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To Overcome Communication Challenges in Distributed/Virtual Scrum Teams

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To Overcome Communication Challenges in Distributed/Virtual Scrum Teams

To Overcome Communication Challenges in Distributed/Virtual Scrum Teams

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Master of Science in Project Management

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Abstract

The purpose of this research is to give an overview of a scrum in distributed teams and to suggest ways overcome communication challenges in such projects. In this research proposal, the latest available research on a scrum in distributed teams will be thoroughly analyzed and evaluated to know the possible solutions for communication problems in distributed teams. A review of the literature suggested scrum is widely accepted agile methodology in software projects and also it works best within collocated teams. However, the literature review also proposes that lack of proper communication is one of the main challenge faced by distributed scrum teams which needs more research. Effective communication among teams is fundamental to the agile approach in which proper and continuous feedback are absolutely necessary to improve team productivity and software quality. It is important to have right communication tool, trust among team members, organized daily scrum meetings, proper coordination, less time zone difference between locations and no language barrier to have effective communication within virtual scrum teams. Due to progression in technology scrum projects are going distributed as there are many benefits to the organizations. A brief literature review will be conducted to study the research problem which will provide valuable solutions to the communication issues in distributed teams. This research paper will be very useful to other researchers to solve the other challenges of a scrum in distributed projects.

Keywords – Agile software development, communication, challenges, agile, scrum, distributed teams, virtual, global software development teams.

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Preface

The main motive of conducting this research in the field of agile project management is to provide new solutions to issues of communication in virtual scrum teams. I am grateful to my thesis supervisor Dr. Thomas Sheives for his immense motivation, direction, and valuable suggestion. His timely feedback to every chapter has been very useful to move on the right track to complete the thesis. I am also very much grateful to the almighty god who has given me this tremendous opportunity and strength to make my contribution in the field of research.

1. Introduction

1.1 Introduction to Agile Scrum

The agile scrum approach is considered incremental where team members work in small sections to build the highly valuable quality product. This approach is very easy to get accustomed to and is more emphasized on people rather than process and tools as the fundamental cause for the success of agile projects.

The product is tested as it is developed in sections which help to scrutinize the possible risk quite earlier in the project. In modern software development projects, requirements are quite uncertain as the customers frequently requests changes in projects. This project uncertainty arises from internal issues related to triple constraints (scope, cost and time) or due to outward issues related to the business environment. Customer's feedback can be obtained immediately in agile scrum projects than waterfall projects as the customer is easily available to give valuable feedback. Sometimes the bigger picture of how the working product should look like is not clear due to changing requirements so the use of agile scrum over waterfall then becomes highly imperative.

In the scrum, iterations hold a lot of importance as it is during this time the team evaluates the significant requirements, the present technology and thoroughly scrutinizes the existing skills and capabilities of every team member. It is necessary for everyone to work as teams as successful teams are created when each one who is part of the project has something to contribute that is certainly valuable for the project.

1. 2 Scrum Roles

The roles in scrum largely diverge to the roles that we have in traditional or waterfall projects as collaboration is valued in the scrum to deliver more business value to the customer. The foremost essential scrum roles in collocated or virtual projects are that of a product owner, teammates and the scrum master. The main role of the product owner in scrum projects is to guarantee that from the product backlog the main feature is build first. In order to accomplish this, the product owner has to arrange the requirements in order of their value to the customer. The product owner is also accountable to manage the primary and ongoing funding of the project for which the team needs to execute the project on budget and in estimated schedule. The product owner is held accountable for the failure or the success of the project and has to know the exact purpose of doing the project. In traditional or waterfall projects the project manager does not vigorously get involve in project whereas in scrum there is active engrossment of the product owner. It is also the fundamental responsibility of the product owner to interconnect with the project team members to discuss any important changes and the influence of these changes.

The scrum master is a servant-leader who confirms every team member have exactly understood the scrum process to implement it effectively. It is the main responsibility of the scrum master to safeguard that the development team is working in right direction to create a quality software as per the stated business requirements. The scrum master has to also guarantee that all the project team members are coordinating and communicating satisfactorily with each other. The scrum master has to make sure that the scrum framework is appropriately applied and is accurately understood to the product owner and the development team. In addition, the scrum

master is the best person to know how the scrum process should be exactly executed in the scrum projects.

