

# Scrum: A Challenge for Distributed Software Development Companies and Organizations

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October 24, 2011

## Abstract

Today software industry going to take a new shape of global software development because it takes advantage of high skilled developers, low cost offshore resources, reduce time to market, increase in productivity, improve quality and provide cost efficiency for software development companies .Although at the same time various techniques and practices of Global Software Development face different challenges in term of communication, coordination, control and different time zones. This paper mainly focuses on one of the Scrum technique and its challenges to globally software development organizations.

**Keywords:** distributed software development, scrum, communication, control, coordination

# 1 Introduction

After few decades of successful operations of software development, now the globe is looking for an efficient, low cost and dynamic standardized way of Global Software Development. If you had ask this question from any relative person that is it possible to have a system developed, which has the same requirements, features and functionalities, by a group of people living in different parts of the world and had never seen each other, the answer would have been NEVER!. And it was quite logical. A successful software development requires absolute synchronization of developer's minds, concepts and views and also requires a sense of understanding, cooperation and commitment among the group / team. While for people with such diverse backgrounds it would be hardly possible to understand each other and even if it happens it would not be time and cost efficient.

Now if you ask the same question from the same person now his/her answer will be YES! Global software development is a well known and in fact a very popular phenomena now. It is not just applicable now but is considered as the most efficient ( in terms of time and cost ) way of developing large software. Agile methods are a new approach towards software development. There are a number a agile methods practiced by different practitioners across the world. But here in this paper we will discuss a very important agile method called SCRUM. SCRUM consists of a set of practices that are practiced during the development of the software. Agile methodologies have a very popular and fast growth practices and process in software development industry. Agile methods are agreed to handling any requirements or features change during development process and make shortly iteration for delivery of product. [5] Scrum is iterative and increment approaches for project management in adopt agile methods for software development.[9] Now a days the distributed software development is very important trend

in software development industry. The advancement of ICT framework such as computer network, telecommunication and Internet technologies have provide the enough facilities and advantage for distributed software development high skilled low cost, increase product quality, reduce time to market. However there are some benefits the GSD are also many challenges identified. The main challenges encounter in GSD are poor communication and coordination of different teams and geographical locate different time zone, socio culture, conflicting expectations, and problem of understand and trust of between different team members(Holmstrm, Fitzgerald, gerfalk, and Conchir 2006). The distributed software development required a mechanism to mitigate these issues. Scrum practices and mitigation mechanisms can used to solve the DSD challenge of communication, trust, language problem and other challenge and risk.

## **2 Research Background**

Globally distributed software development rapidly increasing as the software market and companies evolved and developed, it is a very common phenomenon that distribute software development is more risky and more challenging then the software team that develop software which is collocated. Global software development gets popularity that they divide the labor by allocating software development task among various development software companies or software development centers. This type of software development becomes a well known business model for software development companies. There are several reasons behind this popularity and attraction to develop software globally 1). Such type of software development has the ability to extend the work instead of working in regular office hours at a single office or single location.2) such type of development has low costs in term of manpower ,for example from the developing countries the man power has

four time low cost then the developed one. 3 it also improve collaboration between the distant work force due to the advancement in information and communication technology. The aims of this paper are to define the benefits and challenges achieve by applying scrum practices to Distributed software development. What are challenges face during the scrum methodology implementations in distributed software development.

### **3 Scrum**

There are several agile methods and practices such as scrum, Extreme Programming or XP, crystal clear feature driven development and dynamic system development method. Among these agile methods scrum and extreme programming play a vital role and mostly used in today software development. Most of the time they work together but scrum is more focus and concerned about project management techniques while extreme programming give more attention to actual software development. Scrum is a simple frame work which is used to organize teams and get work done to be more productive with good quality. It allows teams and team members to choose the amount of work to be done and decide how best to do it, thereby providing a more enjoyable and productive working environment. Scrum give more attention and focuses on prioritizing work based on business value, improving the quality and usefulness of what is delivered and in this way increase the revenue specifically early revenue. Designed to adapt to changing requirements during the development process at short, regular intervals, Scrum has the ability to allows teams to prioritize customer requirements and change the work product in real time to customer needs. By doing this, Scrum came to know what the customer wants at the time of delivery and in this it improve customer satisfaction while eliminating waste work that is not highly valued by the customer(Rani, Dodda, and Ansari 2010).

