110).

1.5 Research process

In accordance with Sounder's research onion, a study can be obtained by relating entire research methodology. Firstly, existing investigation adopted interpretive research philosophy as stated in research onion. As such, dominant aim was to validate the data from the gathered samples and analyzed in regards to the influence of different methods in the management of software development projects. Reasonable exploration approach affiliated directly with interpretive, hence positive accomplishment of this exploratory study. On the strategy of this research, a longitudinal survey involving team leaders, project managers, and team workers across various firms operating in different industries, cosseted in research through suitability sampling, however, this technique of sampling is a non-probability in the crux. Review survey that was semi-structured in nature was used in the collection of prime information in the quantifiable form, although subordinate research involved gathering, scrutiny, and debate of secondary data got through websites, academic resources, periodicals and journals. Therefore, it is with an agreement to suggest that this current research meets the standards of Saunder's Research Onion, hence clear structure and methodology demonstration.

1.6 Methodology Outline

In this sector, research methodology has been highlighted throughout this study. The study examines the correlation of various challenges with the effectiveness of the scrum method through conduction of data gathering using review and surveys to project participants in different officialdoms where projects have been employed. Moreover, the quantifiable method was used in this research so as to examine the individual intuitions of project members towards administrative issues and project success. Hypotheses are based on the research in the review of literature. Furthermore, details have been stipulated in the third chapter. The figure below shows outline of the research procedure.

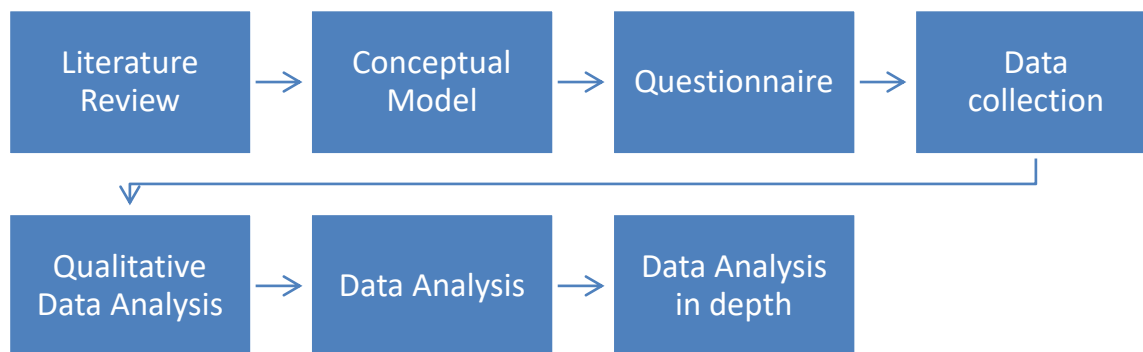


Figure 1: Research Design steps

1.7 Chapters Outline

The study has been separated into seven sections, summarizing a synopsis that has been laid beneath:

Chapter 2: Literature Review: Major concern in the section is an outline of the secondary data collected and gathered. More importantly, the section exhausts relevant empirical evidence with

regard to the factors that affect software development management. Sources of information included journals, organizational websites, periodicals, and publications.

Chapter 3: Research Methodology: In the sector, methodology utilization of the investigation study outlook is described. Besides, the identification of general research procedure and strategy as well as an account of the rationale for an assortment of given methods are also extensively discussed. Moreover, description of methods, inclusion exclusion criterion, assembling technique and instrument employed for data collection. Lastly, elaboration of data analysis methodologies is also presented in adequate detail.

Chapter 4: Scrum Analysis: In the sector, scrum has been analyzed looking into its effectiveness and issues that arise with it in the implementation procedure within organizations. Depth analysis in scrum methodology and its testing were conducted to determine the efficiency of the method, i.e. effectiveness of scrum method in software development project management.

Chapter 5: Discussion: A summarized and effective discussion of the findings obtained through data collection and analysis is presented in this chapter. As such, the section identifies the major organizational methodologies in software management in project development into its succession. Moreover, the section highlights the implications of the research, limitation of the study and future research directions.

Chapter 6: Conclusion and Recommendations: A succinct yet explainable on the results obtained through this research is presented in this chapter. Additionally, the sector points out various achievements in this study, also highlighting areas requiring future further research.

1.8 Chapter Summary

In this current chapter, there is brief information and introduction of the research study. It shows how management in a software development project is a complex and diverse agenda in all organizations. Whereas, highlighting key factors that influence management methods and their implementation in time for success in their functioning, inclusion although not limited to poor skills and low support from management bodies in these organizations. Management of software development projects points out the significance of timely and accurate completion of projects as an important means of improving software development. Research purpose and its goals including objectives have been identified along with a brief outline of the chapters that follow.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Literature assessment always pursues to consider what is presently acknowledged about a topic. Besides, acquisition of data on the topic, literature review is effective in finding areas with insufficient or no research at all. Cottrell & McKenzie (2011, p.40), following the assessment of current literature and identifying the holes, a scholar is then engaged in a well-versed investigation process. This study will essentially engage in understanding what is currently known about the various methodologies in software development projects.

2.2. Analysis of Scrum Development project, and Influence of Various Methods on Project Development

Literature review in this section will be divided into different subsectors. Firstly, Influence of scrum on software development project will be analyzed, followed by, Influence of other methods on project development and lastly, Influence of organizational factors on IT projects. It also climaxes the prevailing breaches in the literature review.

Management of software development project, by its nature, is a once-in-a-lifetime series for managing and distributing products or services (Lindsjorn et al.). Usually, the tasks sequence constituting to project management requirements needs experience in several sections although corresponding knowledge realms. Subsequently, several multidisciplinary teams normally accept projects. Sanchez, Terlizzi and Moracs pointed out the significance of paying attention to team characteristics when they discovered that large teams which are also having different culture influence affect the management of software development projects (p. 1620). Though having project members contributing in several software development can improve project succession as

those team participants provide their varied practices to bear on the existing project, also high dispersion decreases member's effectiveness in contributing to any project for lack of strong social ties with other team members (Snchez, Terlizzi, & Morcs, p. 1616).

Additionally, team apportionment is one of the factors that ensure essential agile software development project management (Lee, Park, and Lee, p. 797). Hence, scrum is very significant in agile software development projects those involving flexibility, speed, and suppleness of both project scope and or necessities as to purchaser needs and evolvment of macro-environment. In research by Amaral, Fernandez, and Varajo verified that software development achievement needs operative team interaction, team cohesiveness, and operation of the full range of each team member's experience, skills, and expertise. Moreover, in a survey of respondents in agile software development projects indicted that team performance is ensured by the quality of inter-member interactions.

Though thoughts concerning solely certain responsibilities in a structural setting often comprise the discussion of the term software development project, still, a description of unifying is not available. Hence, in conclusion, is that lack of common definition is due to attribution of difference in the meaning of the terminology of application to their nature. Software development management is normally defined as submission of different information, skills, techniques, and tools in the execution of a project aiming at reaching for its goals of different stakeholders' requirements.

Therefore, this process encompasses coordinating and directing different project resources throughout the software development lifecycle to gain the required set objectives whereas

incapacitating obstacles that exist. Software development management mainly encompasses innumerable events geared to attaining one ultimate target (Prabhakar, 2008, p.5).

Software development project lifecycle epitomizes dissimilar phases that each and every project should pass through before its accomplishment. Traditionally, they have been used as a milestone in project development. Major stages are a start-up, planning and organizing, execution and finally termination. Often, it is considered that for every project development, the phases come one after another with the completion of the previous one, although, in real life of any project these phases overlap amongst themselves (Andersen, 2016, p.23).

Start-up stage normally entails all actions undertake the initial point. During this phase, the software development project necessities are drawn (Rozenes et al., 2006, p.8). The second stage that is planning entails drawing out the activities of a project, the exact resources needed and timelines provided with expectations outlined too. Then, the execution stage comes in hand; here how project process should be carried out is provided as planned in the previous stage. Project control- is a process which links planning and execution- therefore it can be implemented to reduce time factor between the two phases. In control, functions like “measuring, planning, monitoring and taking a collective action” (Rozenes et al., 2006, p.8) are carried out. Finally, termination of the project follows the project development is marked as completed as ascertained in the timeline scheduled and delivery deadline.

Numerous factors influence the effectiveness of software development project management succession. Such aspects act either independently or cooperatively in manipulating success of a project. According to Pinto and Slevin (1988), they investigated the critical success factors throughout lifespan of project development by conduction of a study involving 600 members of

project management and project managers. Establishment from the study indicated that software development management included project-related issues, firm's issues, and stakeholder-related factors. Among the major factors for project, success included the project task and administrative backing.

Project mission and support from top management body being the crucial entities they determine the management of software development success. However, authors came up quickly to note that management body cannot ignore any of the factors. Since, managers should consider information and input from the project team, the firm, and clients. Hence, ensuring implementation is successful since project development is a complex task. Even if this study is critical in informing about success factors of a project, its deliberation of projects from several industries may limit the applicability of the discoveries in precise industries (Pinto & Slevin, 1988, p. 67).

Ofori (2013) sought to determine the critical factor for successful project management although the focus was drawn to projects in Ghana. Ofori conducted a survey of 200 managers from different organizations. Though this study was slightly different with the one of Pinto and Slevin (1988), outcomes were almost similar. Comparable to Pinto and Slevin (1988) and Ofori (2013) discovered that stakeholders and top management body concerns were leading in factors affecting succession in software development management. Moreover, other factors included the project's goals and purpose, leadership, client acceptance, resource availability, personnel and communication in project implementation.

Remarkably, researchers discovered significance for each critical success factor was pegged to a given organizational factor. Particularly, age and number of employees of the parent company

were key determining factors of how each factor affected the succession of the project management (Ofori, 2013, p.14). Correspondingly, according to a study by Pinto and Slevin (1988), the applicability of the outcomes in this research in specific contexts may be low given consideration of multiple management sections. However, this research will look into the outer scope more than the Ghanaian context.

A similar approach by Ofori was used by Ahmad et al. (2015) in the investigation of critical factors affecting the management effectiveness in project development. Following their research, the focus was drawn to the Pakistani public sector. The survey questionnaire was used in the research by the researchers on over 300 participants, of whom 185 completed the survey questionnaire that was used in the final analysis. Authors analyzed and tested in correlation to major four factors that influence the effectiveness of project management in software development. Control and planning were the major factors according to a study conducted, but very closely followed by workforce soundness and quality performance respectively. The article was significant given relation of different factors which influence the outcome of a project management process. Although, creditability may be conceded by the catastrophe of the author to describe qualifications of the respondents in rating relevance of various independent variables tested (Ahmad et al., 2015, p.815).

Investigation of critical success factors in the performance of management of software development, Babu and Sudhakar (2015) reviewed existing literature related to project management. Through their systematic review, found out that crucial factors for success are classified to organizational-related factors, managerial performance factors, external environmental factors, and project-related factors. Management-related factors being a major factor included incompetence of personnel responsible and lack of support from the senior

managerial body. On the other hand, organizational-related factors involved troubleshoot communication, team members' competence, and technical skills. Moreover, factors related to the external environment were client acceptance, subcontracts and quality of supplies.

In addition, the mission of the project, monitoring, feedback, and schedule are major factors to a project-related factor which influence managerial of software development. Hence, authors accentuate on the reputation of understanding crucial factor for accomplishment in management of software development. It is seen that the authors argue that these factors offer good guidance and understanding on project implementation rather than the project's goals. Also, they provide guidance to team members on how to identify important elements of the project and act as a valuable set of tools in aligning operation on activities during the management of a software development project. Although with in-depth sight offered by the article, a number of sources relied upon to arrive on the conclusion and even some sections are omitted and others not cited (Babe& Sudhakar, 2015, p.3285).

Another focus on critical issues that influence success in project management was conducted by Elias et al. (2014), numerous factors exist throughout the management process of a software development project hence influencing its outcome after implementation. In their research, they sought to develop a clear framework which could guide in understanding critical influencing factors to the management of a project. Development of the framework was founded on the reviewing of relevant literature and collected primary data from a construction project in Malaysia.

Through this development, they discovered that for success in project management, various factors play a vital role in software development project, for instance, project-related factors,

external issues, management actions, and project procedure. By their argument, these factors are influential in the success of project manager as each of them are dependents on success measure of evaluation. Although then, these factors act collectively in determining overall project success. It is important to understand these critical factors in the development of a software project. Failure to this understanding may lead to the poor success of the project management. Even with this significance in guidance to the future project management strategy, their generalization is limited because they limited to a single country instead of global concept (Alias et al., 2014, p.61).

In quantitative research by Beleiu et al. (2015), into investigating major factors influencing the effectiveness of management in software development. Authors used a questionnaire to gather information from project managers, customers, team members, and sub-contractors.

Questionnaire totaling to 47 were obtained at the end of research which constituted the project managers and team members being most respondents. Out of the nineteen factors, the competence of team members, clarity and directions, roles and responsibility, compliance with budget, time frame schedule and stakeholders' consultation were the major issues in the management of the software development project. Authors point out that it's important to understand crucial factors of any project throughout development to the implementation stage. Since these factors highly influence the effectiveness of any management criteria of any software development. However, this study may be biased as it shows that major respondents were team members and project managers (Beleiu et al., 2015, p.59).

2.3. Project Management Challenges and Benefits of Scrum

2.3.1. Management Integration

Encounters

Cultural Diversity, is a situation where, an offshore individual having diverse cultural backgrounds has many dimensions and differences like attitude, language and communication style, it may lead towards miss understanding the other person in the different environmental area (Herbsleb & Moitra, 2001, p. 17). Miscellany in culture could influence highly on software development on the globally distributed project due to different organizational structure, the culture of responsibility sharing and complicated management level (Deshpande & Richardson, 2009).

Moreover, technical challenges in software development projects are divided into distributed sites. Networks to communicate with each other should be created to establish a connection. These networks must be reliable and faster as work is distributed and then integrated through the configuration management task (Herbsleb & Moitra, 2001, p. 19). The organization experienced in software development projects can experience a variety of technical issues which directly or indirectly affect effect on project performance.

Besides, regular coordination is another critical challenge which is mainly entailed in the management of team members across the board in software development system. Because different individuals are working together across different sites to achieve one goal, it produces many coordination issues (Taweell et al., 2009).

Process Management Challenges are other critical challenges facing scrum methodology.

Throughout synchronization between disseminated sites, it became challengeable to synchronize

their processes between each other (Herbsleb & Moitra, 2001, p. 17). This coordination is highly critical at this level.

According to Smite and Borzovs (2006, p. 58), they state that contextual differences are normally “Organizational differences, diversity in process maturity, inconsistency in work practices, goals and expectations” (environment) could affect the project performance.

Moreover, Cross-border transaction is an Organization faced challenges belong to remote site both political and legislative (Smite & Borzovc, 2006, p. 59) while working in global software development project. This will affect project performance and deadlines.

Besides, multi-sourcing affects the effectiveness of global software development management in project distribution, in the sense that, an important issue is the involvement of various teams in the development of a single process (Cusick & Alpana, 2006, p. 26). Also, monitoring is a critical aspect in management, since continues monitoring could affect the effectiveness of the team (Moe & Smite, 2008, p. 226).

On the other hand, Managing Development which mainly entails managing activities and procedures used in development across different sites is another important challenge for management (Goodman, 1961, p. 153). It requires good control on practice and standards using in the organization. Furthermore, Infrastructure Challenges, which majorly deals with Infrastructure issues like network and facilities, could affect the performance of the project (Smite, 2005, p. 240). Well, structure infrastructure always required to start the project.

Practices

Generally, “Team Gathering” also plays a vital role, in the sense to avoid problems due to culture and raise knowledge on project domain; few sprints are performed initially by gathering of

SCRUM team prior to the development phase at one site (Barczuk, 2007, p. 385) and (Karsten & Cannizo, 2007, p. 236). Cultural distance can be reduced by conducting meetings quarterly with all distributed members of the SCRUM team (Smits & Pshigoda, 2007, p. 373) and (Unson, 2009, p. 317). Planning of SCRUM, retrospectives, several social activities, and sprint can be performed during such gatherings (Karsten & Cannizo, 2007, p. 236).

In addition, “Proactive resource management”: Ensure that the members of SCRUM team possess required tools and knowledge of implementing SCRUM strategies. Several tools for collaboration such as wikis, blogs, whiteboards, and team viewers are found to be really efficient during using of SCRUM strategies (Paasivaara, Durasiewicz & Lassenius, 2008) and (Sutherland, Schoonheim & Rijk, 2009, p. 7). Communication and issuing outcomes of SCRUM meeting can be posted on wikis by members of the distributed team (Paasavaara & Lessenius, 2006, p. 111). Tools such as issue tracker, rally and backlog management tools found to be effective (Sutherland et al., 2007, p. 274) and (Cho, 2007, p. 235).

2.3.2. Scope Management

Challenges

Strategic Challenges: These challenges belong to decision-making issues. First of all, it is important for management to declare a project “offshore” (Taweel et al., 2009) which requires detailed assessment followed by standards and plan. Next distribution of the work across globally distributed sites, expected difficulties during this distribution and their possible solutions according to resources available on respected sites (Herbsleb & Moitra, 2001, p. 20).

Practices

One of the effective ways is “Mandatory participation”: While conducting retrospective meetings, a compulsory 30- minute presentation is performed by each SCRUM team to avoid “offshore silence” (Karsten & Cannizzo, 2007, p. 238). Involvement in these meetings assists build on the authorized disseminated team (Karsten & Cannizzo, 2007, p. 238). Cultural obstructions can be reduced by urging members of the offshore team to furnish important data while conducting meetings if SCRUM (Paasivaara, Durasiewicz & Lessenius, 2009).

Moreover, another way of solving is the use of “Gradual team distribution”: Knowledge of project domain can be improved by the transition of SCRUM team from one site to another site gradually (Sureshchandra & Shirinivasavadhani, 2008, p. 219). This also reduced cultural barriers starting sprint at offshore involved, onshore SCRUM master who later involved with the onshore team (Summers, 2008, p. 336).

2.3.3. Time Management

Challenges

Time zone differences: In global project development projects, people work across temporal distance due to a geographical location between remote sites having time differences. Following are two management challenges due to time zone differences. Furthermore, Time Delays “We work they sleep.” Due to geographic location and time differences between sites, time delays occur during synchronization in important processes between remote sites (Smite & Borzovs, 2006, p. 60). Moreover, short intervals due to continuously (round the clock) development on GSD sites, there is very short intervals between processes for coordination and configuration management (Mockus & Herbsleb, 2001, p. 184).

Practices

Synchronized working hours: Highly used practices by SCRUM teams to assure the feasibility of synchronous communication among sites that are distributed. This can be achieved with adjustment of working hours, extended work hours, residential working (Summers, 2008, p. 336). Few strategies are adopted by teams to deflect the motive of raised lapping time (Unson, 2008, p. 316). Three questions are answered by team members, prior to meeting such that meetings can be made effective and small (Smits & Pshigoda, 2007, p. 374).

“Site-based local SCRUM team” Members of local SCRUM team gather and conduct local SCRUM meetings because of reduced overlap time (Vax & Michand, 2008, pp. 310). Inter-team communication can be assured by following SCRUM of SCRUMs practice with the important members from each team. Autonomous local teams and allocation of architecture subsystems that were independent and having motivated interfaces are required in forming such team which in turn decrease communication in inter sites (Vax & Michand, 2008, pp. 310). Several communication lines can be established by conducting an extra distributed meeting with technical lead and SCRUM master of each SCRUM team (Vax & Michand, 2008, pp. 310).

Besides, “Modified SCRUM practices”: SCRUM practices are altered and extended in few cases in order to deal with challenges of communication. It is very efficient to reward the measure of SCRUM among members of local SCRUM by conducting a “mini SCRUM” every morning (Berczuk, 2007, p. 384). Emails should be responded before 12 hours in order to avoid time lag (Vax & Michand, 2008, pp. 310). Only important SCRUM team members will go to the meeting rather than the whole team to be present during late nights (Sureshchandra & Shrinivasavadhani, 2008, p. 219). Other practices included postings of remarks and outcomes on wikis. Mailing

discussions of local meetings and the onshore team will carry demo of sprint (Sureshchandra & Shrinivasavadhani, 2008, p. 219)

2.3.4 Cost Management

Challenges

Abnormal, Budget Overrun: The budget of a GSD project sometimes increases due to several factors (Smite & Borzovs, 2006, p. 57). There are variations in development cost (Mockus & Herbsleb, 2001, p. 184) between different sites located in different regions. The management cost is also varying unexpectedly due to same (Smite & Borzovs, 2006, p. 57)

Practices

In this section, there were no particular practices got as per this study.

2.3.5. Quality Management

Challenges

Maintaining Quality; Quality is the implementation of standards in all process areas. In GSD projects it became challenging for management to maintain quality aspects as work is distributed among different sites (American national standard, 2004). Moreover, Product Quality: Low development cost is a most attractive factor in developing countries in order to compete in the software market, but it could contribute to product quality (Smite, 2005, p. 244). On the other side, Process Quality: Inability to maintain quality in processes could contribute to product quality in result losing customer satisfaction (Smite, 2005, p. 238).

Practices

However, there were no practices got on this topic to be discussed.

