An Analysis on Scrum Methodology in Global Software Development – GSD

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Abstract— The development of applications in collaborative production environments poses problems relating to teamwork, control and communication. Global software development (GSD) has increasingly identified agile techniques that require regular contact and self-organization between remote sites to mitigate challenges. The main aim of this paper is to present an analysis of the challenges in GSD using Scrum practices. This study discusses the Scrum practices in GSD from existing database libraries from 2009 to 2020. It is found that there is relatively quite wide activity in the area of GSD and it may be difficult to apply Scrum in GSD but it provides solutions to the issues people face in this area.

Keywords—Agile approaches, Global Software Development, Scrum, Scrum practices.

I. INTRODUCTION

Global Software Development (GSD) offers cost savings, and reduced market time (Vallon, et al, 2018, Shameem et al, 2020).

It is a new trend in which IT service providers use global resources and continue their practice to achieve higher efficiency levels (Sriram & Mathew, 2012). This research seeks to understand the fit between agile methodologies and the development of global applications, and thus contribute to the increasing knowledge in GSD (Mathew & Sriram, 2012). We chose “Scrum” because it focuses on daily project management and commonly used agile method. A rising number of GSD project managers are taking serious account for the use of Scrum practices in their development (Hossain, et al, 2009). The next section gives an overview of the Scrum method and discusses the research background for this research. Section III explains the methods used in review. Section IV describes the results. Section V addresses the findings to draw conclusions. Section VII addresses the limitations of review.

II. RESEARCH BACKGROUND

This section includes a brief overview of the GSD Challenges and Scrum practices to clarify the essence of the proposed research structure. In this section, Scrum practices, role of Scrum in GSD and the need for this analysis is shown.

A. Scrum

Scrum is an iterative and systematic approach to project management. In Scrum, software is distributed in increments called "Sprints". Sprints start with planning and finishes with analysis and review (Hossain et al., 2009). Every sprint allows opportunities for improvements for the succeeding sprint. This is the reason scrum is very flexible through sprint cycles. It allows the developers to share their ideas in the manner of suggestions. They examine and discuss all the barriers requiring contribution from other team members. In this way, they overcome their impediments they have had or will have (Bhavsar, et al, 2020).

B. Scrum in GSD

With several collocated development teams, Scrum has already found a successful and effective method for managing projects (Hossain et al., 2009). All old methodologies became unsuccessful because Scrum proved to be very flexible in making changes in development of software at any phase. Now, people can develop software in very less time than past.

C. Review's Objectives

Scrum teams are encouraged by regular contact. Thus, the implementation of Scrum practices in GSD projects is evidently difficult because team members are physically separated (Hossain et al., 2009).

Study suggests that project management practices, i.e. Scrum practices are most common among other agile practices. Therefore, Scrum is becoming increasingly popular as an agile tool and can be used for globally dispersed teams. Due to global projects, it was decided to find and explain different challenges and techniques to deal with them to support Scrum (Hossain et al., 2009).

A large amount of related literature was presented over the years. In 2009 Hossain et al. studied and identified different challenges about scrum in GSD and gave suggestions to overcome these challenges. Similarly, Ansari and Doda (2010) described the use of scrum in GSD with very effective way. This literature review is written using these researches.

III. RESEARCH METHODS

There are following three primary stages, used to provide necessary steps, shown below in Figure. 1.

Figure. 1
STAGES OF RESEARCH

These are following research methods used to conduct review.

A. Research Questions (RQs)

The main aim of this review is to address the following questions in research listed in table 1.

TABLE 1
RESEARCH QUESTIONS ALONG WITH MOTIVATION

ID	RQs	Motivation
RQ 1	What is the role of scrum in GSD?	Identify role of scrum in GSD.
RQ 2	What factors cause restrictions in use of scrum for GSD?	Identify challenging factors cause restrictions for scrum in GSD.
RQ 3	What techniques and methods are widely used to tackle these issues in GSD?	Determine the techniques used to deal with challenges in use

		of scrum for GSD.
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B. Databases for Literature Researching

This study was applied on following libraries:

- IEEE Xplore (ieeexplore.ieee.org)
- Diva Portal (diva-portal.org)
- Elsevier (sciencedirect.com)
- Digital Commons (digitalcommons.harrisburgu.edu)
- Ijitee (ijitee.org)

Figure 2 shows the ratio of number of papers found for this research to number of selected papers used in this literature review.

Figure. 2
RATIO OF NUMBER OF PAPERS FOUND TO SELECTED PAPERS

C. Inclusion and Exclusion Criteria

Following table 2 shows the inclusion and exclusion criteria to conduct this research on Scrum in GSD.

TABLE 2
INCLUSION AND EXCLUSION CRITERIA

ID	Inclusion Criteria	Exclusion Criteria
1.	Studies focus on	Studies do not focus on
2.	Studies focus on scrum and answer any RQ.	Studies are not applied on

3.	Studies consider challenges of GSD.	Studies are not related to RQ.
4.	Studies are published in English language.	Studies are not written in English language.