Scrum is a simple “inspect and adapt” method and software development process designed to add energy, focus, clarity, and transparency to project teams developing software systems. A properly implemented Scrum was designed to increase speed of development, align individual and organization objectives, create a culture driven by performance, support shareholder value creation, achieve stable and consistent communication of performance at all level and enhance individual development and quality of life (Rani, Dodda, and Ansari 2010).

- **Scrum Roles**

Scrum frame work has three roles which aim to deliver the working software in sprints which usually in thirty days of iterations. The three roles are the following.

1. **Scrum Master:** This is a role which is related to management and the main responsibility of the scrum master to promote the development team and remove all hurdle and obstacles that make problem throughout the sprint. He has a duty to pay full attention to bring good communication among team members and at the same time also play the role of coordinator among customers and members of project. Scrum master is the one who has experienced in business and software industry to perform his functions easily (Sutherland and Schwaber 2009).
2. **Product Owner:** Product Owner or scrum owner has the responsibility to prioritized customer needs and he assures that the software will full fill the requirements of the customer. He also sure that the entire team members developing the product according to the customer needs. It is also the responsibility of the product owner to explain all the requirements to the team members and it is the product owner who will approve or reject the requirements.

3. **Scrum Team:** During the development of agile software the scrum team usually from two to eight members. The team has the ability to organize itself and its work and in case of any hurdle and hazard they can inform to scrum master. Every team member can update his progress to other team member in scrum meetings.
- **Scrum meeting:** Scrum method have several meetings through the development process of the software or product.
    1. **Sprint planning meeting:** At the start of the each sprint, sprint planning meeting take place. In the first part of this meeting, the product owner and scrum team discuss about product backlog, fix goals and also give insight to understand thinking of the product owner. In the second part the scrum team selects some tasks from the product backlog and makes commitment for the given tasks completion by the end of the sprint. This is the main point in the scrum that the team make commitment for the completion of the assign task rather than the product owner impose on him to complete the task.
    2. **Daily scrum meeting:** Members of the scrum team meet daily once in the morning, this is a short meeting about fifteen minutes and everyone from the scrum team attend. It's a great opportunity for the team member to participate and report about the progress and obstacles. Every team member report three things to other member of the team. (a) What they did from yesterday (b) What they will do today? (c) What hurdles and obstacles on their way? This is the responsibility of the scrum master to point out the hurdles and then help the team members to resolve them as the meeting finished (Rani, Dodda, and Ansari 2010).
    3. **Sprint review:** At the end of the sprint, sprint review takes

place. In this meeting the team give a presentation what they built during the sprint. Management, product owner, scrum master and customer take part in this meeting. It last from few minutes to few hours but the main purpose to make presentation and get feedback what is build during the sprint. In our project meeting last for one and half hours.

4. **Sprint retrospective:** Just after the sprint review sprint retrospective session take place. In this meeting every individual team member report his/her progress about his/her own specific role in the project. Product owner ,team and scrum master all attend this meeting and its opportunity for all to discuss about what is working, what is not working and agree on changes they want to adapt. In our project sprint retrospective last for one and half hour.

- **Scrum artifacts:** The purpose of using scrum artifacts to store information about the project and few of those artifacts are discussed below.

1. **Product Backlog:** Preparation for a Scrum Sprint starts with the product owner developing a plan for product or software. The product owner could be a customer or customer representative. A product owner needs a vision and knowledge about the product that reflect its ultimate purpose, a business plan that shows us how revenue can be achieved from the product in a specific time frame. He will prepares a list of customer requirements prioritized by business value. This prioritized list is actually the product backlog and it is a single list of features prioritized by business value delivered to the customer. The product owner takes help from the scrum team when he is ready to prioritize the product

backlog to estimate the cost of developing features. The product backlog includes all activities visible to the customer and all activities that will be the part of the project. Items who have highest priority in the product backlog need to be broken down into small enough that will be easy for further estimation and testing.(Rani, Dodda, and Ansari 2010).

2. **Sprint Backlog:** The scrum team select top priority features from the product backlog and scrum master make commitment to deliver these selected features, now these features are put in another backlog called sprint backlog. Task from the sprint backlog are broken down into pieces and it will require two days. Development team is responsible for is responsible for any updates and will communicate with the product owner.
3. **Burn Down Chart:** During the sprint planning meeting scrum team point out and make estimation of specific tasks that must be completed within the time frame of the sprint. Burn down chart is the graphical representation between the work left out and duration of the work. This type of chart usually created in excels sheet, share point and white board. The chart should be updated on daily bases (Sutherland and Schwaber 2009).