The teams in scrums are cross functional and self-organized about 5-7 in number due to which they allocate task within themselves and are vital to the project's success. That means the development teams gathers together and then they mutually decide their priority tasks as per the goal of the project. The development team initially puts effort on the important business requirements prioritized by the product owner which are also significant to the customer. The development team is intensely provided assistance by the scrum master so that there is a smooth flow of scrum process within the project teams. For distributed scrum projects to be highly successful it is significant that everyone within the scrum roles thoroughly understands their prime responsibility within the project.

1.3 Benefits of Scrum

Scrum is widely concentrated on project management practices as compared to other agile methodologies (Zaidi and Qureshi ,2014., Schwaber and Beedle, 2001). Scrum framework is useful for teams as it acts as an instrument for them to manage themselves independently which augments the team's performance in terms of quality and speed. The principal behind using inspect and adapt idea is that scrum framework is used to check at every iteration the teams are stirring in the accurate direction to create a product which has highest business importance as per the customer. So when the teams inspect the working of the teams they get an opportunity to make improvements in their existing work. In adoption, the scrum teams make the necessary modifications to the subsequent sprint and thus learn from their mistakes. Also, transparency in scrum teams is absolutely essential in which teams understand the complete scrum process instead of concentrating on their individual tasks. In addition, in scrum projects, there is a lot of autonomy

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in terms of deciding the tasks so this is actually a strength of scrum projects to create an affirmative working environment.

Nowadays even many organizations are implementing agile scrum adoption as scrum provides huge benefits for a long period of time. Also, customers aspire for quality software which has huge business value and they do not accept the product if it fails to meet their stated business requirements. Many organizations are implementing agile scrum in their organizations as customer satisfaction and developing valuable working software which is considered fundamental priorities to sustain the competitive market. Technology is growing rapidly and with fewer cost companies want to create software which will enter the market in a relatively short time which is certainly possible through agile scrum methodology.

In addition, agile methodologies have been proven to be more successful and the chances of failure or chances of creating defective products are very less. It was initially found that scrum framework works greatest where teams are collocated. However, in the study done by (Passivaara M, Durasiewicz S , Lassenius C, 2009) suggested agile method like scrum can be successfully applied to distributed projects. This undoubtedly demonstrates that agile scrum is just not limited to collocated projects but it surely works in an efficient way even for distributed or virtual projects. According to (Sutherland J, Schoonheim G, Rijk M, 2009), distributed scrum teams are teams that are separated geographically but come across on regular basis for scrum meetings.

1.4 Agile Project Management

Agile project management is vital to software projects as it gives an explanation to solve traditional project management issues related to changes, weak estimates, overestimated or underestimated budgets, slipping schedules, undermined risks (Karlesky and Voord, 2008). In my view, agile project management is surely based on basic project management approaches but it also looks at a larger picture of effective application of project management within organizations to achieve success. In addition, in the agile scrum projects, there is less risk as it can be acknowledged quite earlier in the project which gives considerably better visibility and adaptability in the execution of the scrum framework.

It is observed that project managers find it difficult to manage the transition from waterfall to agile projects as they are more inclined towards documentation. Therefore, investigating agile scrum project management is crucial for understanding the need for transition and to find techniques to cope up with the changes. Change management in agile is not deficient however the alterations are done as per the iterations and opinion received from the customer. These fresh changes are added in iteration planning meeting and further added as part of the project. It is exceptionally imperative to make note of the changing requirements and alter the required project work every iteration. While in traditional project management change management process takes places where executives and project manager determine the need for any fresh changes.

The researcher identifies that change is evident in any project whether agile or waterfall, therefore, every project manager must ahead of time explore the risk of accommodating fresh changes with regard to triple constraint (time, cost and scope). The traditional methodology should

be used when requirements are clear, no changes and the client is aware of the final product. In addition, in agile scrum projects, it becomes comfortable to do a correct assessment of present and future risks at every iteration's when the project is executed. It is in general responsibility of the team as a whole and not the scrum master or developers to recognize the risks in projects during each sprint.

