Issues and Implications of Scrum on Global Software Development

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Abstract- **Global Software Development (GSD) is progressively becoming an ordinary practice in the software business; also there is an increasing awareness of agile practices applying in offshore, global and distributed Software Development (DSD) projects. Global software development aims at bringing together the current international software industry and to make optimal use of globally existing talent, whereas possibly reduce cost, time and effort to market. Although the idea seems quite promising at first look large geographical spread, cultural differences and multiple time zones in global software development environment leads to many drastic issues and challenges like team management, collaboration, communication, infrastructure, cost and quality management etc. Agile methodologies come into play when dealing with such type of problems. The aim of this paper is to explain the benefits of using scrum methodology in a distributed software development environment. The paper also highlights the challenges that are faced by the agile team in the distributed environment of a global software development project. The provided information can be useful for Global Software Development experts to get familiarized with various challenging factors that may affect communication, collaboration and coordination related processes in GSD and also with the use of various Scrum practices.**

I. INTRODUCTION

Global Software development is a software development approach in which the development team is scattered in multiple geographical locations. The team members may belong to the same organization or in some cases they belong to distinct external organizations. The team members can be in different locations in the same country or in different countries. Understanding an optimal arrangement of teams and team members to make a fruitful collaborative developing environment is a difficult and interesting challenge, this research area is still in infancy stage in the field of software engineering [1]. GSD facilitates both vendors and consumers of IT services and global trade in attaining excellence. Global services commitment is made between consumers and suppliers of services for the fulfillment of dynamic business requirements, by providing flexibility in incorporating change requests, improved visibility throughout development process, and Speedy turnaround [2]. The motive of agile software development is to uncover suitable ways for better software development. A better quality product can be developed by giving importance to customer and tram collaboration over tools and processes. In GSD environment working software should have compact and comprehensive documentations, involve customer collaboration over contract negotiation and positively responding to change [3]. The overall face structure of an agile process is shown in figure 1 below.

Agile processes are planned to upkeep early and fast development of software applications. This is made possible by developing these processes in iterations. During iterations the stress is made on the delivery of working software that provide grade and value to customers as well as to project. Aim of agile processes is to provide workable deliverable in a dynamic way. Proponents believe that in agile process main concern is to provide deliverables and working products in a dynamic way without emphasizing on design models and documentation perspective. Experts of agile development process concluded that when documentation and analysis process is neglected it leads to corporate memory loss, especially when complex and large scale software are developed [4]. It is clear that organizations will have to face some sort of challenges in coordinating and integrating agility and global service delivery, but also it makes organizations able in delivering quick and error-free software that meet the concerned business requirements.

Figure1. Agile frame work

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Scrum is the most popular agile methodology, mostly used in distributed environment and it is considered as an

empirical management process which regulates and controls the software development. The approach or tactics which treats the software development as a self-organizing process facilitates teams to produce and deliver workable software in an iterative fashion in order to fulfill the customer requirements. Scrum process is known to be a black box type approach which aims at fulfilling the goals of the project by building the team and the processes dynamically during the project. Whereas, in traditional approaches, such as waterfall model, the significance is given to the process in a fixed and static manner from the management point of view [5]. Figure.3 shows the analogy of white box and black box nature of traditional and Scrum process models and figure.2 represent the overall overview of scrum process modal.

In Scrum Planning and Postmortem phases are important because this defining the inputs and outputs which are known as sprint. Planning is vital for overcoming any blockage in any phase or process during development. In agile terminology the Postmortem meeting known as retrospective, this is important for looking at the processes and creating knowledge base through best practices.
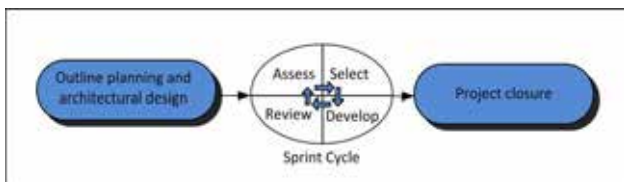