## 4 Distributed Software Development Challenges

The main challenges of GSD are mainly categorized in communication, coordination and control challenges these problems compound due to temporal distance, geographical distance, and social cultural distances, but besides what the literature and previous research work suggest, we



would also like to present and discuss these already identified challenges in the light of a project that we participated in. The class of Master of Information System implemented a project in one of its mandatory subject called Agile methods. We would present the challenges this group of students faced during the implementation of Scrum practices during the development, although this group of students were collocated, but it was a multi-ethnic group and were facing almost the same kind of problems that we face in GSD. it was a group of twenty eight students, these students were divided into 3 different sub groups. all these three sub groups has to work together on developing a system. Describing the system i think is not relevant here. I would just present the type of challenges that these sub-groups or its team members faced.

- **Communication:** Communication was the major problem that all those groups raised in the sprint review meetings. there was a lack of communication among the groups, As these groups by itself has students belonging to different backgrounds and from different parts of the world so there were also problems of communication and understanding among the group members with in groups. but as this paper is about the implementation of Scrum practices in Global Software Development, so we would focus on the issues emerging between groups. Communication is also thought to be the major challenge that appears during the DSD, due to geographical location, temporal distance and different of time zone etc. The temporal distance may make a number of communication issues such as the reduction in the collaboration, synchronous communication difficulties and delay of project work. In cause of geographical issue is reducing face to face communication or informal contact, and also results in mistrust or reduced trust on team members.

- **Cultural:** The groups involved in this project were not able to communicate effectively, and even if there was some sort of communication, it was over shadowed by misunderstandings and difference of understandings of scenarios, which was natural as this was the first ever agile project they were doing. But in GSD this matter is of great importance when people with different backgrounds having different languages when communicates to implement a common task. Socio cultural distance and language also produce the misunderstanding and misinterpretation issues during the GSD. The different cultural is big challenge in global distributed software development due to communication style difference, different organizational structure, and different language. For example when Asian people discuss a problem their language and communication style are different then European people (Herbsleb and Moitra 2001).
- **Management:** The selection of the right person to be the scrum master was also an issue in some of the groups and to control and guide the group was then another big challenge for the scrum master. so overall the management of the team also came up as a challenge for us. Management and coordination of large team in geographical different location are also big challenge for DSD. Management challenges of GSD are cost management issues, team management issues, risk management issues and time management issues(Hossain, Babar, and Paik 2009).
- **Peer to Peer (Scrum masters) Communication:** Peer (Scrum masters) presenting groups to communicate with other groups. It sounds very good and helpful, you can get any information by communicating with the scrum master. but in the particular project mentioned above, this scrum master thing was becoming a hurdle in effective com-

munication and the reason was that for this kind of communication, when scrum master provides all information to other groups and get all information from other groups, the scrum master has to be very well informed and up to date, which was not the case with the student groups, so they wanted to have a direct communication, because when one scrum master on either side of two groups communicating is not up-to-date. the whole communication process becomes ineffective. and i personally think that direct communication is much more effective than indirect communication (through scrum masters). But only of agile manifesto allows it.

- **Coordination:** The lack of coordination was there during the project, and it came in front at that third sprint review. When the groups were not able to integrate their product or parts of the project that they did. In this project the output of one part of the software was an input to the other part, so a coordinated effort was required to implement it, also the overall idea about the project, about its size, context, display and everything requires better coordination, the more the coordination, the better the results of the project will be.

Increase coordination cost and reduces awareness in the team members due to geographical distance and socio culture distance. Strategies challenges: The strategies challenges are decision making problems. it is important that management making a decision that the project is developed by distributed teams or co-located teams. Another problem is that a decision also required how to divide the work among different distributed teams.

- **Synchronous/Direct Communication:** Scrum practices widely benefits from informal communication and direct communication, although there ways of formal communication but the reliance is majorly on di-

rect communication in the form of daily scrum meetings. and the main objective of the Scrum or agile methods as a whole is to have a coordinated effort to implement the project, and all the three given phenomena i.e. whether its synchronous or direct or informal communication none of them can be seen in the distributed software development.

- **Reliance on other external factors:** In case of DSD almost all of the communication and coordination is through a certain medium and technology which is something that you cannot fully rely on in certain parts of the world, like there is an electricity problem in South Asia. Similarly the Internet bandwidth issues in some parts of the world etc.