2.3.6. HR Management

Challenges

Higher Documentation overhead: Ensuring project visibility for every stakeholder in the project is another challenge which requires detailed documentation in order ensures clarity (Cusick & Alpana, 2006, p. 25). Also, Complex Hierarchy: Complex hierarchy/structure of organization effects on the running processes caused a delay in resolving the problem (Smite, 2005, p. 238). Not forgetting, Staff Management: It is very important to empower the staff. Encourage them in order to participate actively in the team, by performing good socialization, safety and protection sensation and rewards (Cusick & Alpana, 2006, p. 26). Eventually, Trust: In a GSD project peoples participate in common software development in different geographic locations and backgrounds. Therefore, trust is a most important factor between them. One can lose trust effect due to various reasons, i.e. job security, poor socialization, shifting of responsibilities etc (Moe & Smite, 2008, pp. 228).

The input of Trained Team members: There is always a need of trained workforce for the project (Mockus & Herbsleb, 2001, p. 110). If the team is not well trained, then it leads to project slippage. Besides, Inexperience: Getting experience in offshore project for the organization is always challengeable. In-experience in distributed developments is a major reason of failure for GSD projects (Smite & Borzovs, 2006, p. 56). The inclusion of Willingness: Changes not always welcome in Organizations, because of their complex internal structure and ambiguous hierarchy level results delayed in scheduled (Smite, 2005, p. 240).

Practices

“Dedicated meeting room”: Video projector is fixed at every site to make meetings of SCRUM transparent to everyone (Summers, 2008, p. 336). Assures that each distributed place is allotted a

distinguish room for the meeting which consists of all the equipment and communication tools (Sutherland, Schoonheim & Rijk, 2009, p. 5). Usage of “Single room”: Separate room to the SCRUM team to communicate is allotted. If an individual change team, he should be able to move to these room of new team (Sutherland, Schoonheim & Rijk, 2009, p. 8). Frequent, “Coffee/ice cream meetings”: Culmination of a module member of team celebrates by going to ice cream shop or coffee bar. Several issues are also discussed during these meetings. This improved mutual understandings and trust among members of the team (Danait, 2008, p. 215).

Sometimes, “Visits”: Project vision can be improved by substituting visits. Cultural distance can also be cut down by frequent visiting of the offshore team by product owner during development (Summers, 2008, p. 3370) and (Therrien, 2008, p. 334). Maintenance of designed revolution between both onshore and offshore team improves coordination (Summers, 2008, p. 335) and (Danait, 2008, p. 214). Making members of the team completely realize the project vision can be made by roadmap meetings conducted by product owner (Therrien, 2008, p. 334). Furthermore, “Key documentation”: Important documentation should be maintained properly in order to increase collaboration among team during usage of SCRUM practices (Vax & Michand, 2008, pp. 310) and (Therrien, 2008, p. 334). Misunderstandings can be avoided with the help of use case diagrams. Several tools such as enterprise wikis, PM tools, and issue tracker assert improved documentation and make project transparent (Vax & Michand, 2008, p. 310) and (Therrien, 2008, p. 334).

Additionally, “Distribution policy”: It is reported in the literature that each integrated team of SCRUM should be distributed among two sites (Vax & Michand, 2008, pp. 310). A study mentioned that the distribution of each Scrum team was among two sites, though there are multiple sites in which the project is distributed (Vax & Michand, 2008, pp. 310).

As well, “SCRUM master needs to be a strong negotiator”: SCRUM master should be firm. He should be capable of prioritizing requirements and force member of the team to rescues on corresponded time zone because, practices of SCRUM depend on the trust and collaboration among members of the team (Cristal, Wildt & Prikladnicki, 2009). In addition, “Training”; several issues related to technology are trained to SCRUM team. Value of the SCRUM and collaboration among team can be improved by giving training on SCRUM initially (Vax & Michand, 2008, pp. 310) and (Therrien, 2008, p. 335).

2.3.7. Communication

Challenges

Communication: It is most important challenge faced during GSD projects. The team across geographical location faced communication issues due to their location, time zone issues and socio-culture backgrounds caused project delays. The organization needs a definite way to communicate the plan with stakeholders; it can be formal, informal, vertical horizontal, synchronous, asynchronous, structured and unstructured (Herbsleb & Moitra, 2001, p. 16).

Likewise, Linguistic diversity: It is also the most important challenge faced by GSD management. The distributed team across the globe has different linguistic backgrounds. It is therefore hard for them to coordinate and communicate with each other. It may lead to misunderstanding; miss-interpretation caused project delays (Deshpande & Richardon, 2009).

Similarly, Data Privacy challenges: (both Customer and organizations) Data protection is always important. In GSD project the protection of data is more important as it communicated between different geographic locations. The customer also has a concern on his data security. Failure could affect customer relationship. So, it requires a mechanism to avoid this (Cusick & Alpana, 2006, p. 61). Equally, knowledge Management challenges: Organization requires an effective

way of information and "knowledge sharing mechanism" by using pre-defined standards and procedures. Staff training regarding this mechanism leads to effective collaborative development. (Berkilingl, 2007, p. 4716).

Practices

“High reliable communication bandwidth”: An environment with fertile communication can be provided with the help of several communications tools, which avoids dumb, poor, and in dependable transmission (Paasivaara, Durasiewicz & Lessenius, 2009). Several tools are used for communication such as webcam, phone, instant messengers, video and voice conference, SMS, email, net meetings, teleconferences (Danait, 2005, p. 216). Therefore, suitable tools can be chosen from a broad range of tools desirable for the bandwidth of communication (Danait, 2005, p. 216) and (Paasivaara, Durasiewicz & Lessenius, 2009).

Consequently, “Reduce SCRUM meeting length”: Challenges with asynchronous communications can be covered by cutting down the length of the meeting. Duration of the meetings can be reduced by being prepared with SCRUM questions prior to the meeting. This strategy eliminates distributed meetings early mornings and during nights (Cristal, Wildt & Prikladnicki, 2009). In addition, “Additional distributed meetings”: Collaboration among team members can be improved by conducting regular meetings informally to solve several matters (Paasivaara, Durasiewicz & Lessenius, 2009). In these meetings they can discuss testing, architecture design and social issues among others (Danait, 2005, p. 216).

Equally, “The use of a “global” task board”: It is useful in amending the productiveness of agile teams distributed globally. Actions to be done will be controlled by using minutes of meetings by a member of all the teams delays and problem that were not expected aroused in some cases

(Danait, 2005, p. 216). Formulation of tool to plan and execute sprints by globally distributing teams could be an effective initiative. Unlike, normal teams there won't be any architect, developer, project lead or a project manager. None of the members were assigned with similar responsibilities. Responsibilities dealt early (Danait, 2005, p. 216). Hence, a belief of group possession and port switching amended several acquisitions of the member in a team.

2.3.8. Risk Management

Challenges

Risk Management challenges: Almost every project involves risks, and for global software development projects it is most critical because of work synchronization across geographical boundaries and facing threats of risks more than a non-software development project. Managing risks in a software development project become difficult for management (Ebert, Krishna, and Jha, 2008).

Practices

No practices were found relevant to this category.

2.4. Influence of Organizational Factors on Software Management Project Success

Mostly, organizational factors are major challenges that affect succession of project development manager. According to Zidane et al., (2016), organizational participation is the key to an internal succession of software development while the project environment is the external determinant to its succession too. The writers categorized organizational factors into five sections; organization communication, organizational culture and style, organizational process assets, organizational enterprise environment and organizational structure factors (p.163).

Remarkably, Zidane et al. (2016) sought to investigate organizational culture as a critical success factor in the management of a project. In order to achieve this, they used 15 respondents using qualitative mixed methodology. Main participants were project managers, developers, functional managers and product owners with over 6 years of experience in their respective fields. Most of the values pointed out were honesty, trust, professionalism, positive attitude, and tolerance that scored highest ranking. However, regardless of some other values discovered were a commitment, transparency, respect, and discipline. Author encourages in promoting interrelation during the project management process to ensure the success of software development (Zidane et al., 2016, p.162).

Moreover, Nguyen and Watanabe (2017, p.760) uphold the importance of organizational culture as a crucial aspect in project management basing their argument through 200 participants in project construction in Vietnam. The respondents were subjected to a survey aimed at collecting specific data. In contrary to Zidane et al. (2016, p.160) who discovered that being open was the critical cultural factor while commitment was important too, Nguyen and Watanabe (2017, p.778) found out that commitment of managerial body to the project development was the most important aspect in the success of its software development.

Generally, overall performance on project outcome is based on work orientation, working towards project goals, team members' commitment and alignment towards objectives laid upon. Moreover, other aspects that influence project development according to organizational culture include participants' satisfaction and learning performance. However, all authors have argued the use of culture as a tool towards improving project management rather than spoiling them. Even if the study provided by the writers give an overview of inward understanding of culture effects, it

is, however, biased as it has used few participants to conclude on the aspect (Nguyen and Watanabe, 2017, p.781).

Stare (2012) went ahead to show the relation between organizational culture and organizational performance. He found out that organizational culture was effective in reducing cost in project management and even project delays. Research entailed more than 900 people who were project managers, developers, team members and several stakeholders in the Slovenian public sector and another sector by the use of a questionnaire. According to Stare, performance was associated with respect to the manager's authority, prioritization of project development. According to this writer, even although, project organizational culture is high, the inappropriate reward system in Slovenian context led to poor performance in the management of software development. Hence, rewards can influence project development in a great height on how it is done.

Moreover, in another research by Stare (2011), this also investigated on impacts of organizational culture towards project management with a focus on Slovenian enterprise. In this research, the writer used aspect of organizational structure as opposed to the reward system from other researches. An online survey was carried out with a participation of about 137 respondents from different enterprises. Most of the respondents confirmed that project management were carried out in organizations with matrix structure knowledge. The organizational structure was dominant. On the other hand, organizational culture signifies the intensity on project implementation and management. Most impacts of organizational culture was felt in the reduction of project delay although, less felt in the reduction of cost.

According to Onuta (2012), the success of project manager is majorly influenced by organizational structure. Hence, administrators for project development should look for ways in

coping with organizational structure to ensure good implementation of software development. Additionally, managers should cope with the culture of the organization. Besides, Onuta (2012) discovered that organization performance and success of project management are dependent partly on the ability of organizational structure.

Therefore, project managers must learn the implications of how organizational structure affects software development. Since the organizational structure on project development lies with team members 'commitment and managerial control from the topmost point. Although, this research is credible it could be enhanced by interviewing and doing more survey to establish more effects (Onuta, 2012, p.1).

Other researchers like Alkassas et al. (2013), affirms that the structure of an organization is influential to software development management. The argument was established through consideration of different organizations of different structures. In their clarification of the study, they used participation of 53 engineers in Egypt who responded to a survey questionnaire. Participants included project developers, project administrators, test engineers, and product owners. With consideration of costs, time, project types and experience of the administrator, the study sought to analyze the effect of different organizational structure to project development. Out of this research, it was found out that the effectiveness of organizational structure is determined by project length, project type, completion of project and project size. Based on the findings, writers proposed that an organization must choose a manager and planner before setting up an organizational structure. Team members for project management should always come last in the management. The use of one country for this study makes research shallow and inappropriate to prove all over the world scenario (Elkassas et al., 2013, pp. 411).

Additionally, the organizational structure on matrix type was investigated by Schnetler et al. (2015) to identify characteristic features. The study was established through a survey questionnaire that was done by 2800 project development team members. However, only 106 participants responded to the survey. Major positive characteristics of matrix organizational structure also had a high connection to drivers of project success. The research was done in South African companies. Positive characteristics included high communication frequency, employee's motivation, flexible use of personnel and job satisfaction. However, negative characteristics were also brought by matrix organization which includes cost increments and power competition. Above all, communication frequency played a vital role in project success. Although, the research is biased as it concentrates on the positive part (Schnetler et al., 2015, p.11).

Other significant authors like Nahmias et al. (2010) pointed out on the influence of project development management in connect with organizational structure. The main aim of the study was to investigate different aspects that influence software development management. In this research, data was gathered from 3 organizations with similar capacity and had previously implemented their projects with the use of scrum methodology. Through the findings of that research indicated that organizational structure affects software development basing on the ability to support the project management and requirements.

In some cases, changes in organization structure can also be influenced by software development management too. While, in this study, aim being on bringing positive impacts on software development management, changes on the structure of the organization may face resistances, leading to a negative influence on the management of software development. However, this

research is biased as it only constrains itself to three cases of similar companies (Nahmias et al., 2010).

Moreover, the organizational structure was discovered that it influences the outcome of software development by Allen et al. (2014). Project success is highly influenced by the concept of organizational structure. Critic point of view of the research was to investigate key issues to failures of project development and implementation issues. The cases we based upon two companies to represent success and failure in different projects. For instance, New Growth Factory project by Proctor & Gamble was used to represent a successful project while 123-Foot Patrol Boat by the United States Coast Guard to represent a failed project.

Therefore, in their study, it indicated that failure or success of a project depends on organizational structure. Starting with organizational structure implemented by P&G aimed at creating small groups that focused on new-growth initiatives, which made it effective in the implementation of the New Growth Factory project. Groups consisted of team members who were dedicated to the software development all the way to the implementation stage. On the other side, the structure of the Coast Guard's parent organization, Homeland Security, did not offer appropriate support to team members in the whole process. Even if matrix organizational structure offered an autonomy of manager of that project, this led to his isolation. Hence, assistance needed by project administrator was not offered, being a major reason why software development and its implementation were canceled in Foot Patrol Boat project. It is true to say that this study is applicable to different scenarios and contexts as organization structure implicates influence on project management (Allen et al., 2014, p.1).

Additionally, organization communication is another factor which influences most aspects within an organization, hence contributing to project development and implementation success.

According to Mutuku and Mathooka (2014), importance on organizational functioning and success is very dependable on organizational communication. Reflecting impacts on performance of employees is highly influenced by communication channel within the organization.

In this research, collection of data was got from Nokia Siemens Networks Kenya. A descriptive questionnaire survey was used with over 156 respondents who included mainly project managers, support staff middle managers within that organization to determine effects of communication on their own motivation. Involvement in decision making, channels used in communication, communication nature and information sharing were among the most critical aspects in organizational communication, hence being key determinants in motivation concept of employees. Therefore, motivation of employees enhances productivity, according to authors, recommends that organization should come up with effective ways of communicating to ensure employees are motivated (Mutuku & Mathooko, 2014, p.28).

More emphasis has been done by Culo and Skendrovic (2010) on importance of communication management towards influencing project development. Upholding findings by Mutuku and Mathooko (2014) that managing an effective communication arena is difficult but go ahead to insist that for a successful software development management, the guidelines require communication strategies. By reviewing existing literature, the authors came up with a conclusion that project manager's communication skill and effectiveness determines outcome of software development process.

Truly to state, positive communication strategies contributes a lot to effectiveness of software development outcome however this is facilitated by cooperation from stakeholders to the development of software. Because several project managements are comprised with teams of different individuals of different backgrounds, cross-communication skills among team members and ideologies of diversity minds. Therefore, managers who learn how to communicate with team players ensure effective outcome of software projects (Culo & Skendrovic, 2010, p.228).

Communication seems to be the most important issue in project success. Since, it is more affirmed by Ramsing (2009). Software development managers need to understand effective strategy of communication to improve on project outcome. In this study, Ramsing reviewed an existing literature to develop on the concept. He found out that truly communication and interpersonal skills are most of major strategies in project development. Hence, managers should improve on effective communication. Availability of information with effective communication skill in fact improves project development and even its implementation strategy.

Primarily, effective communication in project management begins from problematic power relation regarding project managers and team members. In fact, to ensure a positive outcome of a project development depends highly on effective communication between project manager and team members, however to improve it more, communication between project manager and top management should be more effective too. Critically, input of these different groups into software development process ensures it is successful, although this can be effective if every individual puts more interest to it (Ramsing, 2009, p. 345).

Various organizational process assets are evidenced in influencing project development outcome. The assessment was done by Alpert and Hatshome (2013). The authors used grounded theory to

argue their research by interviewing over 23 professors in 13 states in the United States of America to establish on their case. The study was to show the impact of project management processes and several tools to enhance successfulness in the implementation of research projects. Respondents replied with use of consistent project management processes, in which they took time in planning on research and the overall timeline of that particular project development.

Generally, professors used main tools like a timeline, storage systems, and task list in order to ensure orderly of those particular projects. The professors particularly participated in stakeholder engagement, collaboration in those projects and seeking research support. Moreover, learning of the organization was a critical issue in the implementation of best practices in research.

According to Alpert and Hartshorne (2013, p. 541), the experience of assistant professors in their project management turned out to be positive or negative depending on their input to the projects individually.

According to Mathur et al. (2007), the focus was drawn to intangible project management assets as a source of competitive advantage in project management to ensure successful software development. Respondents to this study were members of the North American Project Management Institution. Through findings of an intangible project resources allocation scenario, organizations were able to develop successful software with proper project management strategies. Hence, through this investigation, investment on intangible projects assets is more effective in ensuring success in software development. However, this study is generally biased in that sampling was not wide but just on an academic angle (Mathur et al., 2007, p. 460).

The same authors Mathur et al. (2013) furthered they're sought in investigating organizational project management assets characteristics and outcomes. It was thought as bridge 1between

organizational assets with organization support and the software development management goal satisfaction. Resources that apprehended and distributed knowledge about project management, in addition to facilitation of sharing and use of information were categorized as resourceful value. Two knowledge processes were considered as rare while two exclusive perceptible and impalpable assets were characterized as inimitable. Therefore, these organizational assets were critical in ensuring high software development and its management strategy. Project administrative assets that were inimitable, rare and valuable made key importance to project management outcome to be successful. Though, the report is biased since its self-reported and low response rate (Mathur et al., 2013, p. 112).

2.5. Importance of IT effectiveness in business development.

In the recent year's increase of technology has influenced the use of technology in the business world not forgetting in personal purposes. More importantly, technology has changed the reasoning of the business world, according to Purnama and Subroto (2016), who reason that the revolution of technology in recent years has shifted businesses into another level. In their study which was done in Indonesia by use of medium and small enterprises. Through this study, they established that the use of technology has improved services and increased income. This, therefore, boosted the performance of small and medium traders (Purnama& Subroto, 2016, p.984).

Affirmation of the study was done by Tanriverdi (2005), through establishing a connection between IT software and business improvement in the performance of multi-business firms. The research was carried out by the involvement of 1000firms though turnout of 250 which collected data that was required. By this outcome, IT has played a great role in the improvement of businesses (Tanriverdi, 2005, p.311).

Similarly, Byrd et al. (2008) argue that the influence of IT projects in business can affect it directly or indirectly depending on how technology is used to achieve goals by that particular company. In their study, the authors used a resource-based view approach to determine and support their understanding. Their research involved different managers of different companies, project managers and team members who ascertained that indeed software applications were effective in improvement of business output (Byrd et al., 2008, p. 161).

Also impact of IT application in financial concept in organizations, Bacha (2012), sought to investigate the idea by sampling data from 100 French firms. He concluded that information technology systems are the backbone to many business outlets and significance as they ensure easy handling of activities and services to both clients and members within the organization (Bacha, 2013, p. 752).

Furthermore, Ong and Chen (2014) sought to determine the influence of information technology on any firm's value. Basing their argument from about 100 information technology leaders from *Information Week*, the writers discovered that as much as information systems contribute highly to the performance of those firms it also improves their value too in the world's perception mirror. Besides, information technology systems are felt in a long-run perspective, not in short-term concept (Ong & Chen, 2014, p. 70).

Other research by Ong and Chen (2013) postulates that a assessing similar concept of information technology implication in business. In their study, 4480 firms were involved as respondents in the collection of secondary data. Through this study, they indicated that Information Technology capabilities have very high importance in the development of a business in any way including company's performance, value, and its future. Effect on company value owes to be the confident

impact of IT aptitudes on prospects for revolution, expansion, and development of intangible assets (Ong & Chen, 2015, p. 669).

A caution from Luftman and Brier (1999) affirms that information technology should be harmonized business operation in question. Also, information technology systems are more successful and of importance in a business environment that is strongly supported by the senior managerial body, strong quality of leadership and proper communication channels and effective. The findings are based on opinions from managers of Fortune 1000 companies in the United States (Luftman & Brier, 1999, p. 125).

Moreover, Santhanam and Hartono (2003) affirm that technology systems in organizations are highly attributed with the financial performance of that particular organization; the writers have argued that past performance and halo effects must be acknowledged when predicting this relationship (Santhanam & Hartono, 2003, p. 125).

2.6. Influence of Organizational Factors on Software Development Management

Sudhakar (2012) points out that the success of software development projects depends on innumerable factors in the study. Sudhakar reviewed the existing literature to conclude on a good explanation what are main factors that influence the success of software development projects and then categorizing them to seven subsections.

Through his findings, he acknowledges the unique nature of software projects that make their critical success factors slightly different from those of other projects. The complexity of a software development starts with the need of balancing between knowledge in software management areas and technical knowledge about the exact project to be implemented.

After a thorough review of the literature, the research found out that a total of 80 factors which could be categorized to organizational factors, communication factors, product factors, team factor, technical factors, project management factors, and environmental factors. As much as organizational, cultural and managerial are highly influential in software development so does technical factors play a vital role in software development and implementation. Hence, every success factor cannot be ignored or excluded since it has a part to play critically. However, the study is based on a secondary source which makes it not applicable in normal situations since no interview or survey was done (Sudhakar, 2012, p.537).