Figure 2. Typically Scrum process diagram

II. BACKGROUND

Traditional development methodologies are considered to be the heavyweight processes of developing software. These methods are based on a successive sequence of steps, for example requirements explanation, solution structure, testing and deployment. Many of these methodologies require comprehensive design documenting and defining a constant set of requirements at the start of a project. There are various different traditional methodologies such as: Waterfall, Spiral Model, and Unified Process. This heavyweight process comprised of wide-ranging planning, heavy documentation and broad upfront designs. Agile software development methodologies are introduced to provide answers to concern business community who are asking for light weight, rapid and more agile software development. According to oxford dictionary agile processes are devoting the importance of being agile, willingness for motion, nimbleness, activity, dexterity in motion. Some of the agile methodologies like ASD, DSD, Lean development and scrum are acknowledged that customer satisfaction could be achieved through the lightness to concerned processes [6]. Now we try to know that how to design systems by using scrum practices in distributed and out-sourced development environment. Some practitioners have explained different scenarios of software development projects worked on by traditional teams, where each member is independent and responsible of its assigned task and no team level collaboration is required. For successful development of distributed projects in global based software development critical attention should be paid to the alliance of the mission and business goals, instantiate of principles of agile principles, recognize the mindset of agile which is different from traditional development and the evaluation of the relevant technologies for the implementation of agile approach [7].
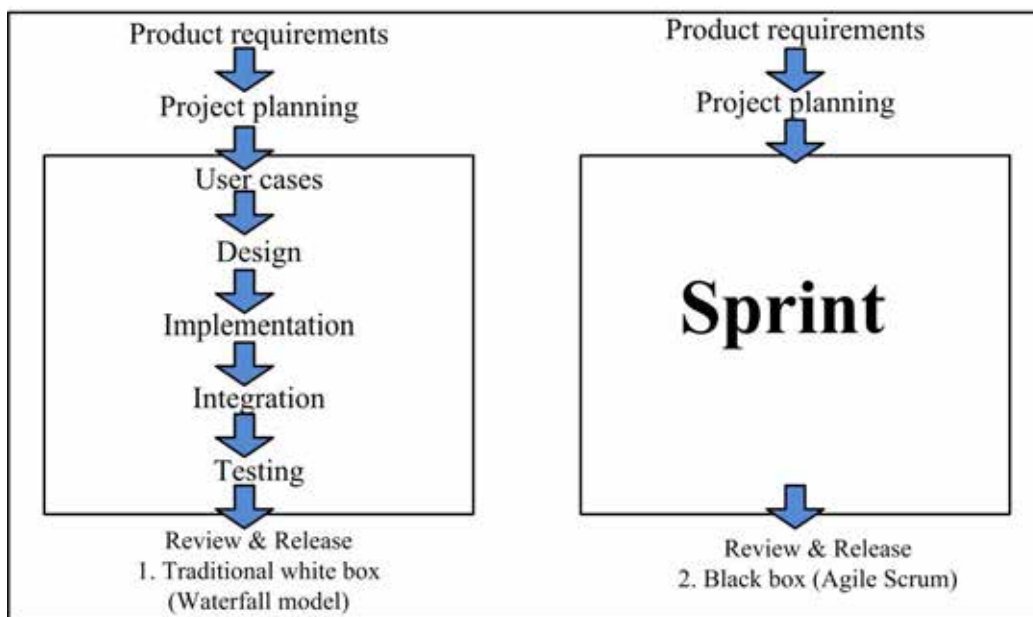

Figure 3. Comparison of Traditional and Scrum Process

III. A VIEW OF SCRUM IN GLOBAL SOFTWARE DEVELOPMENT

Scrum is an incremental and iterative development managing approach which consists of a series of shared practices. The six Scrum practices that may be typically used in GSD are: story backlog, sprint planning, sprint, daily scrum meeting, scrum of scrums and sprint retrospective. This success of these practices depends on close collaboration and positive interaction among software engineers, sponsors and clients. Different authors suggested that the main cause for the achievement of Scrum process is the interaction among Scrum team members. In GSD this interaction is difficult to achieve. However, irrespective of the variance among nature of GSD and Scrum inherent structure there is an increasing trend in examining the use of Scrum practices for GSD to grasp the benefits of this agile process. Empirical studies targeting this trend show that Scrum improves trust, motivation, documentation and quality of the work and product [8]. Reports based on industrial experiences also show that use of Scrum practices also ensure frequent and timely releases, availability of options to reduce some challenges faced during process and also promote team collaboration and communication[9]. However, the information provided is still not enough to direct new projects to finally adopt GSD with Scrum knowing all implementation and management level challenges beforehand. The aims of this study is to extend this knowledge about the challenges and benefits of the application of Scrum practices in GSD.