## 5 Scrum face challenges during the implementation in Distributed Software Development

Although scrum practices are thought to be the best for physical collocation of development team members. Scrum teams must have the ability of self organization and also have facilities and tools of communication and collaboration. the problem of having daily sprint meetings with all the team members present was one issue and a number of other issues like this one arises when you implement scrum. and if you are doing a Distributed Software Design, then an effective coordination among the distant/not co-located small team members is really important. The different geographical locations of team members in DSD are difficult to apply scrum practices. There are many challenges arise during DSD project such face to face communication problem. Language issues, cultures issues and management and coordination issues.

- **Face to face meeting is difficult:** The face to face meeting was some time not possible in the case of these student groups when all these students were collocated, because of different reasons. While in the case of a distributed software project teams located in different countries in the world so face to face communication is almost impossible which is in fact the key of Scrum practices in the form of daily scrum meeting(Hossain, Bannerman, and Jeffery 2011, Paasivaara, Durasiewicz, and Lassenius 2008). Some time The distributed team members even do not understand what their goal is in the project and also sometimes do not know the importance of the information provided regarding project due to lack of face to face meeting.
- **Misunderstanding or lack of information:** Different socio cultural factor and the difference of the medium of communication which includes the use of different languages by the groups or group members also produce misunderstandings and misinterpretation issues during the GSD(Hossain, Babar, and Paik 2009). The issues and misinterpretation due to cultural differences is also a challenge in global distributed software development due to socio culture distance, communication style difference, different organizational structure, and different language. This difference in the culture of distributed teams has also some time a big impact on the team collaboration and communication process.
- **Project management challenges:** In this agile project of three independent teams we noticed that there were a lot of management issues and according to our understanding it was because of having no one to manage and to unite these teams at a certain point. Maybe its takes us a little away from the basic principles of agility, but in the other case if we don't have this personal or managerial post then in the case of difference of opinion between the groups could lead to a chaos. Which

happen to be in the case of this student project and when in the end all the teams has done a great job and has successfully produced their part of the project, but due to the lack of management and lack of coordination due to the absence management entity. We believe that for a better coordination and specially in the end during the integration process there must be some required to manage and coordinate these independent groups. Similarly management of the project is also a challenge in distributed geographical software development due to different time zone, different socio culture and geographical distance. There are many management challenges during global software development process such as large team management, risk management, integration management, knowledge management issues and process management challenges. All team members work together and are collocate during the scrum methodology of Software development process. The managing and coordination of distributed teams is a huge challenge during the distributed software development due to geographical distance, temporarily distance and socio cultural distance.

- **Distribution of work:** This is one of major challenge during geographical distributed development. The challenge is that distribution of work should be assign on base of working specialist not assign according to location. This will be lead to an architectural which will be start reflecting of team geographical distributed(Shrivastava and Date 2010). Thus it will becomes impossible to complete the user stories and features within iteration in different geographical location will become overspecialized a particular component.
- **Different time zone:** Different time zone is also one big challenge for distributed teams during global software development. The impact of this time zone difference can be imagined from the scenario that in

globally distributed teams, sometimes when one group is working the other group is not working. This issue can be dealt with if you have to face it once, but in case of Scrum practices you have to coordinate and communicate all the time. The synchronous or direct communication is greatly affected by this different time zone problem. This is produce misunderstand, miscommunication and need to rework and redo of other team work. Which produce delay during development of software product?(Paasivaara, Durasiewicz, and Lassenius 2008, Shrivastava and Date 2010)

- **Reduce time of new remote team members:** The communication challenges of distributed teams appear to be more challenging when there are remote new team members. Due to lack of face to face meetings and lack of direct communication the new remote team members are not able to know how to fit-in and also the other team members face difficulties to express its work and to make the new member understand the progress in the project. Sometimes they are also new to work in agile methodologies or scrum practices. [7] Reduce team management is also an issue in large development teams during the global software development. There lies poor coordination between the teams and so the teams and its members are not able to know about their role and work in project development. The distributed teams and the members could not share information and their perception with each other due to communication problems, which results in reduced trust among the teams and its members.
- **Documentation update problem:** Although there is not a lot of documentation in agile practices but in the Scrum practices there is a concept of maintaining backlogs, Backlogs are of different types but the main product backlog is of high importance and its of great importance

in terms of communication too. In Distributed software development process when you don't have a synchronous and reliable direct communication, Product backlog plays the role of an asynchronous communication. the roles and tasks and also the progress in achieving those goals of all the groups can be checked in the product backlog. In this case the product must be up to date and must be reliable. this product back log appears as a major documentation in end of the agile project. maintain and update challenges appears some times between distributed teams during the Distributed software development. These problems occur due to miscommunication and misunderstand between scrum masters when they are not clear about their responsibilities and their work and are not able to update product backlog when new features come(Paasivaara, Durasiewicz, and Lassenius 2008, Shrivastava and Date 2010).