On regards of Iyamu (2017), for IT projects to perform their intended work implemented for in an organization, it all depends on improvisation of these particular projects. Therefore, improvisation of this project determines their failure or success. Several, factors of both technical and non-technical affect this kind of improvisation of projects and their implementation success. In this study a lot of information was gathered from over 31 telecommunication organizations in South Africa, through this, authors found out that non-technical factors can be classified into different parts, for instance, human capacity, change management, project process, a power relationship, organizational structure, and know-how. For IT improvisation, then all these aspects must be considered with a lot of interest. However, this study could be more effective if it considered doing research on a wider scope of participants to develop a substantial study on the topic (Iyamu, 2017, pp.1-8).

Standing et al. (2006) also sought to investigate various attributes of software development projects management from the perceptions of information technology professionals and information technology support workers. Information was obtained from both Information Software and Information Technology personnel of 500 Australian organizations. Basing on the

findings from this study, authors discovered that both IT support workers and IT professionals acknowledged on the vital role played by both internal and external factor on improvisation of software development projects.

However, IT support workers had biased information on the success and failures of project implementation purposes; they argued that a lot of problems arise from external factor leading to the poor outcome of project purpose and taking credit on the success of the software development projects. On the other hand, IT professionals were positive and objective to both external and internal factors, hence crediting that they both influence the failure and success of a given software development process and implementation of it.

Moreover, leading internal factor was personnel and ability of management to carry out their duties effectively. Even although this research provides a wide insight in factors that influence project success and failure, results obtained were however biased as all respondents were ignoring to state their contribution to the failure of given software development and its management as a whole scope (Standing et al., 2006, pp.1148-59).

While the main aim is at investigating major success factors that influence the success or failure of software development projects, Schiederjans, and Yadav (2013) sought to assess critical success issues in association with ERP implementation success. Use of the past literature was the main source of data. Moreover, they engaged in the use of theoretical development. Critical success factors identified from the study were then divided into three portions: environment, technology, and organization; which were then divided into several parts under each factor. For illustration, the organization aspect was composed of various factors such as support from the

top managerial body, change management, and implementation plans which were among other major issues under the company factor of critical success.

However, writers discovered that some of the success-critical factors were not adequately addressed in the already existing literature. For example, review on trust as a very critical issue in the success of project management leading to the implementation of ERP. Trust, according to writers, is the main critical success factor under the environment aspect (Schniederjans & Yadav, 2013, pp. 364-87).

According to Kamhawi (2007), most of the critical aspects influencing the success of project management are dependent on success dimension being addressed. 70 participants were used in this research by the authors to peg onto their argument. Respondents were actively involved in the implementation of Enterprise Resource Planning (ERP) systems. By basing success on project success metrics, major success factors identified from the study included planning process, resistance in the organization, the usability of the system and other several issues. On the other side, the process of planning and organization fit were majoring as success factors from the dimension aspect of business success metrics.

Interestingly, the writers found out that classical success factors from the business success metrics point of view that, strategic fit, training and top management among other several issues to insignificance in project implementation (ERP) systems. However, this study may be bias based on the perspective of information laid from two dimensions was just subjective since the sample size used in this study was small (Kamhawi, 2007, p.34).

Organization factors play a very crucial role in the determination of software development projects-based organization established by Lee et al. (2005). Writers based their argument on

internet-based inter-organizational systems (IIOS) planning projects in Taiwanese firms. Survey questionnaires were used in the study which involved over 200 participants from different information systems executive working in IOS planning projects in Taiwanese organizations. At the end of this study, it was clear that organizational and environmental were found to play a major role in influencing the outcome of project development. It was established that the relationship between chief executive officer (CEO) and chief information officer (CIO) was very critical to the influence of project success or its failure.

In fact, the two heads should always assume combined responsibility if the realization of project benefit is to be of the question within the organization set up. The maturity of technology in use within the organization was a second factor that rose from this research. Technologies, which are mature, have higher capabilities and recording improvement success rate. Regrettably, in this research, biases are evident due to data collection method, as it involved in one type of professionalism. In addition, cultural aspects of different countries were not put into consideration. For instance, culture aspect in Taiwan is very different with other countries all over this world, hence, affecting generalize ability of the case findings (Lee et al., 2005, p. 527).

2.6.1. Organizational Culture and Management Styles

Sangar and Iahad (2013) assessed critical factors influencing software development projects with a lot of focusing on the implementation of business intelligence systems (BIS). They approached their study case from two perspective factors namely; management as well as technology.

Collection of information was entirely done through reviewing existing literature and interviews. Respondents to their interviews were individuals with relevant experience and professionalism in their own fields of working that was specified to experience in information systems and BIS.

A succession of these IT projects was influenced by several management factors, even although their relevance differed in different stages. For instance, at pre-implementation phase, major critical managerial factors, which were brought out, had clear vision and mission, the culture of that particular organization and support from the managerial body. However, in the implementation stage, success managerial factors included support from management, the involvement of stakeholders, effective project management and management change that indeed took a center in project success.

Moreover, in the post-implementation phase, end-user training and educating were sole critical factors that were identified in regards to organizational factors. Some of these organizational factors worked closely with technological factors (data accuracy, hardware/software usability, integrity, IT infrastructure, network, and confidentiality) in order to determine success in implementation of software development projects. Nevertheless, as another study, this particular research has omitted other roles played with other factors, specifically external factors, which majorly influence implementation of software development projects (Sangar & Iahad, 20113, p.176).

Managerial capability and capacity of a project manager also play a very critical role in organizational factors which influence the outcome of software development projects and their general management. Blaskovics (2016) sought to determine various roles played by managerial capability and personal skills in relation to its influence in project outcome. Blaakovics (2016) did the study through conduction semi-structured interviews and use of literature reviewing. A semi-structured interview was done by interviewing project managers from different five companies in determining impacts of the attitude of project management on project success.

Moreover, identifying the interrelationship between personal characteristics of the project's administrator, attitude and leadership style of managerial quality. By the end of research some of the managerial attitudes that were driven included; strategic orientation, were the most significant factors found influencing project success, especially regarding the quality of stakeholders-orientation and time frame which project managers used for motivating, stakeholder engagement and communication ensuring project is managed in an effective manner. Moreover, strategic- orientation enables the completion of software development in the time since development quality goals are addressed.

In addition, optimization, planning, and control were other main techniques that were used in project development by managers of software development. The budget of software development was impacted by these factors like attitude. Mainly it was attitude employed by project managers and even their leadership qualities that determined success in project outcome, which was also determined by managers' characteristics. Through this, the success of project development is indirectly determined by personal characteristics of project managers. However, failure of this researcher was to take into consideration other factors while comparing interrelationship of personal leadership and managerial attitude skill which have become a greatest limitation in his study (Blaskovics, 2016, p.261).

In project management, project managers have vital responsibilities to ensure its success. By this, managers are seen as implementers of organization strategies hence giving them a strategic tool in any organization (Kloppenborg & Opfer, 2000, p. 18). Since they are viewed as key implementers in an organization, managerial body from top position should always provide essential support to project team in order to fulfill its work for better programs in software development.

In regards to Sarif et al. (2016), support from top management body down towards project team is very effective as it proves the commitment of the organization to the success of software development, hence project improvement. Through giving resources required and direction from the top managerial body to team players in software development ensures commitment. Always, teamwork progress is determined by support from the executive body in terms of resources and appreciations, therefore leading to project success.

Generally, in IT sectors, topmost executive body believe that all organizational issues should be given more importance as compared to technical issues since a lot of rapid changes and adjustment of customer requirements (Doherty & King, 2001). According to Zwikael (2008), the increase of support from topmost managerial body determines success in software development projects and their implementation success too. Variance on support from top management body towards project management body differs depending on which industry that particular firm lies or requirement of organization involved.

Usually, it is believed by the top executive management body that “no-one-size-fit-all” type of support. Henceforth, each and every software development project management should be measured and handled according to its level which normally depends on goals and organizational desires. Therefore, the involvement of organizational head managerial body is very influential in project development and its management.

Soft competences of project managers also play a vital role in the success of software development and implementation cycle. Smith et al. (2011) evaluated how soft competence of project managers affected project success. The research was done by requesting project managers to relate stories along themes of optimism and stress and how these incidences

influence software development success. Basing an argument on stress as an outcome factor, it indicated that stress is a tool which may influence a project success in either positive way or negative manner.

Through, viewing stress in two sides, on the one hand, stress was found to affect motivation positively. However, on the other hand, stress poorly handled, showed a negative impact on productivity, the behavior of an individual and status of an individual's health. Improvement 2to software development projects can be achieved through management optimism and positive impact on project success.

Even then, optimism can only influence software development project positively only if project managers' capabilities to maintain is at a realistic level. Therefore, the manager's capability to formulate an appropriate project development plan is dependent on sanguinity. Confirmation was ascertained by Barna (2013) where he stated that competence in software development project is important. The study was done by use of 21 participants who were project managers. In the research, it was indicated that lenient skills related to communications, team force and leadership complemented technical skills to achieve software development project success. Such competencies included listening to different ideas, tracking progress on a daily basis and formulation of clear and easy decisions, among several other issues (Barna, 2013, p. 17).

In reference to Gichoya (2009), Information and Communication Technologies (ICTs) have led to an improvement in operations remarkably towards effectiveness and efficiency, especially in delivering services by governmental organizations and sectors. However, several factors influence this effectiveness of software development schemes, hence determination of this particular outcome of effectiveness.

In order to ground a strong argument, the author did research in developing countries through a secondary collection of data. The Kenyan e-Government reality was on top of research priorities. Most of the attribution by that study was upon successful implementation of government ICT projects to enablers and drivers. The driver identified in the research was support from the government sector as it related to organizational factor. Identification of enablers, on the other side, was the inclusion of effective managerial and embracement of good practices. Other major factor identified included; leadership styles, data systems, infrastructure, and organizational culture all these factors influence successes of software development in one way or the other (Gichoya, 2005, p. 175).

Overall, the review of survey helps in identification of imperative role played by organizational culture in the implementation of a software application effectively. Through this research, it is evidenced that organizational culture is associated with believes, assumptions, values, and ways of interaction utilized by the management of that particular organization and its employees. It is, therefore, effective change in management being an essential component in an organizational culture may also affect project success or failure (Katzenbach & Thomas, 2016).

Several changes in management are required like changing mindset of workers to ensure the improvement of software development improvement within the organization. Moreover, this improves the degree of acceptance among the customers (Katzenbach & Thomas, 2016).

Implementation of new technology within an organization always faces opposition from other employees due to culture tradition of the individual in the firm setup (Knight, 2015). Thus, maintaining an ongoing project, the culture of the organization should be looked upon.

Additionally, management style as similar to organizational culture, it plays a vital role in software development and its implementation process and mainly its management effect.

Pretentious that managerial and leadership may be considered as interchangeable, argumentatively, leadership is considered to be very critical in project management.

Numerous researches suggest that different styles of organizational management and leadership influence software development in both positive and negative manner. For example, Repressive leadership coerces employees to remain within the identified lines of discipline and perform any function as instructed by their leader or manager (Rhatigan, 2016). In such a situation, prevention of disciplinary action is majorly the only motivation behind steering employee behaviors and attitudes in favor of the software development projects.

However, on the contrary, advice-giving leadership or managerial skill enables management body to know a lot on employees' beliefs and expectations on the introduction of a new technology concept and application on a prior stage. By this, management is able to make a necessary arrangement that positions the technology as favorable in the eyes of the workforce (Rhatigan, 2016).

Chan and Mills (2011) have put a lot of efforts in explaining the influence of leadership's styles in software development, its implementation, and management. The authors sought to investigate various influential issues towards implementation of developed software. Their research relied upon a collection of data obtained from the doctoral thesis paper of a particular student who was involved in the software development process.

The success of the particular software development was greatly influenced by leadership style of project culture and project leader (Chin & Mills, 2011, p. 68-76). Moreover, leadership was

found to be a very vital player in software development through research which was done by Shore (2005). Through reviewing of existing literature relating to a high failure in information systems (IS) globally, the author attributed the success of software development projects into three critical factors which included external environment issues, organizational context and technology trends.

Leading factor in organizational issues was leadership giving the highest percentage from findings. While admitting that there does not exist a one-size-fits-all leadership strategy in the management of software development projects, this writer quickly notes that success of software development depends on leadership style at every given stage within its development cycle.

Through this study, it was found that charismatic leadership was more appropriate in the initial stage of a software development scheme since at this very stage a lot of opposition is experienced by other workers. However, the leadership needs to shift towards a task-oriented as software development will be in progress. Periodical reliance on a relationship-oriented leadership is required at every single phase. Collection of data from a secondary source makes this research biased since opinions are individual, author of existing literature (Shore, 2005, p. 1-4).

Despite its shortcomings, these particular findings are affirmed by Ng and Walker (2008) during the investigation of project managers' contribution to software development project across different stages in its life cycle. Grounded on a case study done in Hong Kong public sector on ICT project implementation, it was discovered that past success of one leadership style by a given project manager could not be carried forwarding to another project with equal success. On the other side, software development manager ought to adjust their leadership style to fit the

given context and implementation stage of the particular software. However, a major shortcoming of this study was a focus on a single project which may lead to selection bias (Ng & Walker, 2008, pp. 404-24).

Moreover, manager's leadership was found to be more influential in software development success by Randeree and Ninan (2011). In their research, they used a tailored instrument to investigate the effectiveness and efficiency of leadership approaches employed in more than 42 IT projects in the United Emirates, out of this study, it was established that usage of leadership methods that promote and improve information sharing techniques, trust and autonomy of the team members was very effective and efficient in enhancing success in software development project team. Though this research is highly recommended to the usage of appropriate approaches to leadership in IT projects, its generalize ability may be limited given that no comparison is provided between UAE context and other parts of the world context (Randeree & Ninan, 2011, pp. 28-45).

Research by Randeree and Ninan (2011) was affirmed by Natrajan and Chattopadhyay (2014) during a comparison of how different leadership styles impact the success of software development projects. The author sampled over 50 IT professionals in an Indian software organization to compare the impact of task-oriented, boundary-spanning and relation-oriented leadership behaviors. Through their research, they found that the leadership style of project managers was very influential in software development projects as they addressed different aspects which are people-related such as behaviors and motivational feelings.

Interestingly, all of these four leadership characters and behaviors played a very significant role in software development, its implementation, and management. Even then, the relative

importance of relation-oriented leadership behavior was the highest when compared to other three leadership behaviors. This was due to the fact that, this behavior's ability was effective in creating trust and support while empowering project members effectively too. Normally, software development projects with limited face to face interaction, in particular, are heavily dependent on the relationship behaviors for success. However, according to the authors, they feel data collection was insufficient due to a number of participants in the delivery of credible results (Natrajan& Chattopadhyay, 2014, p. 1-7).

Other authors like Gottschalk and Karlsen (2005) are very quick in noting that leadership and competencies that are very vital issues in software development projects are however dependent on the type of project and its nature in which project managers are involved in. Researchers assessed which among six managerial roles was more significant in determining software development success. The study involved two surveys in which one was an internal IT project whereas the other was outsourced IT project. From the study, the project manager involved in outsourced software development project had a very low experience as compared to managers who were involved in internal software development projects. Henceforth, personnel leader role was, more critical to the success of an internal project manager than outsourced project manager (Gottschalk & Karlsen, 2005, p. 1137).

Moreover, the success of software development projects depended on the interactions of organizational culture and other organizational factors which were reported by Ifinedo (2007). In this study, the writer assessed how organizational culture structure, size, and IT factors, interact to determine the success of ERP implementation. The study was based on data collected from over 470 firms in Estonia and Finland. The outcome of this study indicated that organizational culture, structure, and size were all important factors in software development projects. Software

development factors were the moderating variables in this relationship. All these factors collectively acted to determine overall software development success. However, this research has a limitation in that its personal biased due to the fact that the selection of participants firms was not random (Ifinedo, 2007, p. 28-39).

2.6.2 Organizational Structure

Organizational structure is also one of the key players in influential effect on software development projects either in the success or failure scenarios. Accordance with Sarif et al. (2016), the organizational structure is one of the major organizational factors that influence the outcome of a given software development project in an institution. In this study, data were collected by the author from over 89 project managers and team members involved in software development and its implementation process in government agencies in Kuala Lumpur and Putrajaya.

Out of the findings got from this study, the organizational structure was rated as the main issue projecting a percentage of 93% indicating that it influences project outcome in a greater deal as compared to the other factors. In particular, this factor influenced the adherence to costs, technical objectives and deadlines (Sarif et al., 20116, pp. 1-6). Perhaps a more detailed case study on the organizational structure was done by the research which was conducted by Chege (2014) to determine its effectiveness towards project development and its implementation. He identified that top managerial body support to middle level and then lower level management as a vital and critical factor in the determination of software development project success.

Moreover, Mahoney and Wixon (2008) also recognized that organizational structure played a vital role in supporting project outcomes and their managerial process. In both cases, the supportive organizational structure is one that has got the potential and ability to handle soft

issues such as culture, beliefs, employees' motivation towards IT adoption and use and values through effective IT governance procedures carefully introduced across all levels of the organization.

In addition, Mburugu et al. (2016) investigated the influence of the organizational structure of software development by drawing focus into management and implementation process of electronic project monitoring information system (e Pro MIS) for institutions of higher education in Kenya. Data used for analysis in this study were collected from 162 members of staff who were subjected to a survey. Authors used complexity, formalization, and centralization as major indicators of organizational structure. In tertiary institutions, centralization organizational structure was highly used as compared with others, where complexity organizational structure came second and lastly formalization organizational structure.

Ideally, by this centralization organizational structure, decision-making was mainly done at the topmost managerial body. Interestingly, both centralization and formulation organizational structure recorded a higher performance in implementation of e-ProMIS than those who employed complexity organizational structure. Out of these facts, then a conclusive argument can be drawn that complex structures are an inappropriate way of implementing some of the projects such as e-ProMIS. As other studies with shortcomings, this research had limitations since generalization of the study findings given the specificity of the context in which it was conducted (Mburugu et al., 2016, p. 50).

Regarding Saylor (n.d.), normally organizational structure is an ideal way and more effective tool in achieving most of organizational objectives and goals. Usually, the structure itself eases coordination processes and procedures between persons interacting within an organization.

Formalization, centralization, bureaucracy, and complexity are the main types of organizational structure. Formalization structure refers to written policies and organizational rules that formalize internal procedures of the organization. Major objectives of formalization organizational structure are to control employee's behavior through utilizing formalized and well-articulated policies. Therefore, decision power by working force is controlled when addressing issues since work processes are to be referenced from articulated policies and rules (Eynali et al., 2014)

On the other hand, centralization organizational structure is majorly where decision-making power is centralized to the higher levels of management. Most of the decisions are formulated by the higher positions in the hierarchy and passed down the line to the employees. It is therefore found out that centralization structure, usually having the heavy weight of responsibilities to decision-makers as the progression of the organization depends on judgment capabilities of the high-level manager (Eynali et al., 2014)

Moreover, bureaucracy, states that set of regulations are set to control efficiency and effectiveness of activities within the firm. Bureaucracy also refers to the organization of social relations through the administrative approach and employment of legal rules within the metes and bounds of an organization (Grigoriou, 2015). According to Daft (1998), complexity illustrates a number of managerial and staff position in organization setup. Mainly it refers to job titles, description of the job, hierarchical levels and other several job factors that exist. Gresov and Drazin (2007) stated in their work that there were two main types of complex structures namely; vertical and horizontal.

Influence of organizational structure on the implementation of software development projects is acknowledged by Ravasan et al. (2015), through their investigation on various influences of organizational structure on implementation Enterprise Resource Planning (ERP) systems. In similarity to Mburugu et al. (2016), so did the authors base their argument on analyzing data from three traditional variables that defined organizational structure: formalization, centralization, and complexity.

Moreover, in this study, CIO position and organizational size were also added as variables of organizational structure. Data collection was done through the usage of a questionnaire which involved 203 participants from Iran. Questionnaires were administered to project managers, main project users and key project members involved in ERP implementation. The study established that organizational structure played a vital role in software development project, their implementation, and management strategy. A critical part of these organizational structure forms was in the influence of coordination of all organizational elements to achieve the desired goals and objects of the project in hand. Although findings from his research differed slightly from that of Mburugu et al. (2016) since high degrees of centralization, formulation and complexity were indicated as the most effective ways of controlling software development projects.

Additionally, to these findings, CIO and size of the organization were also discovered to be more effective in the success of software development and their management scheme. However, the only limitation of this study was a low generalization of the findings and the absence of strong theoretical background to support this study (Ravasan et al., 2015, p. 39).

Another affirmation was done by Idemudia and Gbaraka (2016) on the significance of organizational structure on software development and their implementation process. The

research was done in banking sector firms. In this study, the authors involved about 90 participants who were projected members and project managers from 10 banks involved with software development projects and implementation of those projects. As the research was done, the focus was drawn upon major organization structures which were formalization, complexity and centralization ways on how they affect project outcomes.

Authors of this research discovered that apart from complexity, formalization and centralization structures, another factor affecting success of a software development is an individual perspective, through the interaction of these persons ineffectiveness of developing projects necessary to the given organization. Although it may be impossible in the elimination of differences among individuals in software development within a given organizational structure, project managers should ensure that all structural differences, including the conflict between team individuals, are politely resolved.