IV. BENEFITS OF SCRUM AND ITS CRITICAL SUCCESS FACTORS IN GLOBAL SOFTWARE DEVELOPMENT

For a Scrum based project to be successful it is important to facilitate coordination, collaboration, and self-organizing culture inside the team. Using Scrum in GSD environment the following important benefits are expected to be achieved.

A. Reduced Ambiguity

Although uncertainty and ambiguity is a big problem in all development environment environments, it is even at a higher scale in GSD due to informal communication in distributed teams. These ambiguities can be in the administrative procedures, project management, and also in customer requirements and design. Combined with a lack of team experience and domain knowledge, the condition can get even worse. With an inherent availability of communication and coordination practices in Scrum through daily Scrum meeting and planning it is expected to greatly reduce this problem from global development environment.

B. Maximized stability

Use of Scrum practices in distributed environment also maximizes the stability of the development process, as generally a distributed team is unable to follow a defined process due to the scattered team as well as scattered information.

C. Understanding deficiencies

The inter dependencies among responsibilities entail the frequency, size and type of coordination required between the contributors in a distributed GSD project. It is crucial for planning and implementation of the project to have a grip on what synchronization needs are to be expected.

D. Facilitate coordination

For team members coordination Communication is one of the way in which distributed team members can coordinate, beside this they can also bring together via processes, product line structural design, management practices etc. These choices can be realized as an exchange between upstairs and risk. Beside the above mentioned factors there some Recommendations to familiarize SCRUM to a global engineering setting which are:
Use teamwork gateway to support interactively the SCRUM meeting and bring up-to-date the task backlog. It is quite not likely that the entirely teams are accessible at any point of time. If the development pace is fast then after each shift the scrum meeting may be conducted. A more detailed weekly SCRUM concerning management can be setup midweek

V. SCRUM ISSUES IN GLOBAL SOFTWARE DEVELOPMENT

Along with the benefits of using scrum in GSD there are various complications faced by several organizations which are using scrum methodology. These problems are caused mainly by geographical distance, culture differences, communication problem, team management, information sharing and management, process and organization supervision issues and practical issues etc. Using agile and scrum software development practices in GSD the following challenges may accrue during product development.

A. Effective usage of SCRUM practices

To efficiently implement scrum practices is challenging in global software development when they are too many sites. It is hard to encourage all team members to actively involve in scrum meetings.

B. Geographical distance

Using various scrum practices in distributed environment can affect some aspects of project such as: team collaboration, face to face communication, languages and temporal differences. So the agile and scrum should extend to global and distributed development. Different authors also illustrate culture as a critical success factor in offshore and global development and outsourcing relationship; culture differences among distributed team members have a negative effect on projects performance and may cause misunderstanding. There is always a difference of cultures and habits of people across global scrum teams, which is

unavoidable in case of distributed/outsourced projects .In the words of Gupta and Ravel (1999), cultural problems can create or breakdown an distributed project/offshore project [10]. One method we identified was to focus more wisely on an understanding of the nation-state and its primary social structures. Possibly, the only approach to achieve that position of awareness is by living and experiencing life in another culture, as proposed by anthropologists involved in ethnographic reading [11].

C. Risk Management

Management of project risk is one of the main actions in project management perspective. Global software development has many issues concerned with correction of problems, evaluation of problems, sharing of information and risk detection [9]. Shortcoming in software arises due to specific factors such as lack of team members' interest, group coordination and attentiveness and communication related problems. Risk management activities are performed in order to tackle with these risks and meet concerned business needs. Proper requirements description and satisfactory measures are introduced to meet these business needs [12]. In Open Source distributed software development (DSD) onsite communication among team members and clients is difficult and costly task to perform so various alternative techniques are suggested by different researchers and practitioners for better and cost effective communication. These techniques conclude practices, various tools and special skilled persons and proper modularization across locations. Also researchers have recommended agile practices for better coordination between various teams and communication among them in GSD perspective [13]. In coming section various cons and pros of merging agile and GSD will be discussed in detail. Risk management is given importance in traditional project management and is included one of knowledge areas in PMI body of knowledge. It's still a research question that how risks are handled and managed in agile software development. Risks cause unexpected circumstances and outcomes especially in GSD perspective. Risk can be positive or negative, positive risks cause opportunities while negative risks generate threat for project. This is separate from that issue, which is an unexpected or unanticipated outcome. As different possible aspect is involved just before risk, it is not known that where the risk is accrued but exist in the project.