## **6 Using Different Techniques to meet these challenges that arises during the implementation of scrum in Global Software Development**

- **Face to face meeting difficult:** This challenge can be handling using ICT mediate asynchronous tools such as video conferencing, teleconferencing, web conference and audio and video Skype during the distributed daily scrums. So the team members are virtually present in daily scrum meetings which helps in understanding each other's perception and building spirit in distributed teams(Hossain, Babar, and Paik 2009, Therrien and Lebel 2009). When there is communication



bandwidth problem or other ICT tools issues and video conference or teleconference is not possible. Then used the Internet Relay chat (IRC) or email or wiki that support the daily scrum meeting(Hossain, Babar, and Paik 2009, Therrien and Lebel 2009). When the distributed teams located different time zone and synchronize communication impossible then adjust working hours or answers three questions by email before the distributed scrum meeting start. "What did I do yesterday? What will I do today? And what impediments are in my way?(Hossain, Bannerman, and Jeffery 2011)

- **Culture misunderstand:** The literature suggest that scrum practice reduce the socio culture distance and culture misunderstanding by using team gathering, Visit, and information communication technologies tools used.[6]. Before distribution of project start all teams members get together and attended the initial sprint of scrum. In this gathers the team perform the same sprint planning, review scrum meeting and other social activities which is reduce the social distance and misunderstanding between the teams members. The scrum distributed teams members visit to other site during the sprint are reduce the cultural distance and increase the project vision and understand team's members (Paasivaara, Durasiewicz, and Lassenius 2008, Hossain, Bannerman, and Jeffery 2011).
- **Team management:** The literatures propose that managing large team size by divided the small manageable teams into small sub teams or local teams. Each local scrum teams are self organization because each local or sub scrum teams allocation independent architecture subsystems and having good interface each teams to decrease inter communication between local teams.[3]. The scrum of scrums meeting practices are used for inter communication between distributed teams(Hossain,

Babar, and Paik 2009). Scrum master of each local teams are participate of scrum of scrum meeting who is represented his or her team(Hossain, Babar, and Paik 2009, Therrien and Lebel 2009). He is share information with another teams what problems his/her team face during development process.

- **Distribution of work:** This problem can be fix on this method that all of distributed team focus on complete of user stories not to add feature of component. The scrum team focuses on deliverable product to the customer value not architecture of the system. All distributed team used the same product backlog during the distributed software development.
- **Different time zone:** When the time zone difference 3 or 4 hours between distributed team then adjust work hours practices is used so the daily scrum meeting may be held on morning or afternoon time. When the time zone differences are so large between the distributed teams then team may be select someone for representative who has earlier worked with remote team and have good relationship with team. He will also attend daily stand up meeting of his team. He is role like foreign officer he will communication to other teams and also communication to his teams members.
- **Focus on training of new remote team members:** The Literature shows that the new remote team must training for scrum practices. They must be understood and training how methodologies scrum is used in this project. The training about initial scrum training or technical scrum (Hossain, Babar, and Paik 2009, Shrivastava and Date 2010).
- **Key documentation:** Maintaining valuable documentation are im-

prove the DSD team collaboration process while using scrum practices(Hossain, Babar, and Paik 2009, Shrivastava and Date 2010, Cottmeyer 2008). A global backlogs are used for maintain and update the user stories and application features which helps to reduce misunderstand among distributed teams and improve teams collaboration process. Scrum teams used various tools for managing backlog. For example wiki, issues track (e.g Jira) and management tools e.g. scrum work etc(Cottmeyer 2008).

## 7 Conclusion

Today software industry going towards Global software development and it can be achieved to offshore skilled people from around the world but at the same time GSD facing numbers of challenges. In this document we actually tried to highlight some of those challenges. We used our on-going project at university level where the students were actually using Scrum and some features of XP for implementing this project. Students were divided into three groups and all features of scrum were adapted. Experience from this project were used to identify and gather the challenges. In the second part of the paper some solutions were suggested to solve or at least handle these challenges in a better way. These solutions were actually adapted from the suggestions from the previous literature. The precision of these solutions or suggestions can be verified only by adapting and implementing them.

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