Research by Nandi and Kumar (2016) probed further into impacts of organizational structure especially the centralization structure towards its influence in software development scheme and implementation of such. Authors engaged in a quantitative cross-sectional survey in the collection of data from 51 Indian organizations that had previously been engaged in software development and implementation. Collection of data from these project managers was done by the use of a structured questionnaire.

The success of these software developments was measured against user acceptance of that particular software system. Establishment of this research indicated that different types of centralization structures affect project success in different ways. For a start, policy-related centralization (related to policy decision-making) was found out to have a negative impact on

acceptance from users on software projects developed. On the other side, work-related (related to the employee autonomy) had an adversative impact on the utilization of the systems. Following their research basing an argument on negative implication of centralization structure, they were quick to conclude that decentralization of organizational structure to be appropriate in ensuring success in software development projects, hence opposing centralization. However, this contradicts findings from Mburugu et al. (2016) and Ravasanet al. (2015). Outcomes of this particular study though could be highly compromised by the failure of authors considering project-related factors while assessing influences on success of the software development scheme (Nandi & Kumar, 2016, p. 728).

Decentralization structure has also attracted more influence to software development projects when compared to centralization. Lee et al. (2016) set on to investigate how organizational structure impact software development schemes within organization setup. Their focus was driven to innovation of software development projects through sampling of 2,811 open source projects. Findings from this study, established that in a decentralized organizational structure, ideas given in software development process are not omitted, although it may suffer from acceptance of wrong ideas.

Despite this shortcoming, overall effect of decentralization structure is an enhancement of inbound and outbound innovations in project that are open source. Superiority of decentralized organization structure in enhancing innovation owes to the increased autonomy it grants project members. Officialdoms that may limit creativity of software development project members in a decentralized structure are fewer when compared to those in a centralized structure (Lee et al., 2016). Luna-Reyes et al. (2008) did illustration on organizational structure influence to software development system. Focusing more on how formation of organizational forms and institutional

arrangements affect outcomes of a given software development project scheme. This research took place in Mexico government.

Achievement of this objective by the authors, they collected data on a sample of government projects by interviewing project managers. Establishment from this study was found out that institutional arrangements were critical to realization of software development schemes in government projects. In precise, the frameworks guiding collaboration between government ministries involved in software development and their implementation ways played a vital role in determination of overall outcome of projects at the management stage.

Major Key institutional arrangements factors that influence outcome of software development project consisted of culture, legal and social relationships between different government agencies. However, on the other hand, bureaucracy and relationships were most critical success factors related to organizational factors. Doherty et al. (2010) did another view on organizational structure towards its influence in software development process; they state that organizational structure is a two-folded structure. At one hand, implementation and management of software development projects lead to modification organizational structure. While on the other side, organizational structure of a company is a critical determinant of software development project success.

Collection of data was done from interviewing project managers and team players involved in software development projects and their implementation process. It was established that software development systems implementation led to the flattening of organizational structure, decision-making through decentralization and increased levels of horizontal integration. Changes of organizational structure witnessed during software development process implementation were

greatly attributed to requirement of adjusting organizational structure to fit different software development project (Doherty et al., 2010, p. 116-31).

2.6.3. Organizational Communication

Generally, communication is a very influential tool in any organization or any setup not only to software development but in general interaction effectiveness. Communication is a very influential pivot in software development projects in every organization. When assessing influences of communication quality on software development projects succession, Aubert et al. (2013) conducted a case study in a large international manufacturer. The particular manufacturer was engaged in enterprise resource planning (ERP) implementation projects that entailed deployment of SAP software and related organizational changes.

According to findings of this research, it indicated that influence of different aspects of communication quality depended on success dimension under consideration. By authors' view, communication quality can be attributed to user-related attributes. However, communication quality on technical competence is minimal on project outcome. Another aspect of communication was communication content which had an equal measure to communication quality. Conclusion by authors on this was that project managers must ensure enhancement in their communication quality to different stakeholders if they are to enhance success on software development projects. Even though, this research has limitation given that its findings are based on a single case study and different patterns may be observed if other contexts were to be explored (Aubert et al., 2013, p. 64).

Another research suggests that absence of effective communication quality, especially for global software development projects, increase like hood of project failure or leading to its achievement

of moderate success (Imtiaz et al., 2013). Unproductive inter-departmental and cross-functional communication increases risk of failure to a greater extension of developing software. Moreover, according to (Imtiaz et al., 2013), organizational communication, employee feedback and frequent team meets between organizational employees and project teams are some highly favorable factors in maximization in probability in software development success.

A further research by Taylor and Woelfler (2011) highlighted importance of communication quality towards influence of successful software development project in an organization. As such, their focus was drawn to intra and inter-organizational communication strategy as most of critical factor in IT project success. In addition to realization of how important leadership is towards project outcome and even team work communication (Taylor and Woelfler, 2011). According to these authors (Taylor and Woelfler, 2011) presence of effective communication and collaboration skills among software development has been recognized to be crucial too towards software management.

Communication clarification may be considered as the best tool to stakeholders' communication effectiveness that may influence success of software development. Rammos and Mota (2014) explored failure and success factors in software development projects. To achieve this, an explanatory survey was conducted involving software managers and other key players to determine how various companies in Brazil perceived different success and failure factors. From this study, clarity of language usage in communication was the major cause of ineffective stakeholder communication ways. Precisely, some of clients could not understand some of terminologies used in communication as they were IT oriented. Failure mainly comes when IT experts tend to explain some of technical concepts to their clients hence causing process dysfunctions.

The situation was similar to Brazilian context; in those ineffective communication situations was one the major factors that led to failure in project management. In some of crucial instances, stakeholders did not understand need of communication as it made no mean to them. In a situation, a common place of disagreement was generated in the organization and stakeholders' ineffective. However, this research was biased based on number of respondents, hence causing it a great setback in its findings (Ramos &Mota, 2014, p. 350-57).

De Aranjooand Pedron (2015) affirmed findings of Ramos and Mota (2014), in a study of investigating the non-technical skills that influence outcome of a software development and its management process to achieve its successfulness. Through the findings of this author, it indicated that leaders should express all required qualities and skill in conveying important information to different stakeholders involved both directly or indirectly to that particular project, stakeholders maybe shareholders, other employees and clients.

Normally, software development leaders are viewed as critical players in execution of information in project development situations, it is therefore, wise for leaders to nature their qualities ensuring success influential effect in software development. Essentially, they are required to understand clients' needs then translate this particular information to technical team using IT terms which developers and programmers understand. Moreover, they should translate these technical language terms from programmers and developers for clients to understand in a clear language. Without effective communication platform at leadership level, may lead to conflict and continuous problems between clients' requirements and product delivery form (De Araujo &Pedron, 2015).

Naqvi et al. (2011) assess impacts of stakeholders' communication basing their arguments from findings obtained from software development companies in Islamabad, Pakistan. During conduction of this research, the writers targeted 70 heterogeneous projects from 24 software companies. Success or failure of these software development projects primarily relied on the effectiveness of stakeholders' communication strategy. Precisely, it was discovered that 66% of software developed remained effective due to correct communication technique with stakeholders while the reset percentage failed due to poor strategies in communication between organization and clients.

Perhaps, communication was the major tool in determination of project outcomes with regards to quality in stakeholders' communication and more importantly their demands considered. Failure to prioritize stakeholders' communication as a success factor was attributed 29% of projects that suffered cost overrun, scope creep, delays and client clarification. Furthermore, authors are quick to note that other factors that influence success or failure of software development projects should never be ignored instead their effectiveness targeted to stakeholder communication strategy. However, design of this research failed to recognize other key factor related to stakeholder communication that attribute to software development success from the 70 sampled companies. The provenance of all projects' accomplishments to operative stakeholder communication and all project failures to standardization stakeholder communication constitutes grounded reporting (Naqvi et al., 2011, p. 5824). Additionally, Flannes et al. (n.d), states that some of factors of software development completion relies on technical aspect heavily in effectiveness of that particular project while overseeing people issues that are involved. When project needs increases then does technical requirement increase too, hence bring out effectiveness of an individual in software development designing process.

Consideration of a study conducted by Flannes \and Levin (2011), communication is the best foundation in effectiveness of software development outcome as stated by these authors. Thus, project members should be able to communicate effectively amongst themselves so as to address project issues and align direction of project track path. In order to dispose project information effectively, proper procedures for information generation, collection, dissemination, validation and storage should be clear. (PMI, 1996) Henceforth, information passing and communication control is one of the most critical factors that influences outcome of a software development project. Therefore, all stakeholders involved in software development project in a timely dissemination and information transmission technique embraced to achieve desired goal and objective should ensure communication passage.

Communication quality was also identified by Wilfong (2014) as a key factor to software development projects and even in their management practices. His research sought to discover how project environment could be improvised in order to ensure effective success in project development process and throughout its maintenance. Outcome of his study, it was clear that communication played a very critical role in project success given the role it did in organizations by creation of relationships.

Moreover, other very significant aspects that respondents found more effective in project influence were like timeliness, precision and frequency. Virtual connectivity was found to at the topmost point as it played a pivotal role in software development success determination. Since stakeholders are situated in different location globally most of their meetings were done through internet connection, whereby at some points they could hold meetings in their working places. Hence, this connectivity enhanced the frequency of meetings and communication.

Communication consistency, especially from project managers, was also cited as one of other major issue in success of software development process. Besides building of good relationships, high-quality communication in software development projects is concluded to be enhancing trust, especially between team members and team leaders, which essentially was critical to software development process success (Wilfong, 2014). Besides, in another research by Xie et al. (2013) it was clear that communication was a great influence factor to success of software development projects in any organization system. Focus of these authors was of software implementation in hospitals. In their research, they collected information from various hospitals in Dublin County on how communication and organization culture affect the effectiveness of software development projects with their implementation.

It is contended that communication in software development and implementation process is very complex given the need to take into consideration of different adaptively strategy, mentalities and thought patterns of the different stakeholders involved. Particularly, effective communication method is necessary for adapting into changes arising from implementation of information technologies. Internal organizational communication channels should be effective such that it creates links amongst key players in project development and hence flow of information is improved.

Besides, communication channels should be effective and clear, in order to improve project success. From this study, it is noted that factors, which limits communication channels such as multiple layers of bureaucracy, led to ineffective communication, hence inhibiting software development success. Effective communication was also found as one of major critical issues that enhance changes in organization management (Xie et al., 2013, p. 165-73).

2.7 Chapter Summary

Entirely, this chapter entailed a very comprehensive literature review of the available empirical evidence with regards to various aspects that affect success of software development processes and their effective ways of managing them. While focus was given to published articles and other publications in peer-reviewed journals, certain other sources, including organizational websites and other students' works. The chapter begins by identifying various challenges facing effective methods of handling software development projects. Through this, many challenges have been pointed out to ensure they are addressed effectively.

In the subsequent paragraphs, various factors have been selectively placed out to show how they affect software development process in their own perspective ways. Most of these factors are organizational related as they outline issues that hinder or ensure success in project development. Some of these factors included organizational structure, organizational culture, and organizational communication. However, each of them has some critical success factors that influence effectiveness of project development.

CHAPTER 3: SCRUM METHODOLOGY

3.1 Scrum Introduction

Currently, the expansion team in trading with the provisions of clients is facing numerous important encounters. Along with the fluctuations in necessities, adjustment of contemporary technologies requires to face threats with respect to the traditional approaches of developing software (Beedle, 2002). Increased competition level of the software in market also raised the need for adaptable and adjustable methods of developing software with high ease of change. Due to the altering behavior of software market, companies commenced the enforcement and adoption of wavering, altering and emerging drift of methodologies to develop software generally called as Agile development (Schwaber, 2000).

The main attention here is to confront the varying needs of software market and efficiently handling them (Schwaber, 2000). Takeuchi and Nonaka granted a quick, changing and reconciling process of software development (Takeuchi & Nonaka, 1986). Subsequently, in 2002, Schwaber and Beedler together processed SCRUM and reported their work (Schwaber, 2000). SCRUM, a light weighted agile methodology to develop software, small iterations are used by SCRUM. The main aim of SCRUM is to respond rapidly to modifications. It follows a substantial way of developing software than other traditional approaches as shown in the figure

below

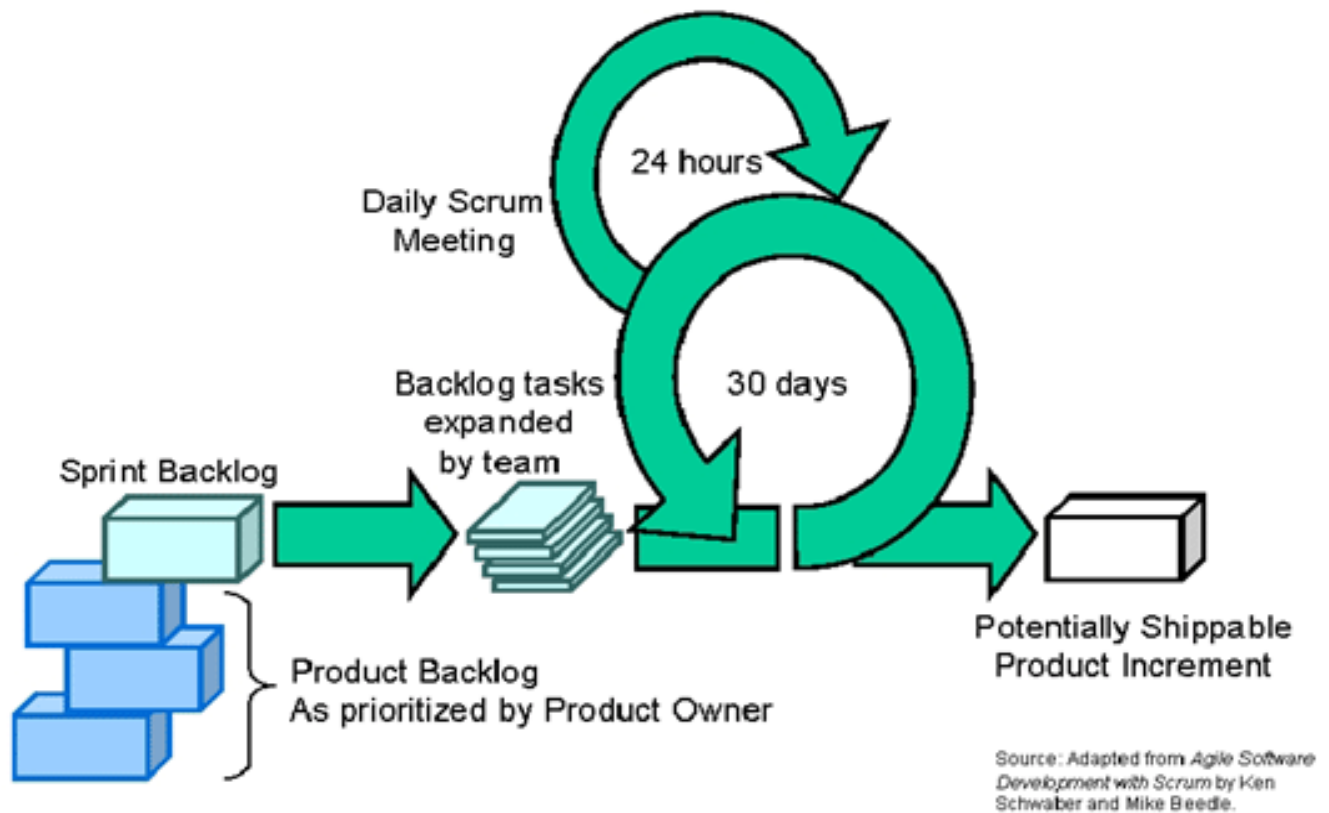


Figure 2: scrum process

The fundamental idea behind this approach is that development of a system depends upon several uncertainties which include technical, unstable and incomplete requirements, time bound infrastructure, resources and other technologies to develop. SCRUM affords such compliances in process of development that delivers a system efficiently before deadlines to the customer.

3.2 Stages in Scrum Process

SCRUM methodology comprises of three phases. The following section describes the various stages in SCRUM process (Beedle, 2002). Moreover, this ensures that software development is

done effectively. Through this process, every step is monitored and evaluated to ensure SCRUM practices are achieved.

3.2.1. Pre-Game Phase:

Planning, utmost design and architecture phase in a software development life cycle are covered in this phase. The necessities come from customers, marketing team and developing team.

Prioritization of these requirements is accomplished and assessments are acquired which are later joined to product backlog (Nerur, Mahapatra & Mangalaraj, 2005). Updating of the list is made next to respective iteration. Members are selected to commit for the project in this phase. This phase also includes planning of tasks such as managing risks, controlling and choosing resources and tools (Schwaber, 2000). Designing architecture of system, depending on product backlog is attained at this stage. In order to interpret the design and comment it for adjacent phases of life cycle, as eminent meetings will be conducted by the termination of pre-game phase (Beedle, 2002,).

3.2.2. Development phase:

Game phase is another name of this phase. Here, alterations are predicted and any unpredictable changes were contended to admitted them, repeated cycle that include system increments are developed called sprints (Schwaber, 2000). Generally, a sprint comprises about 2-4 weeks of cycle. Each sprint includes planning till implementation phase proceeding with phases of delivery. By end of each sprint, few deliverables that needs to be acquired unlike teams can function over unlike increments in several sprints (Beedle, 2002). Based on the projects nature, the total number of sprints of a system may vary.

3.2.3 Post-Game Phase:

This is the final stage of SCRUM, just prior to release of system. It begins once all requirements are performed. Tasks such as system quality assurance, module integrity, and integration documentation are performed in this phase (Schwaber, 2000).

3.3. Scrum Roles

SCRUM has several roles, they are discussed them in the below section.

3.3.1. SCRUM Master:

This is a role of the management is to promote development team and abolish all hurdles that induce obstruction throughout sprint. It plays a major lead in perpetuating an apparent environment for promising, cooperation and communication among members of the SCRUM team. He acts as a coordinator among customers and members of project (Schwaber, 2000).

Usually SCRUM masters are someone with high experience in industry to perform functions easily. The tenets of SCRUM to be pursued are the team members' duty. During the meetings of daily SCRUM are resolved and facilitated by SCRUM masters. They always aim for improvement of team members' performance (Beedle, 2002).

3.3.2. SCRUM Owner:

Needs of the customer are prioritized by the SCRUM owner and he assures that the project confirms to requirements of the customer and he make sure that needs of business are being approached properly (Schwaber, 2000). He observes if all the team members are developing accord to needs of customer. He also checks if the direction of all the efforts. SCRUM master modifies and sustain the product backlog. None other than the SCRUM owner can alter the product backlog. SCRUM owner to team members (Beedle, 2002) explains requirements.

Discuss upon the status of the project if it is done systematically. SCRUM owner handles the approval or rejection of requirements.

3.3.3. SCRUM Team:

They are the authentic members obliges for activities such as analyzing requirements, designing the system, implementing the design and testing the developed system. There can be around three-eight people involved in the SCRUM team. They organize themselves and in case of hazards they inform to SCRUM MASTER. Individual progress is updated to the rest of the team members by participating in SCRUM meetings conducted daily in reciprocate environment (Schwaber, 2000)

3.3.4. Customer:

The customer deals activities concerning the requirements. Customer's perspective is given high importance. Satellites of customer can also meetings conducted at sites that develop (Nerur, Mahapatra & Mangalaraj, 2005).

3.3.5. Chickens:

These are dedicated to work with the project by taking responsibilities officially (Schwaber, 2000).

3.3.6. Pigs:

These people are the one who is dedicated to work with the project by taking responsibilities officially (Schwaber, 2000).

3.4. Scrum Meetings:

SCRUM methodology involves several meetings throughout the development (Schwaber, 2000).

The meetings in SCRUM are discussed in detail in this following section.

3.4.1. Sprint Review Meeting:

Process of SCRUM begins with a sprint-planning meeting. This meeting is anticipated for eight hours. In this meeting, managers and customers meet the SCRUM team. The product owner before start of the meeting prepares product backlog. He demonstrates the prioritized information. Team is left for discussing their perspectives. They altogether conclude the activities for the SCRUM in sprint. Capability of team, delivered items by end of the sprint and scalability of the technology are considered while meeting the decision and strategy will be prepared by the whole team for enabling the activities to be delivered before sprint terminates. All the members of SCRUM team should actively participate and communicate their views. Product owner to all members should share product backlog.

3.4.2. Daily SCRUM:

The members of the SCRUM team meet daily once in the morning in order to update the daily progress of work. The meeting is conducted for about 15 minutes. Each member of the teams should answer the three questions (Schwaber, 2000):

1. “What did you do yesterday?”
2. “What will you do tomorrow”?
3. “What obstacles are in your way”?

3.4.3. Sprint Review:

This meeting is conducted during the end of the sprint. The whole work done by the entire team throughout the sprint will be demonstrated. Management, customers and product owner will actively partake in meeting. Generally, it lasts for 4-5 hours duration (Schwaber, 2000). Each

member saves Deliverables of the sprint. Only achievements of team will be discussed. Experiences of the team members are shared.

3.4.4. Sprint Retrospective Meeting:

Team, product owner, SCRUM master attends the meeting, which lasts for three hours.