D. Quality Assessment

This stage is performed to determine studies. These are the following Quality Assessment Questions.

QA1: Does the study identify main objective of review?

QA2: Does the study identify role of scrum in GSD?

QA3: Does the study indicate the restrictions in use of scrum and determine strategies which are being used to deal with these restrictions?

E. Data Extraction

This phase is performed to extract data from selected primary studies which respond to RQs.

These are the following properties which are listed in Table 3 regarding the criteria for RQs.

TABLE 3

PROPERTIES OF RESEARCH QUESTIONS

Properties	Research Questions
Role of scrum in GSD GSD using Agile Methodologies	RQ1
Is Scrum fit for GSD? Role of Scrum in GSD	RQ2
Role of Scrum in GSD Scrum practices in GSD	RQ3

F. Data Synthesis

It is applied to collect quantitative and qualitative data that form evidence from selected papers that answer RQs.

IV. RESULTS

A. Selected Studies along the Years

Figure 3 shows the quantitative analysis of selected studies on the issues of using scrum in GSD along the years.

Fig. 3

QUANTITATIVE ANALYSIS OF SELECTED PAPERS FOR SCRUM IN GSD

Findings about Research Questions

It includes qualitative analysis to answer the defined RQs based on quantitative analysis.

RQ1) Role of scrum in GSD

Scrum used in the GSD helps to increase output efficiency.

'Figure. 4' shows the role of scrum in GSD (Kalluri, D., 2017) (Sriram & Mathew, 2012).

Figure.4
ROLE OF SCRUM IN GSD

RQ2) Factors cause restrictions using scrum for GSD

It has been found that, in distributed environments, communication related problems are notable challenges. Cultural differences between the dispersed team members may influence team coordination and communication. Due to large geographical areas between team members, there is a big difference in Time Zones. Shortage of meeting rooms is one of the main restrictions in GSD using Scrum (Hossain et al., 2009). Cultural distance is also an eminent challenge (Ansari & Dodda, 2010).

RQ3) Strategies used to deal with restrictions and support Scrum practices

1. Synchronous communication:

Scrum teams used certain techniques to provide synchronous coordination where there is no gap in distributed team time. Changing the working hours and working from home etc achieve this. For example, a Scrum team used strict timeboxed meetings. The team members post their three regular Scrum questions or build a backlog to make the meetings fast and successful (Hossain et al., 2009).

2. Team management

It is found that splitting into small manageable sub-teams is a widely used strategy for managing a large dispersed team (Hossain et al., 2009).

3. Office space

It is revealed that to support a better communication and collaborative work, Scrum teams should use single meeting room for one team. In case of a person

changing teams then he or she can be relocated to the new room (Hossain et al., 2009).

V. LIMITATIONS

As every empirical research, this research also has some limitations. This review, which deals with the use of Scrum practices in GSD, may have missed some papers that address Scrum practices in GSD. However, it is sure that it wouldn't be a systemic omission. During the data extraction process, it was found that adequate information was missing in some articles, but defining and categorizing the themes from the papers synthesized data included in the study. Since some of the selected studies do not include comprehensive details, there is a risk of inaccuracies that may have resulted from the extraction process. Despite the advantages of using Scrum practices identified in this review, these practices are also limited by contextual factors of some GSD projects and may be solved by using other techniques.

VI. CONCLUSION

In conclusion, there is a growing demand in use of Scrum practices amongst other agile methodologies because Scrum proved to be best and fast method in GSD. However, there are many restricting factors i.e. communication problems, cultural differences, large geographical areas and lack of space. These are identified in reviewed studies shown in 'fig.2' but can be overcome using strategies discussed in RQ3. Therefore, this review presents that to support the Scrum practices in various distributed projects, a distributed Scrum team should choose various models to reduce the complexities of the project delivery. Yet it is also concluded that Scrum practices may be limited by some contextual factors of Global Software Development's projects.

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Appendix

TABLE 4. SELECTED PRIMARY STUDIES

	Ref	Topic	Author	Year	Place Published	Type
1	[1]	The Use of SCRUM in Global Software - An Empirical Study.	Ansari and Dodda	2010	Diva Portal	Journal
2	[2]	Scrum: An Agile Process Reengineering in Software Engineering	Bhavsar, Shah and Gopalan	2020	Ijitee	Journal
3	[3]	Using Scrum in Global Software Development: A Systematic Literature Review.	Hossain, Babar and Paik	2009	IEEE	Journal
4	[4]	Role of Agile Methods in Global Software Development.	Kalluri	2017	Digital Commons	Journal
5	[5]	Is scrum fit for Global Software Engineering?	Lous, Kuhrmann and Tell	2017	IEEE	Journal
6	[6]	Global Software Development using Agile Methodologies: A Review of Literature.	Sriram and Mathew	2012	IEEE	Journal
7	[7]	Systematic Literature Review on Agile Practices in Global Software Development.	Vallon, da Silva Estácio, Prikladnicki and Grechenig	2018	Science Direct	Journal