1.5 Communication in Scrum

In traditional project management, there is a lot of documentation while in agile scrum communication is exclusively one among the development team and other is of the development team with other stakeholders like clients, testers etc. Both these type of communication has a significant role in developing an excellent software which seems to be the main goal of adopting agile scrum in software projects. Generally, there is communication plan created for traditional projects whereas in agile scrum projects the communication is spontaneous both in formal and informal ways as per the structure of the project. Communication in agile scrum virtual projects takes place during a number of scrum ceremonies for instance during sprint review meeting.

In the study conducted by (Sutherland J, Schoonheim G, Rijk M, 2009) mentioned fifteen minutes daily stand up meetings in agile scrum have a specific purpose of disseminating information of what was done yesterday, what will be done today and to know if the development team has any technical concerns. In reality, major communication of agile scrum within project team members is vigorously carried out during the fifteen minutes daily scrum meeting. In spite of being distributed geographically to keep the record of project work, every single team member must be attentive of the team progress for which these daily standup meetings are conducted. That

is why the daily scrum meeting holds tremendous significance, especially in virtual agile scrum projects to keep every project team member on track of their respective work. This clearly demonstrates that such daily stand-up meetings need to be managed or organized very effectively to avoid any misunderstandings in transmitting valuable information.

In addition to daily scrum meetings some artifacts like product vision statement converse the team the final goal of the project while the product backlog corresponds to the important features that should be incorporated in the project. The release plan is critically valuable to understand the objective of particular release in agile projects. The sprint backlog is another valuable artifact that communicates the team with everyday sprint status and overall project's facts and figures. The task board gives a perfect summary of the present status of the sprint or release which enables teams to get a clear picture of the work managed by everyone.

The sprint planning meeting is usually time box where the product owner initiates the meeting by explaining what features or functionalities are to be developed in the project. In the later part of the meeting, the scrum teams on own decide the necessary tasks accomplish the end goal of the product. Another significant part of agile scrum communication is scrum review where completed work in that sprint is shown to the entire team. Here in this meeting, the product owner agrees to receive the completed user stories as per the criteria set for done for that project. The scrum retrospective advantages the scrum teams to look back at the work and find ways to recuperate their teamwork. The scrum master plays a noteworthy role in the scrum retrospective meeting by encouraging all the team members to look for best practices and ways to upgrade their work.

The researcher is aware that any little mistake in providing a proper message through communication either ways can lead to a big loss in IT projects. To keep a proper update of the progress of the work and to bring transparency in working with development teams of various size and duration good communication is absolutely necessary to a project's success. In agile scrum methodology, there is less emphasize on documentation and more stress is given on effective and constant flow of communication. So as a student of project management this area of research has increased the quest to get in-depth knowledge about managing communication challenges in distributed/virtual scrum teams.

1.6 Problem Statement

The paper will primarily address the research question – How to Overcome Communication Challenges in Distributed/ Virtual Scrum Teams.

1.7 Justification (Why Important)

The main reason for addressing this research question is that many employees in the current situation are facing this issue as globalization and rapidly growing technology has brought world together. In real life, people work in distributed settings in agile scrum projects for months or years together to create working software.

There are many factors that have contributed to the rise of distributed scrum teams like globalization and paucity of human resources at a specific place. It is sometimes really challenging to find people with different skill sets for software projects at a particular location. In a research conducted by (Conchuir E, Olsson H, Agerfalk P, Fitzgerald B, 2009) reported cost savings, less

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time to enter the market, access to skilled workers are other benefits of companies having distributed projects. Therefore, these distributed teams have gain importance as people are seen working independently in an exceedingly adaptable manner. In addition, there is high productivity, more fun, and freedom as project team members get to intermingle with people of different cultural background. But the foremost issue contexts around the proper flow of communication within the distributed project team members which is relatively difficult to accomplish. Nowadays, in order to achieve more profits organizations are constantly looking for several options to build quality product by cutting the extra operating cost. That is why by creating distributed projects organizations can grasp the huge opportunity of hiring skilled employees at a cheaper rate than they would get at a specific location.