Achievements in the on-going sprint will be discussed. Things that need to be improved in successive sprints were also discussed. The SCRUM master (Schwaber, 2000) will note all the answers down.

3.5. SCRUM ARTIFACTS:

SCRUM uses several artifacts for storing the information regarding the project (Schwaber, 2000). These artifacts are discussed in detail below:

3.5.1. Product Backlog:

All the recovery activities that are to be performed by team will be listed here. Product owner maintains it. All the activities throughout the project will be included here (Schafer, 2000).

Declaration of all required functionality tasks and prioritized. Several features related to the project being developed will be included. In order to help to product owner in assessing the precedence and time bound, expected days are also enclosed. Requirements that are both functional and non-functional will be listed out (Schafer, 2000). Precedence of requirements is made in an efficient way.

3.5.2. Sprint Backlog:

It includes the tasks to be performed by the team members in the on-going sprints. Time required to finish unlike features and precedence are considered while selecting items for sprint backlog from product backlog once sprint is sealed, no modifications can be done for that

sprint(Schwaber, 2000). Procedures can be changed according to teams' willingness. Defect tracking system, excel sheets can be used for both sprint backlog and product backlog. Development team is responsible for updating, sharing and communicating the status with product owner and SCRUM (Schwaber, 2000).

3.5.3. Burn Down Chart:

The relation between the work left out and duration will be represented graphically (Schwaber, 2000). Burn down charts are created by using excel sheets, whiteboards and SharePoint. The project management does Creation and maintenance of burn down chart. Daily it needs to be updated.

3.6. SCRUM Practices

A practice is an activity that is repeated repeatedly to improve or achieve specific goals; it's unlike the process where one has to follow a fixed sequence of steps to achieved guaranteed results. In our study we investigate about SCRUM practices currently used in the industry in accordance with their usage and effectiveness.

CHAPTER 4 RESEARCH METHODOLOGY

4.0. Introduction

Methodology of this research emphasizes on collection of data through conduction of interviews and surveys through questionnaire. For both interviews and survey, there is data analysis, which is followed by using the required techniques and tools to derive a realistic outcome. The method is relevant in attaining objectives of the research (Lin, 2011). In the chapter, procedures and methods used have been highlighted in preparation of final closed ended questionnaire. This data will be analyzed using the tools and techniques appropriate to ensure effective results are reached for. The results will be determined in the contextual of relation between the dependents and independents variables (Uyamka& Guler, 2013, p.234-35).

4.1. Research questionnaire design

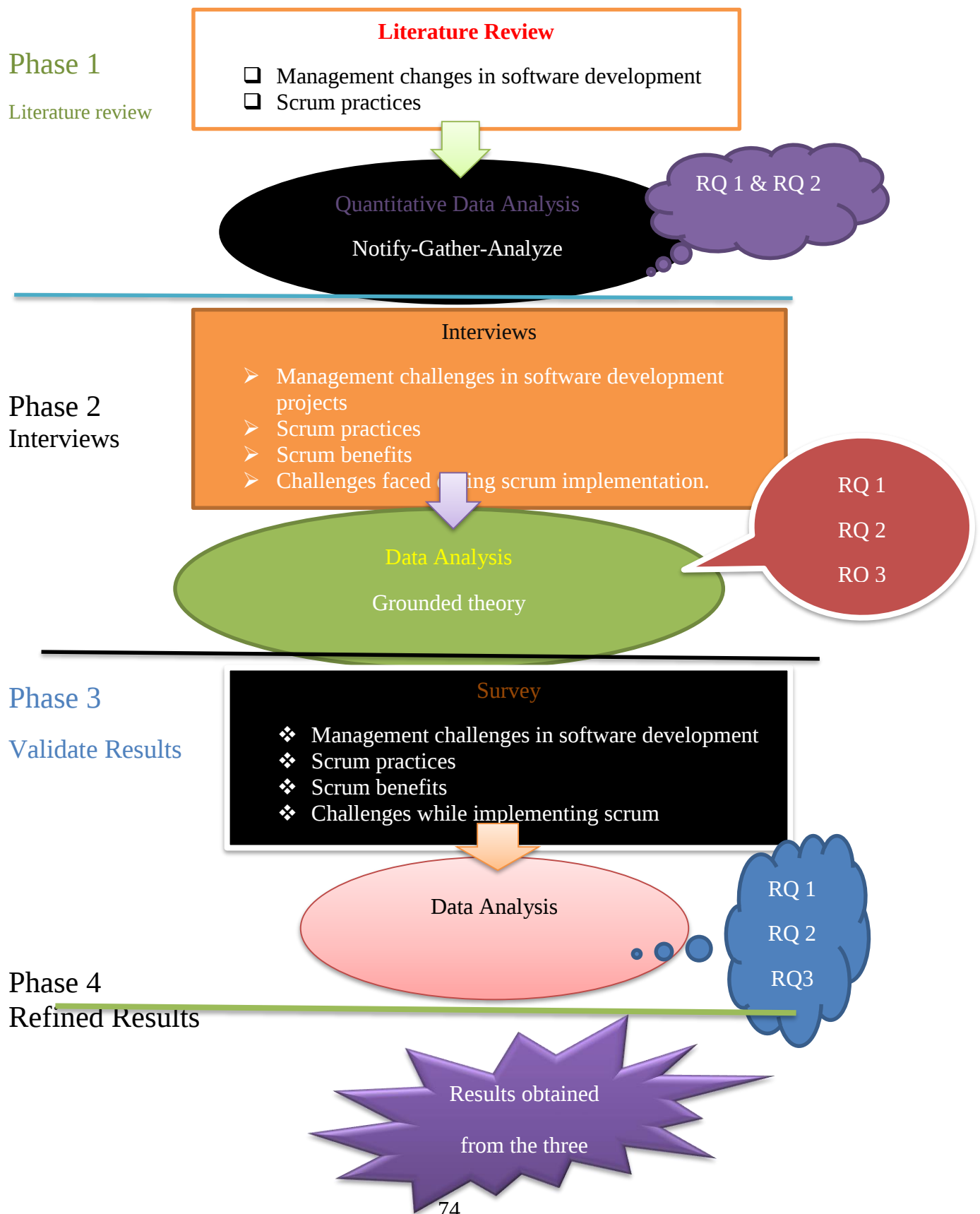
In order to fulfill the required objectives outcome, a research study is employed on quantitative research method for data collection. Both survey and interview methods were used in data collection, whereby, questionnaire for survey were distributed to team members and project managers of different IT projects. Questionnaire was aimed at collecting quantitative data. A standardized questionnaire structure was used. The standardization of a questionnaire enables one to compare and contrast easily various data gained from different respondents (Cargan, 2007, p.90). Moreover, use of structured questionnaire is one of the most effective ways of collecting quantitative data (Moore, 2006, p.141). Therefore, in a structured questionnaire all participants are scaled upon Likert scale. The scale mainly measures attitudes of individuals in that particular subject. Respondents were requested to answer to the question depending on the scale which was designated as strongly agree and strongly disagree.

Questionnaire was a semi-structured type in essence. The implication was that as long as the questionnaire had a predetermining sequence, mainly including general information in the initial stages of questionnaire, the other part of this questionnaire developed as survey proceeded forward. Additionally, attention was given to closed-ended questions, which included both, Likert questions and importance questions. Importance questions, as evidenced from the name itself, tend to gain participant's opinion regarding to the specific topic of discussion. Whereas, Likert questions, tend to share the extent to which participants perceive the influence of various factors affecting the efficiency management of software development projects.

Participants are scaled using Likert scale. Mostly this scale has got numerous advantages which favor its usage. For instance, its reliable, easily administered, attractive model, measures different attitudes and it has been used in several studies with positive outcomes (Nunnally, 1978). Hence, Likert scale was appropriate for this particular study. Likert scale questions, subject participants to a range of choices, normally 5 or 7 in total as per standard of research. Below are benefits of Likert scale:

- ❑ Likert scale simplifies accomplishment of quantifiable research studies, drawing analytical conclusions, graphs and other similar responses.
- ❑ It's a universal method for primary collection of data, easy to understand and interpret.
- ❑ Its questions do not pressurize respondents in answering in agreement or disagreement, hence allowing them to be neutral in their ideas.

Figure 3: research model



4.3. Research questionnaire structure

Both primary and secondary data was collected. A semi-structured questionnaire was used in primary data gathering. The questionnaire was sub divided into 3 sectors containing closed-ended questions. First sector, involved gathering general information of the respondent. It included name, profession, experience period and time of management. Section two, was further divided into 5 areas consisting of questions regarding to different organizational factors, organizational structure and project management process. Closed-ended questions were used in all of the sectors with a clear link to software development project management. Third sector, involved questions on project success, this sector also comprised of 3 parts, subjecting participants to share their own perspectives associated with software development schedule, budget costs and usability.

Communication on ethical consent was declared to every participant prior to this study to ensure elimination of any ethical issue was addressed. Ethical consent pointed out clearly that this study was entirely for academic purposes, hence, the information provided will not be used for any other reasons unknown. Also, informing respondents on their legal rights on complete anonymity and confidentiality of responses provided.

4.4 Validity Threats

Validity threats must be dealt to determine the major components that influence the exactness of the findings. In this section we mentioned several threats, related to our study. Actions were performed by authors to reduce and deflect the disconfirming effect of each validity threat.

4.5.1 Internal Validity

“Internal Validity is the approximate truth about inferences regarding cause-effect or causal relationships” (Trochim, 2005). During the conduction of interviews notes were prepared; ensuring no use of data was experienced throughout the exercise. Moreover, transcripts were prepared after every single interview done. Later, transcript data was emailed back to interviewees for confirmation of information was well entered, through this, internal validity was reduced.

4.5.2 Conclusion Validity

Conclusion validity is the degree which the conclusions reached about relationships of data obtained are reasonable” (Trochim, 2005). Normally, it is hard to make decisions using only six companies. In order to overcome the threat, conduction of survey was carried out to strengthen on the findings established by interviews. In addition, literature review was conducted too. Therefore, it may not be treated as a study work limitation.

4.5.3 Construct Validity

“Construct validity involves generalizing from your program or measures to the concept of your program or measures” (Trochim, 2005). In this study, data was gathered through various ways, interviews were done, surveys were conducted and reviewing other literature work was done. Due to inconsistency in data collection, it will be hard to come up with a comparison basing on the different methods of outsourcing information, which is known as data triangulation process. In regards to data categorization, data obtained in this research paper may have shortcomings which were experienced during data mining through secondary sources and more so through primary method. Some of the challenges and practices are similar although applied in different

situations, hence leading to a wider confusion. However, this reduction in confusion has been addressed by using different citation to bring out differences.

In determining primary studies, normally, the major reason behind literature study is to collect as many studies relevant to software development project management challenges and SCRUM practices. In the initially stage, use snowball technique to gather articles was the plan by making use of a most recent systematic literature review as basis of this study. After following snowball sampling, it occurred that much paperwork for reviewing was left untouched. Hence, consideration of this as a technical threat. In order to overcome this threat, usage of search terms based on our study. Several combinations of those search terms were used to gather articles related to project management challenges in software development and Scrum practices in software development failure and effectiveness at the similar time.

4.5.4 External Validity

“External validity is the degree to which the conclusions in your study would hold for other persons in other places and at other times”. Population threat: Participants in interviews and surveys for our study are from different organizations and dissimilar backgrounds; different roles in the organization, different kind of projects. Furthermore, we have conducted our study with organizations from Asia, Europe and Australia. These organizations again work for organizations across USA, Asia, Africa, Australia and Europe which involves several people with different cultures and domains. It gave more strength and quality to the data gathered. Generalization over time: Nowadays, market trends are continually evolving with several technologies and tools. Several practices are being used by the organizations according to their convenience, Therefore, assuring the generalization of the findings cannot be done.

4.6. Conceptual Model

In this study, a very high-level theoretical outline has been derived that is based on existing literature to link organizational aspects, as independent variables, to the achievement of software development projects, as dependent variables. As proposed by Zidane et al. organization can fall into different five categories, which include: organizational culture and style, organizational structure, organizational communication, organizational process assets and enterprise environmental factors (p. 163). The study is grounded upon and builds upon existing literature regarding organizational factors that influence software development projects succession, particularly, software application projects. It is therefore, assumed that each independent variable works differently towards influencing the software development project, and even if, the overall project succession is a representation of all the accumulative impacts of these individual independent variables.

Each of these five variables is comprised of various critical factors that are considered as success issues towards success of a software development project, as suggested by the existing literature. Under organizational style and culture, major influential factors towards project success include leadership style (Chan & Mills, 2011; Shore, 2005; Gottschalk & Karlsen, 2005; Randeree & Ninana, 2011; Ng & Walker, 2008), managerial capability (Blaskovics, 2016) and top management support. On the other hand, the organizational structure category will consider centralization, formalization, complexity (Mburugu et al., 2016), bureaucracy and social relationships (Luna-Reyes et al., 2008) as the main factors determining the success of IT projects.

Organizational communication section of autonomous variables focuses primarily on communication quality (Aubert et al., 2013). Due to the fact that focus of this research is on the

effective method that influences project success, internal communication will be prioritized. The effectiveness of communication with external stakeholders such as the suppliers will only be considered from the project team's side. The organization process assets variable will be composed of the skill level of project members (Handzic et al., 2016; Kendra & Taplin, 2004), PMO/steering committee (Francis, 2015; Stewart, 2010; Ward & Daniel, 2013; Karimi et al., 2000), the project management methodology, and historical data of past projects (Ali et al., 2008; Gowan & Mathieu, 2005; Tesch et al., 2008) Lastly, the enterprise environmental factors category focuses on the factors within the internal environment including information sharing, flexibility, training, and willingness to change (Soja, 2006). Although the environmental factors that affect the success of IT projects include factors in the external environment (Agrawal & Haleem, 2003, p.27), this study only considers the internal environment.

The dependent variable – the success of IT project – will be considered at the project level only. The success evaluation metrics of the project were based on the existing literature discussing the success indicators in traditional projects and IT projects (Wilhite & Lord, 2006; Vivant, 1999; Misra, 2004; Hughes et al., 2004). The metrics that were adopted for this study include time (schedule), cost and end-user satisfaction. The use of time as a success criterion is based on the adherence of the IT project to the set schedule. The assessment of project success based on cost is founded on the project's adherence to the set budget with no significant cost overruns. On the other hand, the end-user success measures are based on the reported effectiveness of the resulting IT product as assessed by the end users.

4.7. Pre-Test

Many efforts were made to ensure a standardized research practice was achieved to a great extent, therefore making the questionnaire to be subjected to a pre-test scenario. For this case, 10

participants were picked randomly to submit their responses against the sections of the questionnaire. Pre-test proved to be influential in terms of determining effectiveness of the questionnaire in fulfilling the research objectives. Furthermore, pre-test proved to be adequate for descriptive and statistical analysis, hence anticipated, that questionnaire was effective for research objectives set forth. Although, some minor changes were done to the questionnaire relating to communication sectors as the clarity of questions was demanding to participants. By this exercise, full participation of answering questions was achieved. Refer to the appendix for full copy of questionnaire.

4.8. Research methodology

This thesis is naturally exploratory. There is both use of quantitative and qualitative methodology involvement (Seaman, 2009, p.568). In the first phase of this research, research question 1&2 were answered by conduction of survey and interviews on software development projects and scrum practices used in software project development. Systematically, the survey played a great role in this study (Hossain, Babar, and Paik, 2009). The snowball technique was used to go through all the references cited in the works to show how relevant it was based on research objectives and goals. Collected data from the online survey was analyzed using qualitative data analysis technique, Notice-Collect-Think (Seidel, 1998). The results are in chapter 5.

Second phase, research questions 1,2 & 3 were answered through conduction of 20 industrial interviews of indifferent software organizations located in different demography in the global scope. The grounded theory was applied in the analysis of the collected information.

In third stage, online survey was conducted (Creswell, 2002). Major intention of this exercise was to investigate further on the results obtained through literature review and interviews in

order to investigate critical concept of management challenges and scrum practices which had been reported both in empirical study and literature review.

4.8.1.0. Interviews

Mainly, interview forums are used to gather historical data from the respondents' memories and collection of data that cannot be done through quantitative way (Milewski et al., 2008, p.27).

Mostly, interviews are categorized into three sectors, namely: semi-structured, unstructured and structured. In structured interviews, questions tend to be elaborate and clear as possible (Yes-No format). Whereas, unstructured one, is an open-ended asked question as possible, whereby, interviewee is the main source of both questions and answers. Finally, semi-structured interview, combines both unstructured and structured interviews (specific questions and open-ended questions).

4.8.1.1. Data collection

Desired population for industrial study was majorly IT companies having software development projects experiences and using scrum in their organizations. Contact was made through emailing, also by the use of search engine on companies which are known in distribution of software projects using scrum practices. Hence, after identification of these companies, contacts were made appropriately. In this case, semi-structured interviews were used, where some were done face to face while others were done through video conferencing. Then, all interviews were transcribed to avoid interpretations.

4.8.1.3. Interview participants

Some of the major organizations that participated in interview in this research were such as:

Organization 1:

VOPIUM, DENMARK

VOPIUM is a software company that provides free and low-cost international mobile communication via VOLP and Wi-Fi technology. Applications offered by this company can be downloaded directly in the mobile gadgets enabling cheap communication rates, SMS rates and Instant Messaging saving up to 90% on international calling and landline charges. Software works independently of a SIM card or subscriber's mobile network operator. Synchronization, web SMS, just dial and call back are additional features.

Interviewee 1: He is the project manager of the firm. He has an experience of over 12 years in global distribution developed software. He has been attached to this particular company for the past 5 years. They have continuously worked on their product VOPIUM. Team size consists of 80 members and multidisciplinary environment prevailing in 5 offices including Luxernburg, Copenhagen and Lahorc. Case project is to maintain and continuously develop product line and related websites.

Organization 2:

ABC TECHNOLOGIES, INDIA

This organization offers integration of systems, custom based development of software, verification and maintenance services. It is the leading company in India in shoring outsourcing institutions. Offering services with higher quality and reduced risk of acceptance. Provision of customer satisfaction is their main aim. It has got several branches all over the world.

Interviewee 2: his main role is product owner in the organization. Working globally distributed projects using scrum for over 5 years. Currently working on project revenue based on cycle

management system. The team consists of about 16 developers including leads and architect and 9 functional designs from both India and United States.

Organization 3:

SOFT HOUSE, SWEDEN

The company is a Scandinavia's popular software development provider majorly focusing on mobile clients, service systems and outsourcing. Moreover, provide courses on scrum master and product owner certifications.

Interviewee 3: The person works as product owner and also scrum master. Currently, the person is developing accounting software a client. Working in the organization for more than 6 years and participating on software development using agile methodologies for now 3 years. Current team consists of about 25 members from Sweden, Denmark and Pakistan.

Organization 4:

NOKIA, FINLAND

This is one of the world's leading companies in communication platform and internal industries. They provide mobile gadgets, laptops, games and televisions although; their major goal is to provide internet solutions and equipment's.

Interviewee 4: He is the project manager of this company. He has been working in the facility for over 4 years in globally distributed environment using scrum. The current case is on mobile application development project. Developers are from UK, India and Finland.

Organization 5:

XYZ ORGANIZATION, AUSTRALIA

It's one of the major outsourcing companies in finance and accounting domains. Its developing sites are situated in Australia, India and United States. Although, this firm requested not to be revealed to the public, hence the "XYZ" is used.

Interviewee 5: He works as a scrum master for globally distributed project for more than 4 years. For over 7 years he has been working for this particular company. Currently, he is working on a project of developing banking software for a certain bank.

Organization 6:

BIZINTECH TECHNOSOLUTIONS, INDIA

It is a software company provider established in 1896. It has got over 300 customers in the world. It has got experts all over the world providing projects for the HR-payroll, CRM, asset management and distributed systems.

Interviewee 6: Is the technical general management of Bizintech. The interviewee has over 7 years' experience in usage of agile methodologies. Moreover, 10 years' experience in working with distributed projects. Currently, he is working on a project development for computer-based maintenance management (CMMS). Team size is 10. Focus developer, three testers, four marketing members and two business analysts, 6 in India and 4 in Indonesia.

4.8.1.4.1 Interview transcription

Interview 1:

The interview was conducted in two different phases. In the first phase was investigation on the project management challenges faced by the organization in globally developed projects. The

interviewee mentioned that due to distribution of sites globally, there always exist dependent functions being developed in sites and hence it takes too long to deliver the project than estimated. The management doesn't provide regular feedback on their work to the team and the team do not commit to their work. Building and maintaining trust is a very significant challenge in GSD. Due to geographical separation, the team coordination reduces, which in turn reduce trust and the goals become more individual than having common goals. He said another challenge is that the meetings conducted are prolonged as they don't have meetings regularly. Team mates feel bored of being there for a long time and hence they lack interest to actively participate. He said that there are several cases in which the final product failed because of wrong estimations. The interviewee also pointed another challenge that the standards and procedures stated by experts are too complex, but it was not possible for people with low experience always get confused.