D. Communication problem

Scrum teams are distributed globally where for each team a meeting room is required. But in some sites a dedicated meeting room may not available, which is also seem to be a challenging issue because that bound the team communication and collaboration process. Team management: researchers also claim that more than 50'%' of the project can fail due to low experience level of project managers which are working outsourced project. The reason might be that they have ignored the past towards

Information technology, and the discipline of software project management, which causing defects in experience level. Beside this scrum team management is affected due to difference of time zone [14].

E. Knowledge management

An Organization wants an active way of information and "knowledge sharing mechanism" by using scrums predefine standards and actions. Staff training concerning these techniques leads to effective collaborative development. In Scrum approach scrum team members must to gather knowledge, decisions, techniques and skills in the development process through motivated information sharing manner, so that the team members will use this type of experiences which will reduce cost and redundant work.

F. Different working hours

As due to different time zones team members are not available in one time, therefore working hours of such teams should be bring into line in such a way that could improve the user collaboration and communication which will give support to increase transparency and avoid amendment in the work
which is already done [14].

G. Technical issues

When the Scrum team use some of the scrum rules which may be characterized in place of other practices and training, Such as: early Scrum practice, training and methodological Scrum which is arranged to make clear firsthand technological problems, highlight the most significance of this method(scrum) also to advance team cooperation even though using Scrum practices in distributed environment.

H. Inexperience

Having an inexperienced team leads to lack of common goals: untrained members focus less on standards and organization ends. They always contemplate about their singular goals. They lack having shared penalty area. Particularly, when the leaders are not well trained on SCRUM, right supervision will not be given to the players. This is always challenging in a dispersed SCRUM team. The experiences gain in far shore project for a business organization is some time critical, therefore lack of experience in global development environment is main reason of project failure for global and offshore projects [15].

I. Practical Challenges

In Global and distributed application development projects task is distributed into scattered locations, which needs the establishment of a fast and reliable network to join distributed teams with each other. because development task may be distributed then it should be integrated through configuration management task [16].

J.   Time Interruptions

We work they sleep. Due to time and geographical variations between different sites, time intervals issues can happen during management and synchronization of key processes among isolated sites [17].

K.   Data Privacy challenges

As the communication take place between customers and offshore team from different locations therefore data protection is always important for both customer and organizations. Customer relationship can affect due to failure in project. For this type of protection a mechanism is required to avoid this confident [9].

L.   Infrastructure challenges

A solid infrastructure should make available to team members who will provide dedicated support the distributed communication and collaboration among the team and the client. The infrastructure should involve a comprehensive range of interface and tools for synchronous and asynchronous communications.

VI.   DISCUSSION

A most important cause for the achievement of Scrum goals is the physical juxtaposition of software development team members [18]. Though, the collected efforts also reports examples of success in using Scrum practices in global and Distributed Software development [19]. Therefore, using Scrum practices in Distributed software development environment may progresses communication, confidence, inspiration and superiority [12]. many researchers also suggested that some Scrum practices can reduce many of   the known Global development issues and challenges [20]. it is also claims by different authors in different situation that Scrum practices like   scrum of scrum, daily scrum meetings, sprint arrangement and review meetings involve dispersed group fellows in cooperation, support positive thinking of unseen complications, upturn team life-force, and improve trust [21]. Similarly, sprint scheduling provides mutual imagining of plan actions and increases obedience. Moreover, it is suggested that daily scrum meetings carry transparency and inspire easygoing communication between dispersed parties; iterations make available numerous far shore effort monitoring occasions; each sprint meetings make available mutual consideration and thoughts of collective objectives and expand work alertness, and; sprint demonstration carries out transparencies for participants and stop problems timely. Global and distributed applications development needs closely collaboration among team members having diverse tradition background. On many critical dimensions Cultures can be different, like the essential for structure, attitude toward archpriest, logic of time, and communication manners. Whereas many people find such variances inspiring, they can also tend to thoughtful and prolonged confusions, specifically between the people who don't know each other well. A different sense of time can lead to rough and better manner over the interpretation and significance of targets. Cultural differences often intensify communication complications as well. When people are confused as to how to answer back to odd-sounding messages, they often just overlook them or make unkind attributions about the sender's intentions or character.