The interviewee stated that not giving training properly to the team will affect the success of the project in a negative way which in turn reduces confidence among members of the team. He also said that poor customer satisfaction and force from higher level management reduces trust and confidence among members of the team. The interviewee pointed the most significant challenge being faced is because of different time zones, people could not work at same time so they get delay in responses and they can't share information. Members at one site don't know what members at other site are doing hence they lack coordination among them which is also a challenge. He added lack of communication and visibility is also a greatest challenge in distribute projects which results in failure of project. The interviewee also added that not having automated tools to test leads to improper validation. Other great challenge mentioned by the

interviewee is incomplete requirements that lead to misinterpretations. The interviewee said that it is challenging to integrate when there are too many sites.

During the second phase of the interview the interviewee shared his experiences in implementing SCRUM and challenges faced by them in implementing the methodology along with its benefits. The interviewee stated that “Mainly we are focusing on SCRUM. In fact, SCRUM is the best fit for our kind of projects”. He said that they need quick visibility and feedback from all their development projects. He said that the first build of their application on one of the platforms was the kick off to move to SCRUM. It was not that good but team got familiar with the process. In fact, the team had a training session on Agile Software development methodology and one of their Tech Team Lead got the external training as “SCRUM Master”. After the first build based on the SCRUM kick off project, they started following the SCRUM since November 2007.

The interviewee mentioned that the best practice to avoid project delay is to prioritize the objects. He stated that they need quick communication and sharing information regularly to involve all the members to participate. The interviewee added that, in the first step, SCRUM team needs to understand the strategy, covering Vision and Goals to accomplish them. Goals should be commonly shared in order to complete the project according to the estimated deadline. Brainstorming sessions are conducted to find consequences of activities. Interviewee stated that Planning poker is the most efficient way recommended by the interviewees for estimating the schedule and budget. Card deck is given to each person who is involved in estimation and asked to pick one card. Second person should not see the card. When turning of cards is done, discussion on various estimates is done by keeping a tile limit. This process is repeated till estimates are met. It overcomes problem with anchoring. It is funny and everyone is involved.

When an experienced person makes estimates he always over estimate things in which he is an expert and ignore things he is not familiar with. This challenge is overcome by using user stories while planning, if required. Mean average is also best methods the organizations referred about through which estimations there are sustainable and agreeable are met. Important thing is that any tool can be used by them. But objective should always be kept in mind.

He said that the decisions are made in the weekly sprint meetings. Sometimes, the decisions are also made in daily SCRUM. He stated that they have teams based on their expertise and areas, e.g. “we have separate teams for all platforms, and there is a separate team for web development to maintain our web portal, similarly other teams including VoIP, QA, databases, IT, SCM, Designers and tech writers. So, based on the task it is assigned to the relevant team and then within the team, the task is assigned to the relevant team member”. He stated that they are having sprint meetings in the time zone which matches all the required stakeholders. Planning should be done carefully in order to avoid overlap by keeping in mind different time zones. Sessions for brainstorming helps in identifying consequences of the tasks performed. He added that maintaining a distribution policy is very effective practice which will increase coordination among teams. Risks are avoided by evaluating the capability of people before hiring them. He added that an experienced person is recommended to estimate the project by keeping in mind the user stories. He added that sending email on important points that need to be discussed before meeting itself reduces the length of meetings. The interviewee mentioned that all the members of the team are encouraged to participate in all the meetings so that issues can be identified early. The interview said that involvement of customer and end-user would help in reducing the risk of last moment changes.

The interviewee pointed out that trust and mutual understanding within a team is being built during daily SCRUM meetings whereas among teams it is being built in weekly sprint meetings. Team members meet face-to-face during the daily scrum meetings and also in the weekly sprint meetings. The distributed teams meet during phases that are critical for the project. . He stated that they are using various tools of communications and have very well-defined communication mechanism within the team to improve communication. In addition, he said that they have open communication model to reduce any kind of communication barriers. The tools used by them are, Wiki, JIRA, Project Server and emails.

The interviewee said that SCRUM implementation adds value to the business goals. He added that a successful SCRUM has the opportunity to innovate new things. He mentioned that throughout the day there will be availability of the people in order to get some advice or clarify doubts. The interviewee said that the implementation of SCRUM practices is very flexible and changes can be easily adapted. He stated that the most significant benefits they achieved are easy adaption to changes, makes the organizations to develop complex projects by modifying practices according to the customer needs and emerging trends. He said that the regular and better feedback given to the members of team that encourage the team to commit to project. According to the interviewee, the major challenges faced while implementing SCRUM in globally distributed projects was to shift the paradigm of the team. Second major challenge was the communication to comply the team with the communication model required in SCRUM. He stated that they initially provide the training to the team members but now since they are following this model so every new team member becomes part of it and follow the same process. In their case, culture, language and experience did not affect the SCRUM implementation. The third challenge they cope up was defining the sprints and deciding the weekly deliverables. In the

first kick, off project the sprint backlog was also a big challenge which caused delay in the planned delivery. The interviewee mentioned that as a group all the members of the team are satisfied in implementing SCRUM.

Interview 2:

The interview was also conducted in two different parts. In the first part, a question on the project management challenges being faced by the organization in developing software globally was posed to interviewee. Managing software project in GSD context is very difficult which includes several challenges. They always faced problems like short duration to finish project, lack of sensible fashion to integrate, lack of visibility. He mentioned that allocating tasks and removing dependencies among modules is a significant issue in globally distributed projects. People with poor technical experience never understand the copulation between business and organization goals. Time zone differences, communication coordination, cultural, linguistic, and integration issues are the major challenges that significantly affect the success of distributed projects. He said other challenge issuing poor communication tools with low band width leads to reduced transfer rate. Higher level management delays feedback and that leads to poor performance. Lack of trust among members of distributed teams is a most significant challenge that leads to project failure; other major challenge mentioned by the interviewee is estimating cost and budget incurred in the project. He added that not having shared goals among members of teams affects the organization goals. He said that they followed waterfall model initially, then SCRUM in order to overcome the challenges due to software development.

In the second part of the interview, the interviewee discussed the process used by them in implementing SCRUM. The several benefits and challenges faced in implementing SCRUM in

distributed projects. He pointed that firstly it takes time to grasp SCRUM especially for people who are still following waterfall model; secondly people try to modify the SCRUM as per their comfort which causes lot of struggles. Management really has to support the SCRUM model thought including the organization hierarchy. He stated that the spring planning, stand up meeting, retrospective meeting are the various meetings conducted. Story board managing is done by using the physical story board, excel template to store product backlog, sprint backlog, status update, burn down chart. Interviewee mentioned that Product backlog meeting, sprint planning meeting, technical planning meeting, stand up meeting, retrospective meeting are the various meetings conducted. He said they used excel for all this, but there are tools in market like SCRUM Works, Version One, VSTF-2010. He said that they check for any overlapping among user stories and avoid dependencies.

The interviewee stated that there were sessions for members of team were brainstormed on the various tasks performed by them to determine the results. The interviewee mentioned that they didn't use any estimation method other than dividing the task granularly and viewing the history of the sprints to check what was delivered on what time. Also, he mentioned that they formally followed T-shirt sizing i.e. XXL, XL, L, M, S etc. Another formal method used was two-step estimation. During everyday stand up meeting every team member would talk about what task they did yesterday, what are they going to work on today, if there are any roadblocks? These meetings are a good means of synchronous communication between teams. The other practice mentioned by the interviewee is to update the status everyday which will be traced by burn down chart to check the progress of sprint. He stated that making use of several communication tools is a very important practice to avoid communication barriers among teams.

Interviewee added that time zone issues are reduced by working in common time. While setting time for a meeting time zones of all sites should be considered. He added that initially they used to have stand up meetings during end of the day so that US guys can also join the meeting, but later on they realized to have the meeting on morning & not having US guys in that meeting. Every team was headed by SCRUM Master who in-turn will handle the feature teams & have weekly meeting with US folks. The interviewee discusses several benefits of implementing SCRUM in GSD projects. He said that good part about SCRUM is to having working model of the system, after iteration. He also mentioned that it gives the stakeholder clear picture about where are we, how much time is required in short better traceability. The interviewee mentioned that rework can be highly reduced. Status of the project is made visible to all the distributed team members.

The interviewee mentioned that they face few issues in implementing SCRUM in distributed projects. He said that allocating resources properly is a major issue in implementing SCRUM. He said when the team size is too large, they face challenges to adapt SCRUM. Members of team feel inferior to accept their backlogs or mistakes.

Interview 3:

The interview was conducted in two different phases. In the first part, a question was posed on the project management challenges being faced by the organization in developing software globally. He said that due to distance, the teams are not able to meet face regularly. The approach followed by the distributed team members to communicate among them is one of the reasons for poor communication which is a major challenge. Reduced information sharing among the teams is an important issue in GSD where the members of the team possess information but they refuse

to share with each other. Data security issues frequently arose due to relocation of members of the team. Attrition rate is increased in the organizations.

The interviewee mentioned that and work synchronization, lack interest and shared goals are challenge in software development. He also said that low communication band width is also a major issue. If the tools are of low bandwidth there will be lack of audio and video quality which leads to loss of data in turn team starts making interpretations on their own. The interviewee said that requirements are often ambiguous and unclear. Incomplete requirements lead to assumptions and only at the end the team realizes that what they developed is not what the customer wanted. Risk management is the procedure of evaluating or measuring risk and then formulating schemes to handle risks. Identifying and mitigating the risks is a very significant challenge in developing software globally. While developing software globally, there are members from distinct cultures. Due to differences in cultural and language backgrounds, there arose cultural and linguistic issues. Superiority complex often exists in members of the team. Members of the team with high expertise think whatever they say is correct and rest of the members need to obey their decision, which an issue in project management of distributed software projects. The interviewee said that decision making is very difficult in case of distributed projects.

The interviewee mentioned that lacking trust among the team members is the most significant challenge. An environment in which the members of the team are not well treated leads to distrust, Lack of communication among members of the distributed teams. Not sharing status of the project is another challenge distributed team always face. In globally distributed environment, members of team are from various technical backgrounds. Hence, improper training leads to several problems in having a project with improved quality and productivity. Interviewee mentioned that estimating cost, schedule and effort is a major challenge in

distributed projects especially when they lack historical data on similar projects. The other challenge mentioned by the interviewee is the force from higher level management on the hourly paid employees. Lack of timeliness to deliver leads members of team to lack interest on completing tasks. They forget business goals and concentrate on individual goals. The interviewee stated that unclear standards and complex procedures create several confusions in distributed teams.

In the second part of the interview, we have enquired about the usage of SCRUM practices in developing software with globally distributed teams, benefits of applying SCRUM practices and the various challenges being faced by them while implementing SCRUM. He said Product owner, SCRUM master and developers are the main people involved in SCRUM implementation. 7-9 for a SCRUM team is the preferred size according to the interviewee's experience. In case of more people, SCRUM of SCRUM needs to be introduced. Product backlog, burn down chart and sprint backlog is the artifacts gathered. Daily stand up meetings, sprint planning meetings, weekly SCRUM meetings and retrospective meetings are the several meetings conducted in their projects that use SCRUM practices.

He said that daily stand up meetings are conducted daily for about 15 minutes where three daily questions on what has been done yesterday? What need to be done this day and any issues are raised, but not solutions. Weekly sprint review is conducted to discuss weekly progress of the team. Product owner, SCRUM master and developers are involved. Minutes of meeting is noted and posted on wikis, in case of large team. Interviewee said that all the members of the team sit together and decide on time and venue. Usually they prefer it to be in the morning. In case, if members can't make their presence, they need to mail their answers and issues prior to the meeting. Planning meeting is decided by product owner. Product backlog is discussed and

decisions are made accordingly. Whole sprint is planned during sprint planning meeting. Estimations are based on historical data of similar projects. User stories are considered by experienced people while estimating advances.

The interviewee pointed that decisions are usually made by discussion with all the members, but major role is played by the product owner. He said that SCRUM masters don't have any role in decision making. He reports everything to the management. Team is responsible for distributing the tasks based on the project. Strive not to have too much on solution with different teams.

Interviewee mentioned that it is important not to split on technical expertise. Based on functional basis is preferred. Interviewee mentioned that communication is planned before itself. SCRUM master meets the onsite team regularly. Right prioritization delivers valuable products. Problems can be discussed. There are several communication tools such as live messengers, net log, video conferencing etc that improves communication among team members. He said that communication is regular, so that changes can be made according to the market needs and requirements. Appreciation builds trust among the members of the team. Senior management must form a culture where there exists trust between globally distributed teams. Enhancing trust is possible when members of team understand that leader will make proper decisions. Leaders should be capable of differentiating between positives and negatives of the members of team. Regular feedback on employees' work should be given and the team members should be motivated to be innovative.

The interviewee mentioned that training is given to all the members of the team on basic SCRUM implementation. If there is no enough time, the members of the team help new member of the team in understanding the organizational standards. Any issues such as language culture are overcome by having regular social gatherings among members of distinct back grounds. The

interviewee said that working in flexible timings makes it avoid time zone issues. Meetings should be planned in such a way that any overlap in times can be removed. He mentioned that integration is made easier by making the project more visible and sharing common database by all the members. He said that brainstorm meetings are conducted to find the results of the task performed by the distributed members. Leaders should always give reason to all the employees on why a decision has been taken.

He stated that all the members of all the teams should regularly share their work and they are also encouraged to have common vision to avoid delays. He said in a software industry agile way of thinking gives more common sense. SCRUM helps in developing right things in right perspectives. Members of team should be encouraged to have more written communication which is formal. Sharing desktops in critical cases found to be an effective practice. The other efficient practice is to motivate all the stakeholders to actively participate in project and also encouraging team to self-organize will avoid risk occurrence. The interviewee mentioned that in case of too many SCRUM teams, SCRUM of SCRUM of SCRUMS is implemented. These meetings ought to take place once in a day for about fifteen minutes. The important thing that is to be considered is that the duration of the meeting should not be exceeded. These meetings are similar to the usual stand up meetings except that the team members are allowed to discuss the solutions of the problems rose unlike the daily SCRUM meetings where the members of the team are free to interrupt the meeting in case if any of the members are discussing solutions to problems that have been raised. In SCRUM of SCRUM, issues are resolved and discussions are made with the help of team backlog.

The interviewee mentioned that there are several advantages of implementing SCRUM practices in GSD.SCRUM are very simple tool to implement. A Successful SCRUM leads to better

quality. SCRUM is very flexible. He said that practices of SCRUM are not constant; they are mould according to the circumstances and requirements. He mentioned that SCRUM methodology is very iterative in nature. Mutual understanding and trust among the team members makes the members of team to organize among themselves in a better way. Interviewee pointed that Members of SCRUM team are encouraged to choose their own tasks. With the help of SCRUM, issues are easily resolved by prioritizing them carefully and working according to their severity. The interviewee mentioned that the productivity and quality of the end product will be improved to a high extent. He said that implementing SCRUM makes the team more adaptable to changing needs. Investment on building documentation can be reduced while implementing SCRUM practices in a GSD.

The interviewee also mentioned that there are several challenges being faced by them while implementing SCRUM practices in GSD. He said that lack of support from the executives for the SCRUM implementation is the most significant challenge being faced. He pointed that frequent requirement changes in a sprint are also a major challenge. Not having a strong Product owner and SCRUM master is a very major challenge in implementing SCRUM. He mentioned the assumption that a good project manager can be a good product owner leads to SCRUM failure in most of the cases. He mentioned that employees with fear and compliance are also a challenge. Members of the team who lack knowledge on implementing SCRUM practices are a challenge. The most significant challenge of implementing SCRUM practices in GSD is fear of criticism, hiding their mistakes by the members of the team. The interviewee concluded that from his experience on several SCRUM projects, teams are satisfied in implementing SCRUM.

Interview 4:

Interview was conducted to enquire about the interviewees experiences in implementing SCRUM on GSD projects. The interviewee mentioned that managing globally distributed projects is very hard which includes various issues. He stated it is challenging to convince all stockholders on agile usage. He said that lack of trust is a major challenge in GSD. He mentioned that mistrust is created due to poor satisfaction of customers. He added the main reason behind losing trust is poor communication which in turn leads to failure of project. The interviewee said that lack of trust, lack of risk management skills, inaccurate estimates are major challenges that leads to failure of GSD projects. The interviewee also mentioned that activeness of members reduces due to reduced feedback frequency. The interviewee pointed that performance of teams reduce due to less duration to deliver projects. The interviewee pointed that assumptions arise due to language and socio-cultural issues which are a challenge in GSD.

He also added that not training the employees properly leads to failure of project and reduce confidence levels among members of the team. Too many development sites are also a great challenge in GSD that leads to difficulties in integration. Hiding information and progress of the projects leads to delay of project. He added another major challenge that leads to postponing the work due to pathetic work culture. The interviewee mentioned that not having automated testing results in poor validation of the product. The interviewee mentioned that differences due to changing market trends and new technologies are a great challenge in GSD projects. The interviewee added that reduced satisfaction of customers leads to mistrust.

He mentioned that SCRUM is the only agile method they have used so far. Sprint planning meeting, self-organization retrospective meeting daily stand-up meetings, SCRUM of SCRUMs is the meetings conducted during the SCRUM implementation in distributed projects. Sprint burn down charts, product burn down charts and product back logs are the various artifacts used in

implementing SCRUM. Sprint is usually between 2-4 weeks. He mentioned that they have used daily stand up meetings, where the SCRUM master and team meet together to discuss three questions. It lasts for about 10-15 minutes only problems are discussed rather than solutions. The interviewee mentioned that the SCRUM meetings need to be winded up soon, else the team loses interest. These meetings reduce issues with asynchronous communication. In a Product backlog all the activities that should be performed are saved in product backlog. According to priority these activities are performed.

The interviewee mentioned that ranking of the objects help in finishing soon the important tasks, so that delay can be reduced. Only product owner can change contents in product back log. Back log is transparent to all the members of team. He pointed that they have used excel sheets to create them. This is very helpful in knowing the remaining work for a particular time. It is modified every day. Access to alter the burn down charts is possible only to the product owner. The Status of the project is informed to all the team members regularly. The interviewee said that effects of the tasks performed can be easily found out through conducting brainstorming sessions.

He added that team members are made to have common goals. Communication among the team members happen frequently. If there is any issue, they are asked to contact relevant people immediately. Several tools are used for communication to reduce barriers. He said that they used video conferencing, VoIP calls, instant messaging, net log, wikis, blogs etc. the local team members meet daily whereas the product owner will meet the onsite team for planning meetings and for every three weeks face to face meetings builds trust. It gives the clear picture of what is expected and progress of the work. There is no tool that can be used for replacing face to face meetings. He said that risks can be avoided by recruiting the people that suits the position. He

added that the best practice is to encourage customers and end users to involve in the project. As a product owner, the interviewee suggested that coordination issues can be reduced by having fewer number of developing sites distributed SCRUM teams and reduced number of members in each team.

Interviewee mentioned that training plays an important role. Team will be trained on basic fundamentals on implementing SCRUM for a short duration. He said that there are cultural and language issues in implementing distributed SCRUM this can be overcome by having a person between the team who knows remote languages too. Time zone differences are overcome by starting to work bit earlier to cope with onsite team time zone. If required, working late nights by members of team is done. Estimations are made by using a two-step method. On the first day, each team member is asked to make estimation of all stories as points. Second day, each team member is asked to list out their tasks. These are collected and sum up the individual time taken for each person and final estimate are made that way.

The interview mentioned the major benefits of SCRUM implementation in GSD: Simple, natural, flexible, adaptable, high quality, less duration, reduced waste, reduced rework, high visibility, increased innovation. Teams can be relieved from management force. Self-organization of teams is possible. Product quality can be improved. Work satisfaction, customer satisfaction and product can be highly improved. Integration of SCRUM practices with several agile methods is possible. He also stated that they are fully satisfied in implementing SCRUM practices did not face any major challenges in implementing SCRUM. He said it all depends on the team on how they modify the practices of SCRUM.

Interview 5:

The interview was done in two different parts. In the first part, inquiry about the various project management challenges faced while developing software globally. The interviewee pointed out that earlier they have used waterfall methodology. The interviewee pointed that it is very challenging to share the task among the teams who distributed globally. When modules are being developed at different locations, there exist dependencies among the modules. He talks about his current project distributed on three different locations Mexico, Denmark and London. The project is building banking software with 2 important modules being developed at Denmark branch, 1 module being developed at Mexico and another module being developed at London. Module being developed by Mexican team is dependent on the module that has to be developed by London. Denmark team has completed their work. London team had delay in finishing their module and the Mexican team has to wait for the London team to finish and it delayed the overall project delivery. Feedback is not always provided regularly in globally distributed teams.

The interviewee talks about challenges that team loses interest and thereby knowledge sharing decreases which in turn reduces the overall quality of the software project. Due to this, the team will no longer be committed to the project. He further said that they always face problems due to standards; members at each location follow their own standards and it is always difficult for other teams to understand. Unclear standards create confusion among teams. The interviewee also mentioned that planning a project is very important for any project. He said that they always face issues while planning due to geographical separation.

He mentioned that distributed projects often fail due to issues related to coordination and communication. This poor communication leads to poor knowledge sharing which effects on the project. He said estimating a globally distributed project is very hard due to several reasons: unclear problem statement by clients and developers due to their insignificant perspectives. He

added that estimations without any historical data are quite difficult. He also mentioned that poor estimations and lack of common vision always lead to failure of the project. The interviewee mentioned that the stress created by the project managers on employees due to very abrupt deadlines will affect team members' involvement.