Global task board should be used because it is useful in improving the productivity of agile teams distributed internationally. Action to be done must be orderly organized through using minutes of meetings by every member of each team. Postponements and problem that were not expected produced in some cases. Origination of tool to plan and implement sprints by comprehensively dispersed teams could be an efficient creativity. In contrast to, normal teams there would not be any developer, architect, a project manager. No one of the members was allotted with similar responsibilities. Responsibilities allocated early [22]. Hence, a confidence of group possession and port swapping adjusted several attainments of member in a team. For the success of Service oriented architecture (SOA) a disciplined agile should have to always incorporate at least an iteration of sophisticated architectural imaging phase for the right direction towards a well thought governance, reporting of risk and significant focus validation. Scrum practices are used by distributed teams to tackle with cultural and temporal diversity related challenges either by increasing the overlapping working hours between the sites working in GSD environment or this can be done by in empowering and facilitating synchronous communication among team members belong to different locations and cultures with the help of introducing instant messaging and Wiki technologies. Members working in Scrum environment can contribute and cooperate with each other in corporate employed hours or by adjusting operational hours. They can also use an alternative approach by giving answers to the following questions before going to daily scrum meeting:

- What I have done yesterday?
- What I will do today?
- What impediments I am going to face?

And after meeting review notes emailed back to him after the meeting has finished. Also team members belong to different locations and cultures coordinate with each other in working hours and utilize asynchronous communication tools for further meeting practices.

In distributed development environment it becomes difficult for team members to share social activities and to know each other because there is low chances of overlapping working hours between the sites as these teams belongs to different countries and different locations having time zone differences. Also team members hesitate to share feelings and other problems with each other and uncertainties generates because of time shortage and lack of communication. Later, on these uncertainties lead to project delays and schedule overrun issues and hence

project failure to meet concerned business needs. Communication related issues arises because one site is in sleeping time hours while other site is in open state so it lead to coordination and integration related issues and delay in receiving responses from each other [19, 23]. For this purpose these organizations needs to adopt appropriate practices and consider their global settings in order to handle time delay problems effectively. For an open source, distributed scrum project success it is important to substitute a collaborative, self-organized and autonomous management environment within the team. For better communication and collaboration team members should be provided with a solid infrastructure. This infrastructure will provide a comprehensive interface and tools support in order to facilitate team members with synchronous and asynchronous communication. To avoid inadequate and poor communication scrum team make use of the practice multiple communication modes which also help in providing better communication environment. Concerned practice also facilitate project stack holders by providing the facility of various tools support such as web camera, phone, teleconference facility, video conference facility and email etc. [24].

VII. CONCLUSION

We have prepared this study through a literature review on the Scrum practices in Global Software Development where agile scrum approach is used as development process model in distributed environment. The purpose of this study is to find out the main benefits such as: Reduce Ambiguity, Maximize stability, Understanding deficiencies, Facilitate coordination and Recommendations that familiarize SCRUM to a global engineering setting which are: Use teamwork gateway to support interactively the SCRUM meeting and bring up-to date the task backlog. It is quite not likely that the entirely teams are accessible at any point of time. If the development pace is fast then after each shift the scrum meeting may be conducted. A more detailed weekly SCRUM concerning management can be setup midweek. For the success of GSD a disciplined agile should have to always incorporate at least an iteration of sophisticated architectural imaging phase for the right direction towards a well thought governance, reporting of risk and significant focus validation. Also for successful development of agile distributed based software development attention is required to the alliance of the mission and business goals, instantiate of principles of agile and outsourcing Governance, recognize the mindset of distributed agile which is different from traditional development and the evaluation of the relevant technologies for the implementation of agile base distributed development. It is also find out that different challenging issues that limit the implementation of Scrum practices globally distributed development projects such as: Effective usage of SCRUM practices, Geographical distance, Culture differences, Risk management, Communication problem, Team management, Knowledge management, Different working hours, Technical issues, Inexperience, Technical Challenges, Time Delays, Data

Privacy challenges and Infrastructure challenges. This study make available information that can be valuable for Global Software Development Organizations and experts to understand the various challenging elements that may affect the Global Software Development communication, coordination collaboration processes and confine the use of various Scrum practices. Furthermore, the Global Software Development project bosses can also take assistance from the knowledge about the approaches that are actuality used to deal with the acknowledged issues.

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