The interviewee mentioned that cultural and language issues always arose in globally distributed software projects. He said that the team lack knowledge exchange which leads to assumptions that leads to failure of project. Interviewee said hiring right people is very important for distributed software projects. Improper training leads to several issues such as delay in project, time and budget consuming. The interviewee stated that it is hard to update status of the project regularly in GSD requires rework caused delays in the project. The most significant challenge in GSD project raised by the interviewee is time zone differences. Time zone differences leads to communication delays. The whole load of differences in time is endured by one location. Deciding in a GSD context is very hard, due to complex hierarchies, ideas given by members of team are neglected only superior's decision will be finalized which leads to mistrust.

The interviewee stated that in distributed projects, in order to save expenses, distributed teams very rarely meet face to face. Due to this reason, the team's lack trust which in turn leads to project failure. Interviewee stated that the teams often do not cooperate with each other and project delivery delays. As the teams are distributed globally, functionalities are developed at different locations and make it difficult to integrate. Due to lack of face to face meetings, the members of team often communicate with tools and often the bandwidth is poor and loss of information exchange. The interviewee concluded the first part of interview by stating that they have decided to shift to SCRUM, an agile software development methodology in order to minimize all those challenges faced by globally distributed software projects. He further

mentioned the main reasons for shifting to SCRUM from a traditional software development methodology: higher flexibility, adaptability of changes, easy to handle frequent requirement changes, iterative in nature, high visibility of the process and on time delivery.

The interviewee said that in order to overcome the problems with estimations in a GSD they make use of certain SCRUM practices depending on the requirements. In order to make estimations in their distributed SCRUM projects they don't use any complex methodology. They make the team understand requirements without any ambiguity, historical data of similar projects is considered and person days are used. Encourage team in understanding the goals and to make use of rich communication tools especially video conferences. The interviewee mentioned that the distribution of tasks among teams is done by the data base and business logic experts in their organizations based on their experiences and also considering dependencies among modules.

The interviewee mentioned that they conduct several meetings such as daily SCRUM meetings, planning sprint meetings, retrospective meetings. He said that daily SCRUM meetings are conducted to have synchronous communication. He also added that, in distributed projects it is always important to hire the right people based on their understanding level, technical expertise etc. He said that using SCRUM practices build an environment in which members of them could communicate in a clear and fair manner. There are various rich tools to communicate to overcome barriers due to communication. The interviewee mentioned that members of the team are encouraged to share information regularly in order to involve all the members of the team actively. Status of the project needs to be updated regularly to know the situation. He added due to large number of distributed teams, there are reduced numbers of face to face meetings and this challenge can be overcome by using SCRUM of SCRUMs and he suggested it is always preferable to have limited number of sites and reduced team size. He said this practice of

SCRUM of SCRUM grants clumps of teams to talk about their tasks, concentrating particularly on fields of convergence and consolidation. A recursive approach is used to scale SCRUM of SCRUM. He mentioned that they have used two step estimations while estimating the project. In first step, each team member is asked to make estimation of all stories as points. In the next step, each team member is asked to list out their tasks. The time they require to finish each task. Individual option needs to be taken rather than discuss with other members once all the members finish writing. Collect the paper in which tasks and estimates of each person is gathered. Sum up all of them and the final estimate can be calculated.

The interviewee mentioned that when there are lazy and unskilled members in the team, they handle them by providing them better training on the areas they lack knowledge. If, the member of team doesn't have much knowledge on the functionality he has to work, then his task will be changed to a less complex one. He said they help them and provide them with better suggestions. The interviewee recommended setting right expectations, clarifying the requirements. He also said that it is highly useful to make use of protocol. A central management system, in which all the completed tasks will be saved and updated regularly, is maintained.

The interviewee said that they face several challenges while implementing SCRUM while developing software globally. He also said untrained team on SCRUM is a major problem. Concentrating too much on practices instead of SCRUM values and attributes is another setback. Not supplying members of team with sufficient flexibility related to failure, timeliness to rescue, selecting the appropriate method. He said that SCRUM is like a tool, success or failure mainly depends on how the teams apply the practices.

While discussing the benefits of SCRUM, he mentioned that the team is fully satisfied in implementing SCRUM practices in GSD. He added that the SCRUM promotes the members of the team to preserve all the user stories, impediments, requirements in a prioritized manner to improve business values. SCRUM reduces rework and waste. Innovation is improved and increases visibility. It is very simple to use, flexible and adaptable practices. Quality of the product is highly increased. Capability of adapting to changes is possible. Improved satisfaction of customers is achieved. SCRUM practices encourage team to understand the requirements. Early identification of issues is a major benefit of implementing SCRUM.

Interview 6:

In this interview, the interviewee discussed about the several project management challenges in GSD, the various SCRUM practices implemented by their teams in order to overcome the challenges being faced by them. The major benefits and challenges in implementing SCRUM. There are several challenges being faced by the organization in managing globally distributed projects: Communication between teams is a very major challenge that results in project failure. Tools to communicate, with low band width reduce transfer rate. Coordinating tasks among the distributed sites is very difficult. The interviewee said that sharing common goals is hard in globally distributed projects. Quality standards differ from each distributed site and make other teams to misinterpret. He said that there are several variations in cost of developing the project among teams distributed globally and hence difficult to make estimates with incomplete requirements. He pointed that time zone differences makes it difficult for teams to exchange knowledge that leads to delay of the project which is the most significant challenge faced by them in distributed teams said the interviewee.

The interviewee said that there is always less time to ship the product and the higher-level management forces the employees to complete task in less time, which leads to lack of willingness among team members to work, reduce productivity and quality, and reduce innovation. He said that distinct cultural, linguistic and technical backgrounds are also a challenge in managing globally distributed projects team members lack trust. He said that there always exists relation between two models and when developed at different sites they have dependency and lead to integration issues. He added that planning, integration and synchronizing the work is a challenge in GSD. Employees fail to solve problems when are not experienced, He said, if higher level management delays giving feedback team loses confidence. The interviewee added that another challenge that leads to failure of project is lack of trust. The interviewee mentioned another significant issue is estimating the effort and budget of the project due to geographical separation. Project fails when estimations are not done exactly. Misinterpretations occur due to incomplete requirements and linguistic barriers. Changing market needs and technologies create several issues. Status hiding is always high in case of distributed members which increases rework and delays the project. He said that making a decision in creative generation is challenging issue.

While discussing about the SCRUM implementation the interviewee mentioned that the SCRUM team should have shared responsibilities and goals. Everybody is responsible for the quality, delivery. The product owner is responsible for the project life (in terms of money and time); the SCRUM master is responsible for project progress ensuring that all impediments to the projects are removed. He said that the main artifacts used by them in implementing SCRUM are product wish list / backlog, the burn down chart for SCRUM, Project plan prepared in MS Project and the weekly status reports for the Management. He mentioned that the several meetings conducted

by them include Sprint Planning meeting, Daily SCRUM meeting, Sprint Review meeting and Sprint Retrospective meeting. He stated that they have a modified Sprint running for 2-3 weeks.

The interviewee mentioned they conduct sessions for group actions to discuss about consequences. The daily SCRUM meetings are a must usually happen on a predefined time. He added that the points that are to be dealt are sent to all members before the meeting starts to avoid meeting delays. He said that they record all the information discussed during the meeting to avoid information loss. Members of the team are motivated to use video communication since it acts a good substitute of face to face meetings.

He mentioned that the burn down charts is prepared in a white board with the help of stickers. The product back log is shared with the product owner, the Excel file is kept in a shared folder. The meeting plans are defined in the Project planning meeting itself.

He mentioned that the tasks are distributed among the members based on experience, expertise, and also give an opportunity to the team to volunteer to accept tasks. The Daily SCRUM meetings are the catalysts to build trust and understanding among the team. Every project has a communication plan, which says which information, in what form, when and to whom. He said that they use mails, Blog updates and also face-to-face meetings. Involving all the stakeholders is possible by sharing information regularly. He mentioned that the language was not a barrier because English was adopted as the common language. The experience was a problem as in SCRUM we were unable to put a hierarchy based on the role and experience. The stakeholders were either „Chickens“ or „Pigs“. He stated that for the project time zone difference (JKT time is 1.5 hrs ahead of IST) were met by putting a common available time of 11.00 am IST (9.30 JKT time). The communication plan and weekly status reporting as part of PMP (Project Management

Plan) helped them to avoid delays to a great extent. He said that coordination among distributed members is improved by having reduced number of developing sites and team size. The interviewee also added that risk can be avoided by recruiting right people. He said that user stories are concentrated in estimating the project by experts.

The interviewee also stated significant challenges while implementing SCRUM globally distributed software projects:

- ☐ Convincing the Senior Management and the Project sponsor why Agile is better than the classic waterfall.
- ☐ Getting people volunteer to take tasks and contribute to the sprint
- ☐ Lack of test automation affected the Sprint and delayed turnaround time. .It was difficult to build a shared vision on SCRUM.
- ☐ The team worried in getting exposed of their weaknesses.

☐ The interviewee also stated significant benefits of implementing SCRUM in globally distributed software projects: In a successful SCRUM:

- ☐ The stakeholders will get a shared focus
- ☐ Easy to adopt changes in scope
- ☐ Better feedback mechanism
- ☐ Retrospectives help the team to self-evaluate.
- ☐ It helps to improve quality and innovation.

- Easy to learn

4.8.1.4. Data Analysis

Glaser and Strauss (William & Stout, 2008, p.358) used grounded Theory (GT) in analyzing interview transcripts, which were defined. Ground Theory is a qualitative systematic research methodology in which a theory is generated from data by a bottom-up approach (Glaser & Strauss, 1967). Data is gathered and pigeonholed and again categorized and analyzed to generate a theory. In addition, it provides a constant comparison between the collected data continuously. Hence, a theory is developed through a collection of data instead of applying a theory to the data.

Grounded Theory generated by Glaser and Straus have different opinions on the use of the theory. For instance, Glaser emphasizes the individual researcher's creativity within a clear frame of stages (Glaser & Strauss, 1967). On the other hand, Strauss approach is concerned with validation criteria with systematic approach (Glaser & Strauss, 1967). In this research, Strauss approach has been used; Open coding, axial coding, and Selective coding. Successful execution of these generated a good theory as the results. The data analysis was done by performing the predefined procedure of GT by applying open, axial and selective coding theoretical sampling (Cusick & Prasad, 2006, p.22). Then, all data was thoroughly analyzed, and codes were re-checked to ensure validity. Transcribed interviews were used as an input for GT. Finally, outcomes of Grounded Theory help to answer all the research questions which resulted from interviews.

4.8.2.0 Survey

An all-inclusive online survey was conducted during this study in order to strengthen the research. Complete questionnaire as indicated early can be got in the appendix. Respondents

from different sectors were invited to share their experience in scrum method of management in software development.

4.8.2.1. Data Collection and Analysis

The major reason behind this online survey was investigating further on the use of scrum in software development. The challenges and practices identified through literature review and interviews were included in the questionnaire. Invitation emails containing a brief introduction, objectives, and overview of this study were emailed to every candidate. Respondents were requested to reply to several questions' choices which were premeditated on the basis of interview and literature review results. The survey questionnaire is present in the appendix. Several persons took part in the exercise.

Monkey survey tool was used for the online survey which provided features that enabled analysis of data. Through interviews and literature review the questionnaire was composed. Participants were professionals in both software development projects and scrum practices. They included; scrum masters, project managers, product owners, and project developers were all involved in the exercise. Mail requesting alongside a short description of the study was sent to respondents. Results obtained from this survey were used to analysis most of the major objectives and goals of this research in understanding more on scrum and software development.

4.8.2.2. Survey Participants

Respondents of this research were software engineers who are currently or had been involved with software development projects in various industries. They included all functional teams in software development, such as project managerial, software developers, coding, testing, analysts and designers among others. Besides, communication was done through emailing participants

and requesting them to respond to the questionnaire. Several participants conducted the online survey. Below is the table of the participants' roles in different organizations.

No.	Company	Role of Person participated
1.	Wipro	Developer
2.	Valtech India Pvt. Ltd.	Developer
3.	Cyber Solution US. Ltd	Project Manager
4.	Patna Computers Pvt. Ltd	Scrum Master, Developer
5.	CSS Corp Pvt. Ltd	Scrum Master
6.	CashEdge India Systems	Scrum Master, Developer
7.	CMMS Cyber UK. Ltd	Developer
8.	Secure healthcare service. Ltd	Project Manager
9.	Amdocs	Test Engineer
10.	Extreme Networks	QA Engineer
11.	Bizintech Techno solutions	Scrum Master, Developer
12.	Zensar Technologies	Product owner
13.	Monsoon Multimedia	Developer
14.	Tata Consultancy Services	SAP SD Consultant
15.	IBM India	Scrum Master
16.	INFOSYS	Developer
17.	Oracle financial services software limited	Developer

Table 1: Survey participants

The participants who responded in this survey included members from both the management team and development team.

Role	No. of participants
Test engineer	1
Product owner	1
Scrum master	5
Developer	9
QA engineer	1
SAP SD consultant	1

Table 2: roles of participants

4.8.2.3. Data Analysis

Most of participants completed the survey. Thereafter, the responses were compiled and analyzed for this research’s purpose. Respondents were from different organizations with a different background, most of them being developers and scrum masters. However, most of the respondents work with small-scale scrum teams. Improvement in quality and productivity was their main motivation behind the implementation of Scrum. Most top scrum practices included *“Key Documentation,” “Reduce Scrum Meeting Length,” “Synchronized Working Hours” And “High Reliable Communication Bandwidth”*.

CHAPTER 5 RESULTS AND DISCUSSION

5.1 Analysis of data collected

In this report, numerous development management encountered in GSD, and a number of SCRUM practices to overcome these project management challenges were identified. The challenges faced by the organizations while implementing SCRUM practices in GSD projects were also captured. Questions administered through surveys were answered as follows;

RQ 1: What are the project management challenges in software development?

There are several project management challenges in GSD projects and several Scrum practices used in GSD projects. Table 3 shows the list of project management challenges that were reported in the survey conducted. Project management challenges being faced by the organizations were gathered by conducting survey in different organizations. List of project management challenges found during survey were summarized as in the table below:

No.	Project management challenges from interviews
1	“Linguistic issues resulting into misinterpretation of things”
2	“incorrect estimations results in project failure”
3	“dependency among modules leads to project delays”
4	“Poor technical experience fails resolving issues”
5	“poor standards reduce quality of the product”
6	“poor coordination reduces trust and team does not share common goals”
7	“poor planning leads to project failure”
8	“long meetings lead to disinterest among members to participate”

9	“short deadlines lead to poor performance”
10	“Poor feedback leads to reduction in team commitment.”
11	“Poor customer satisfactions lead to mistrust.”
12	“Complex procedures are confusing.”
13	“in proper training result to project failure and loss of confidence among team members.”
14	“Hiding status results in project delay”:
15	“Management pressure leads to mistrust and reduces confidence”:
16	“Time zone Issues reduce knowledge sharing”:
17	“Socio-Cultural Issues leads to misinterpretations”:
18	“Low bandwidth results in decreased transfer rate”:
19	“Poor work environment leads to task slippage”:
20	“Work synchronization leads to poor task distribution”:
21	“Complex hierarchy results in poor decision making”:
22	“Data security issues reduce trust in employees due to high attrition rate”:
23	“Work synchronization leads to poor task distribution”:
24	“Lack of communication leads to project failure.”
25	“Conflicts arise due to new processes & emerging technologies”:
26	“Lack of Shared goals leads to failure of business goals”:
27	“Incomplete requirements result in misinterpretations”:
28	“Lack of test automation leads to poor validation of product developed”:
29	“Decision making is difficult in the innovative world”:
30	“Convincing the stakeholder on Agile is difficult”:
31	“Incomplete requirements result in misinterpretations”:

32	“A large number of developing sites makes integration difficult”:
33	“Lack of willingness leads to poor quality”:
34	“Inability to manage risks leads to failure of the project”:
35	“Lack of information sharing delays project delivery”:

Table 3: Project management challenges found in survey

The mapping between organization and project management challenges were represented in excel table which was attached in appendix part. Table 4 was obtained from analysis. Each company is placed against its total challenges faced. Through this analysis, percentages of challenges were drawn for each company where respondents came from.

<i>company</i>	Total challenges	percentages (%)
1	17	5
2	18	9
3	21	14
4	26	19
5	28	24
6	33	29

Table 4: map between companies and management challenges

Figure 4 shows the percentage view of management challenges faced by the organization(s) using SCRUM in software development projects. It was confirmed that some organizations were faced with numerous challenges as seen in the pie chart. This was due to different management practices employed by those organizations

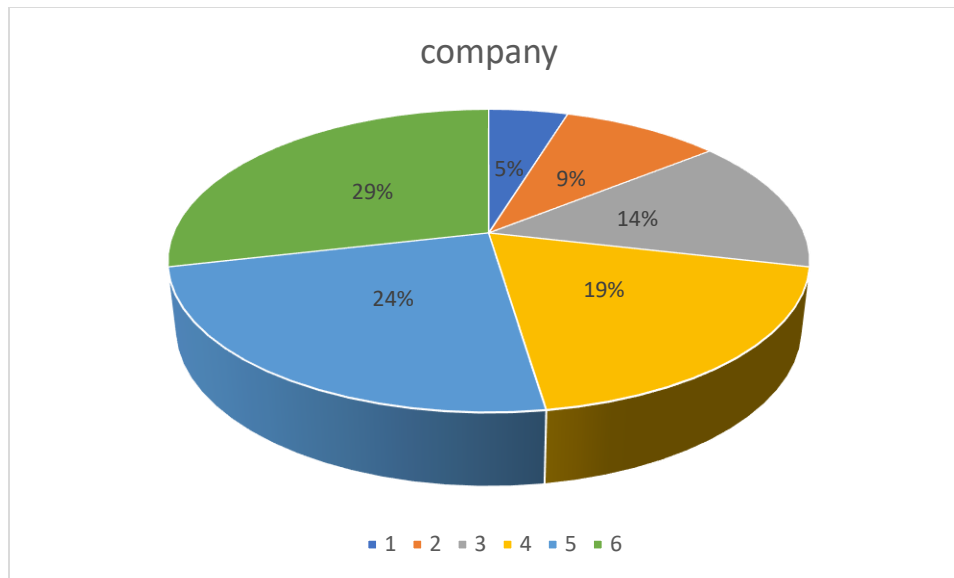


Figure 4: Project management challenges per company

Most reported project management challenges found are incorrect estimations results in project failure, Socio Cultural Issues leads to misinterpretations, Poor feedback reduce team commitment, Lack of communication leads to project failure and Lack of trust leads to project failure.

An online survey was conducted, in which 24 people from different organizations with experience in SCRUM and software development projects participated. Surveys were conducted to investigate if the respondents in their organizations were facing the challenges found in the literature. A questionnaire was prepared based on the data gathered from literature review and interviews were sent to the respondents. The most reported Management challenges from the survey's analysis in methodology.

RQ 2: Which scrum practices are mostly used in software management in different organizations?

Answer for RQ2 was answered by conducting literature reviews along with surveys. There were several Scrum practices used in global software development projects that were reported in literature. Notice collect and think technique was used for analyzing the quality data. The data gathered was used as a basis to prepare interview questions and survey questionnaire. Table 5 shows the list of SCRUM practices that were reported in the survey:

No.	SCRUM practices found in literature review
1.	“Synchronized working hours”
2.	“SCRUM Master needs to be strong negotiator”
3.	“Single room”
4.	“Training”
5.	“Dedicated meeting room”
6.	“Gradual team distribution”
7.	“Modified SCRUM practices”
8.	“High reliable communication bandwidth”
9.	“Team gathering”
10.	“Additional distributed meetings”
11.	“Coffee/ice cream meetings”
12.	“Key documentation”
13.	“Visits”
14.	“The use of global task board”
15.	“Proactive resource management”
16.	“Reduce SCRUM meeting lengths”

17.	“Distribution policy”
18.	“Mandatory participation”
19.	“Site based local SCRUM team”

Table 5: List of Practices found from survey

The SCRUM practices being implemented by the organizations in developing software globally were gathered by conducting interviews and surveys in different organizations. Interview was done to some organizations while others online survey was conducted. The data gathered was analyzed by applying Grounded theory. Table 6 shows the list of SCRUM practices that were analyzed from survey.

No.	SCRUM Practices from interviews
1)	“Sessions for brainstorming helps in finding consequences of activities”
2)	“Prioritizing the objectives avoids schedule slippage”
3)	“Regular information sharing keeps all the participants involved in the project”
4)	“Time zones of all development sites need to be kept in mind while planning for the meeting so that there won’t be any overlap”
5)	“Regular status updates help the team understand where they stand”
6)	“Assuring the justification of decisions improves progress of the project”
7)	“Sharing common goals helps in doing project right on time”
8)	“Limited team size, number of developing sites and distributed SCRUM teams improves coordination”
9)	“Using of trained people helps to avoid risks”
10)	“Using planning poker avoids anchoring while making estimations”

11)	“Avoid dependencies in user stories”
12)	“Motivate team in using video communication”
13)	“Provide training to new employees in usage of SCRUM practices”:
14)	Encourage team to self-organize in order to prevent occurrence of risks:
15)	“Consider user stories when an experienced person is making estimates”
16)	“Two step estimation method to make sustainable estimates”
17)	“Encouraging team involvement in meetings”
18)	“Customer and end user involvement”
19)	“Proper usages of communication tools help improve communication”:
20)	“Email on the important points need to be discussed is sent prior to meetings”
21)	“Record minutes of meetings to avoid loss of data”
22)	“Reduce meeting duration to stop discussing solutions for problems”
23)	Local daily SCRUM meetings avoid asynchronous communication

Table 6: General SCRUM practices from both interview and survey

Table 7 represents the mapping between the organizations and the SCRUM practices used by them in software development projects. The first column represents the organization numbers. The second column represents the SCRUM practices used by the organizations.

Company	Practices Percentage (%)
Company 1	7%
Company 2	14%
Company 3	12%
Company 4	12%
Company 5	10%
Company 6	13%

Table 7: Map between companies and SCRUM practices

Figure 5 shows statistical view of each SCRUM practice used by how many organization(s) in GSD projects. The x-axis is the SCRUM practices and y-axis present the total companies involved in study. It has been observed that 19 practices out of 23 were common among companies. It is also noticed that practices 3, 16, 23 are commonly used in all companies.

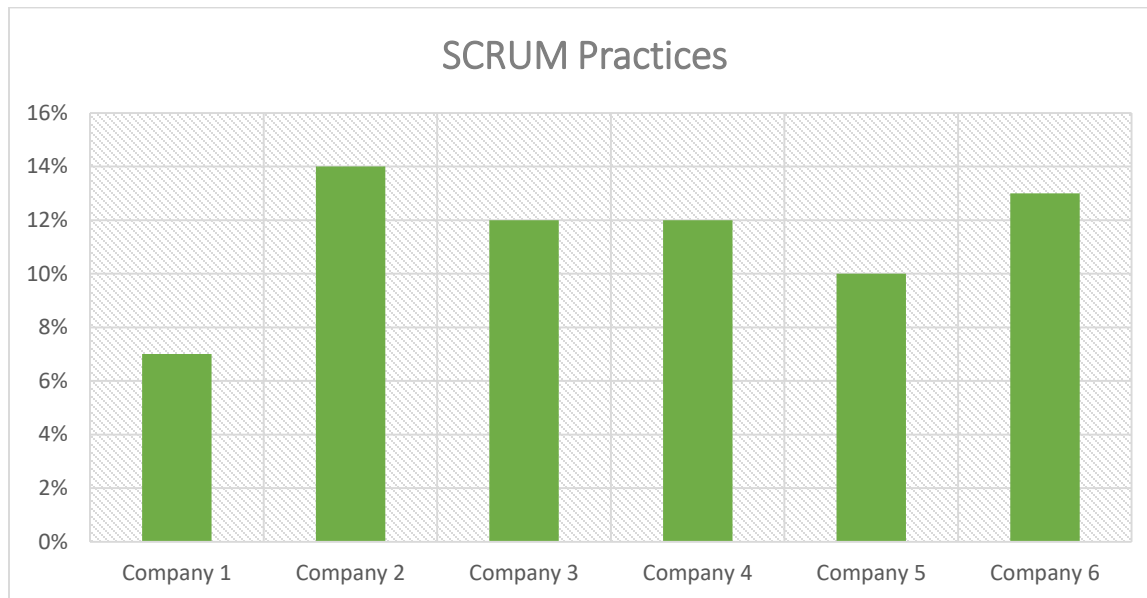


Figure 5: SCRUM practices percentages against all companies

“Sessions for brainstorming helped in finding consequences of activities; Local daily SCRUM meetings avoid asynchronous communication, using of trained people helped to avoid risks and proper usages of communication tools help improve communication.

An online survey was conducted, in which 24 people from different organizations with experience in SCRUM and global software development projects participated. Surveys were conducted to investigate if the respondents in their organizations were facing the challenges found in the literature. A questionnaire was prepared based on the data gathered from literature review and interviews were sent to the respondents. The most reported Scrum practices from the surveys are discussed in methodology sector.

RQ 3: What are the main challenges and benefits of implementing scrum practices in software development?

Answer for RQ3 was answered by conducting interviews alongside surveys in different organizations about SCRUM benefits achieved and challenges being faced by them during SCRUM implementation. The data gathered was analyzed by applying grounded theory. Table 8 shows list of SCRUM benefits.

No. SCRUM Benefits

1.	Visibility and flexibility is provided:
2.	Stakeholders get a shared focus:
3.	Less turnaround time or Time to Market:
4.	Helps in developing right things in right perspectives:
5.	Implementing SCRUM provides better control in the team.
6.	Improved Quality
7.	Easy to adopt changes in scope:
8.	Improved Innovation
9.	Better feedback mechanism are used:

10.	Issues can be identified early in the development life cycle:
11.	Retrospectives help the team to self-evaluate:
12.	Easy to Use

Table 8: SCRUM benefits

Table 9 represents the percentage between the organizations and the benefits in implementing SCRUM practices in software development projects.

Company	Benefits (%)
Company 1	7%
Company 2	9%
Company 3	7%
Company 4	7%
Company 5	7%
Company 6	6%

Table 9: shows percentage between companies and SCRUM benefits

Figure 6 shows statistical view of each SCRUM benefits found in organization(s) during study.

The x-axis is the SCRUM practices and y-axis present the total companies involved in study. It was observed that most the benefits are common between all organizations.

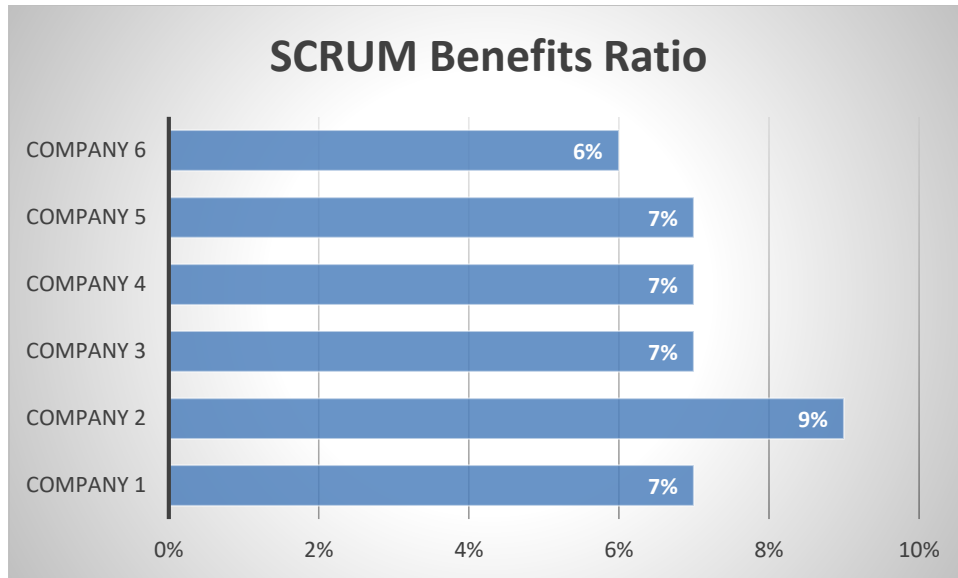


Figure 6: SCRUM benefits ratio against all companies

Most reported benefits achieved by organizations while implementing SCRUM are Visibility and flexibility are provided; better feedback mechanism is used, easy to adopt changes in scope and improved innovation. It was found from the respondents that the organizations were facing several challenges while implementing SCRUM in GSD projects. A list of found challenges is shown in table 10.

No. Challenges faced while implementing SCRUM

1.	Untrained team
2.	Effective usage of practices
3.	Concentrating too much on practices instead of SCRUM values and attributes
4.	Lack of support from the executives
5.	Not supplying members of team with sufficient flexibility

6.	Frequent requirement changes in a sprint
7.	Allocating resources properly
8.	Defining the sprints and deciding the weekly deliverables
9.	Convincing the Senior Management and the Project sponsor on Agile
10.	Lack of test automation affected the Sprint and delayed turnaround time.
11.	It was difficult to build a shared vision on SCRUM.
12.	The team worried in getting exposed of their weaknesses.
13.	Shift the paradigm of the team
14.	Communication to comply the team with the communication model
15.	Getting people volunteer to take tasks and contribute to the sprint
16.	Members of team feel inferior to accept their backlogs or mistakes
17.	Not having a strong Product owner and SCRUM master
18.	Lack knowledge of knowledge about SCRUM
19.	Good product manager cannot be a good product owner
20.	Large team size
21.	Fear of criticism
22.	fear and compliance with employees

Table 10: Challenges while implementing SCRUM

The used questionnaire highlighting the various experience in scrum and software development projects. The questioners were used to purposefully investigate the Scrum challenges highlighted in the questioners are practically faced by the respondents in their organizations. The mostly highlighted challenges during the implementation of the Scrum in software development projects from empirical study were “untrained team” and “communication to comply the team with the

model”. It was very interesting that nearly all the organization face various problems in the course of implementing SCRUM in their institutions.

CHAPTER 6 CONCLUSIONS AND FUTURE WORK

6.1 Introduction

In this study, the use of SCRUM practices in software development was investigated. In first phase of the research, literature review was conducted to find several challenges in managing global projects and various SCRUM practices that alleviate those challenges in managing them. Additionally, under this literature review, the research goes further to see effects of organizational factors in project developments. In subsequent phase of research, various SCRUM practices that are currently being applied by the industries are gathered by conducting interviews. Surveys are also conducted in order to support the usage of SCRUM practices to address the challenges faced during management of global projects. Lastly, data were analyzed by applying grounded theory, and other appropriate techniques.

The usage of SCRUM practices in order to overcome project management changes in software development projects found from literature review is compared with results of interviews and survey conducted with organization and software professional experience in SCRUM and global software development. From the results, it was observed that 26 management challenges and 19 SCRUM practices explored during methodology research. 35 Management challenges and 23 SCRUM practice found during interviews are shown in figure 19.

	Management Challenges	SCRUM Practice
<i>Survey</i>	26	19
<i>Interviews</i>	35	23
<i>Total</i>	61	42

Table 11: Number of Management challenges and SCRUM practices in GSD

Furthermore 26 “challenges which were faced during SCRUM implementation” in software development projects were also found. 12 “benefits of using SCRUM” were also among the findings. It was also observed during survey and interview that there were some management challenges, which were not identified during the review. The list of these management challenges includes:

- ☐ “Dependency among modules leads to project delay”:
- ☐ “Poor feedback reduces team commitment”:
- ☐ “Incorrect estimations results in project failure”:
- ☐ “Short deadlines reduce team performance”:
- ☐ “Complex procedures are confusing”:
- ☐ “Hiding status result in project delay”:
- ☐ “Work synchronization leads to poor task distribution”:
- ☐ “Lack of Shared goals leads to failure of business goals”:
- ☐ “Convincing the stakeholder on Agile is difficult”:
- ☐ “Incomplete requirements result in misinterpretations”:

It was also observed during interviews that there are some SCRUM practices which were not found during literature review. The SCRUM practices were:

- ☐ “Prioritizing the objectives avoids schedule slippage”
- ☐ “Regular information sharing keeps all the participants involved in the project”
- ☐ “Sharing common goals helps in doing project right on time”
- ☐ “Assuring the justification of decisions improves progress of the project”
- ☐ “Encourage team to self-organize in order to prevent occurrence of risks:
- ☐ “Using of trained people helps to avoid risks”
- ☐ “Customer and end user involvement”
- ☐ “Avoid dependencies in user stories”
- ☐ “Using planning poker avoids anchoring while making estimations”
- ☐ “Consider user stories when an experienced person is making estimates”
- ☐ “Two step estimation method to make sustainable estimates”

6.2 SCRUM Challenges

-  **The diversity of Cultural Practices:** A project Team with management having different cultural backgrounds consists of many magnitudes for instance language, communication habits as well as attitude that to some point result to misunderstanding to other team members of the project from the different geographic region. Cultural Diversity could influence the Software Development project because of diverse organizational structure, complexity in the level of management and culture of sharing duties.
-  **Technical Challenges:** In Software Development Projects, duties are allocated to distributed sites. Hence, Establishment of Networks is mandatory as an aspect of communication with each other. The networks have to be reliable and fast. Since work is disseminated and channeled by means of configuration management task, most

organizations running Software Development Projects faces various technical issues effect on project management.

🚦 **Challenges on Project Management:** During direction amid distributed sites, it may become difficult to synchronize their procedures among each other. Consequently, it is always defined as the most critical coordination.

6.3 Data Triangulation:

In this study, there was consideration of factors such as, number of teams, team size, time zone differences, team locations, number of sites, culture. There are few factors that were not addressed due to time constraints such as complexity, type of project, expertise, duration of the project, etc. in implementing SCRUM in global software development. All these factors mentioned can be investigated in future study.

Future work can be done on mapping the relation between the various project management challenges in GSD and the SCRUM practices that were identified. In this study, various SCRUM practices were identified; contribution can be made by considering any one of those practices as a prospect. Another important contribution could be to investigate how various industrial settings could influence the choice of SCRUM practices. Moreover, research on perspective of developers" on usage of SCRUM practices would be beneficial as interviews were conducted based on manager's view. There is a need for conducting even more in-depth case studies to investigate the usage of SCRUM practices in addressing challenges of global software project management.

6.4 Research Limitations

Generally, some factors on SCRUM Software Development Project are predicted based on the following assumptions. Documentation, as well as software models, do not have a role in the software development limited provision for distributed development surroundings. Which, practices advocated by scrum projects that are not in line with other industries.

6.5 Further Research

Interview conducted to team members of Software Development with an objective of expanding the most popular about the adoption of agile methods in their company suggested a set of recommendations.

- ✚ Early partnership promotes salvage and integration because product managers within a SCRUM team work closely on project management sprint Backlog as well as discuss requirements before the implementation at an early stage.
- ✚ Task size, enthusiasm, and the backlog structure are the key factors that need proper consideration to enhance proper effectiveness methodology of SCRUM in Software Development Projects

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Appendices

Appendix A

Part 1 Interview Questions

Introductory Questions:

1. Which role do you play in this organization?
2. What is your role(s) in the current project?
3. Who long have you been working with this organization?
4. How long have you been working on global software development projects?
5. Can you please explain about your organization history?
6. Can you please give a brief explanation on the current project?
7. Please tell us about team size, their nationality and number of developing sites.

Domain specific questions:

- I. What are several agile methodologies you are adopting in your projects? Can you also motivate your idea behind implementing SCRUM?
- II. Can you briefly discuss several experiences you face in implementing SCRUM?
- III. What are the various responsibilities of a SCRUM team?
- IV. What type of artifacts do you use?
- V. What are the several activities that happen in SCRUM methodology implementation?
- VI. How do you implement practices such as sprint, daily SCRUM meetings, burn down charts, product back logs?
- VII. How do you make decisions on planning for meetings, preparing artifacts and estimating the project effort and budget?

- VIII. How is task distributed among teams and within team members? How do you build trust and mutual understanding between and among the teams?
- IX. Do you plan communication among teams and within teams? Which kind of tools do you use for communication? How often do they meet face-face? How often do they communicate?
- X. What kind of management challenges occur while implementing SCRUM?
- XI. Do you train the members of team before implementing SCRUM? Do culture, language and experience affect SCRUM implementation in GSD projects?
- XII. How do you overcome challenges such as time zone differences, integration, data security, infrastructure and delays?
- XIII. Can you discuss the benefits of implementing SCRUM in globally distributed projects?
- XIV. Are you satisfied in implementing SCRUM? Can you tell us few issues that need to be changed for more benefits?
- XV. Are there any other external factors that affect implementation of SCRUM?

Appendix B

Part 2 Survey

Questionnaire

1. Please let us know about your company/organization
2. What is your role in the company/organization?
☐ SCRUM master ☐ product owner ☐ developer
☐ Other (please specify)
3. What is the number of SCRUM teams in your company/organization?
☐ 1-5 ☐ 6-10 ☐ 11-25 ☐ 25-50 ☐ >50
4. What is motivation behind implementation of SCRUM?

- ☐ To improve delivery speed ☐ Improved quality & productivity
- ☐ Planning and delivering deliverables according to schedule
- ☐ Flexible and adaptive with changes

5. Based on your experiences, which of the following benefits are achieved in implementing SCRUM in globally distributed teams

- ☐ Helps in developing right things in right perspectives:
- ☐ Implementing SCRUM provides better control in the team.
- ☐ Visibility and flexibility is provided:
- ☐ Issues can be identified early in the development life cycle:
- ☐ Less turnaround time or Time to Market:
- ☐ Stakeholders get a shared focus:
- ☐ Easy to adopt changes in scope:
- ☐ Better feedback mechanism are used
- ☐ Retrospectives help the team to self-evaluate:
- ☐ Improved Innovation
- ☐ Improved Quality
- ☐ Easy to Use

6. Please rate the SCRUM practices according to usage in your company/organization

- ☐ Synchronized working hours
- ☐ Reduce SCRUM meeting length
- ☐ Site based local SCRUM team
- ☐ Modified SCRUM practices
- ☐ Team Gathering
- ☐ Visits
- ☐ Additional distributed meetings
- ☐ Training
- ☐ Key documentation
- ☐ Mandatory participation

- ☐ High reliable communication bandwidth
- ☐ Proactive resource management
- ☐ Distribution policy
- ☐ Single room
- ☐ Dedicated meeting room
- ☐ Gradual team distribution
- ☐ SCRUM master needs to be a strong negotiator
- ☐ The use of a “global” task board
- ☐ Coffee/ice cream meetings

7. Can you please rate the following issues which you were facing during implementation of SCRUM in GSD context?

- ☐ Un-trained team
- ☐ Concentrating too much on practices instead of SCRUM values and attributes
- ☐ Not supplying members of team with sufficient flexibility
- ☐ Effective usage of practices
- ☐ Lack of support from the executives
- ☐ Frequent requirement changes in a sprint
- ☐ Not having a strong Product owner and SCRUM master
- ☐ Good product manager cannot be a good product owner
- ☐ fear and compliance with employees
- ☐ Lack knowledge of knowledge about SCRUM
- ☐ Fear of criticism
- ☐ Convincing the Senior Management and the Project sponsor on Agile
- ☐ Getting people volunteer to take tasks and contribute to the sprint
- ☐ Lack of test automation affected the Sprint and delayed turnaround time.
- ☐ The team worried in getting exposed of their weaknesses.
- ☐ Allocating resources properly
- ☐ Large team size

- ☐ Members of team feel inferior to accept their backlogs or mistakes
- ☐ Shift the paradigm of the team
- ☐ Communication to comply the team with the communication model
- ☐ Defining the sprints and deciding the weekly deliverables
- ☐ It was difficult to build a shared vision on SCRUM.

8. Which of the following are aligned with SCRUM?

- ☐ Product owner
- ☐ SCRUM master
- ☐ CEO
- ☐ Software development life cycle
- ☐ Project management
- ☐ Business
- ☐ Change management

9. Which of the software tools are used by you for planning projects in SCRUM?

- ☐ EXCEL
- ☐ Mingle
- ☐ SCRUM works pro
- ☐ Version one
- ☐ SCRUM pad
- ☐ Wiki
- ☐ Everything is done manually
- ☐ Note cards
- ☐ Target process
- ☐ Pivotal tracker

10. Management challenges faced during a globally distributed project. Can you please rate the following challenges?

- ☐ Data Privacy
- ☐ Infrastructure

- ☐ Quality Management
- ☐ Managing Development
- ☐ Process Management
- ☐ Monitor and Control
- ☐ Multi sourcing
- ☐ Cross border transaction
- ☐ Contextual Differences
- ☐ Staff Management
- ☐ Linguistic Diversity
- ☐ Budget Overrun
- ☐ Higher Documentation Overhead
- ☐ Willingness
- ☐ Risk Management
- ☐ Trust
- ☐ Training
- ☐ Coordination
- ☐ Communication
- ☐ Time zone Differences
- ☐ Technical Challenges
- ☐ Cultural Diversity
- ☐ Knowledge Management
- ☐ Complex Hierarchy
- ☐ Inexperience
- ☐ Strategic Challenges

Appendix C

Survey Analysis

RQ 1

company	challenges	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	X			X	X	X	X	X		X		X	X	X		X	X	X		X					X	X								X		
2					X				X			X	X	X	X		X	X		X	X	X				X	X		X	X	X	X				
3	X			X	X	X	X	X	X	X			X				X	X			X		X		X	X		X		X	X					X
4	X			X	X			X	X	X	X					X	X		X	X					X											X
5				X				X	X	X			X	X		X		X			X				X	X		X			X			X	X	
6	X	X		X	X			X	X			X		X	X		X	X							X			X	X			X	X			

RQ 2

company	practices	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1														X			X		X		X	X	X	X
2	X		X		X		X	X		X	X			X		X	X	X			X			X
3		X		X	X	X		X		X	X	X	X				X				X			X
4			X	X				X	X		X			X		X	X		X			X	X	X
5	X			X	X						X				X		X	X				X	X	X
6	X		X			X		X		X				X	X		X	X		X	X			X

RQ 3

company	Benefits	1	2	3	4	5	6	7	8	9	10	11	12
1				X	X	X		X	X		X	X	
2	X			X		X	X		X		X	X	X
3			X				X	X	X	X	X	X	
4	X			X		X	X		X		X		X
5				X	X			X	X	X		X	X
6			X		X			X	X	X		X	