There are various challenges that arise while executing such projects due to communication, coordination, diverse time zones, cultural differences (Zaidi A, Qureshi M, 2014). This paper's research question has risen from primary question of general challenges faced in agile scrum projects in which communication is regarded as one of the main challenges.

Amidst of this agile principle emphasizes on having free and honest communication within the team. Certainly, there are various factors that hinder communication in organizations and when this communication is improper team members have to face fights, there is a loss of trust, a lesser motivation which can further clue to project failure. In order to avoid this, it is a wise move to find realistic solutions to evade communication problems to further enhance the excellence of working software.

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In scrum teams that are collocated face to face, communication makes it comfortable to communicate with each other. People can examine each other's body language, have informal communication, create trust and take suggestions or help readily in any situation. This is not same in distributed teams so communication in such projects needs proper attention. Also, when teams are capable of working together at a speedy rate along with bond of trust and mutual understanding gives rise to high team productivity in distributed teams. Again team dynamics can modify anytime in distributed settings so the specific pattern of communication can't be applied to every project. Employees have to make a spot on choice of selecting appropriate tool for communicating which is again very subjective.

After exploring the literature review of various researchers the author can make possible conclusions and add more knowledge to the existing research about the various ways to enhance communication while adopting best agile scrum practices in distributed teams. Understanding solutions to improve communication would begin with the basic understanding of various challenges in scrum implementation in distributed teams. This will make it further clear if it is practically possible to improve communication in distributed scrum teams? Is there need of any communication plan or any specific changes within teams to make this improvement? Will the teams develop mutual faith, confidence and take responsibility for their work with improvement in communication? Just by finding solutions to communication challenges this research can be beneficial to other researchers in answering similar research questions in the field of agile project management. Also, research question can further solve many secondary questions like can similar working hours truly solve communication issues or are there abundant process and project management tools available to keep team members engage in active communication.

2. Literature Review

Scrum framework is extensively useful in distributed software development projects due to which it has obtained tremendous importance (Hossain E, Babar M, Paikh H, 2009). The systematic review studied by (Hossain E, Babar M, Paikh H, 2009) reported the contemporary state of a scrum in globally distributed projects where 20 papers out of 366 conveyed the use of scrum in global software development projects. Out of 20, only 4 were concrete empirical studies and the rest were industry reports. This clearly exhibits that research of practice of scrum in global software development projects still remains as an interesting area which can be fully explored for further research.

This is the single systematic review in today's scenario that shows the various topics thoroughly examined which are given explicitly as per the author, year and the objective–

- Application of scrum framework in globally situated software development projects.
- Challenges confronted while assuming scrum in global software development project.
- Various approaches to solving the issues linked to a scrum in global software development projects.

In the above review, there are about 16 papers that considered the challenges related to a scrum in distributed projects. Also within challenges, 9 papers suggested a lack of communication as the major problem tackled by scrum teams in globally distributed projects (Hossain E, Babar M, Paikh H, 2009).

There are also limitations for this review as the authors claims the data extraction process may have certain minor errors. Further, the paper concludes that there is more gap in research as most of the studies were piloted after the year 2007 for a scrum in global software development

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projects. Also, the solutions for the challenges faced by scrum teams in globally distributed teams are significantly less in number which also requires immediate attention (Hossain E, Babar M, Paikh H, 2009).

To support the above data of empirical research the systematic was done by (Smithe D, Wohlin C, Gorchek T, Feldt R, 2010) suggested more research is required in the field of distributed software development projects.

While researching the systematic literature review of the problems of the distributed software projects (Jimenez M. Piattini M, Vizcaino A, 2009) mentioned when employees work in different locations communication is poorly managed which also directly has a tremendous negative impact on the overall productivity of the team.

In the study (Hummel M, Rosenkranz C, Holten R, 2013) stated communication issues arise mainly due to other factors like different working hours, language barriers and various cultural differences which increase severe misunderstandings. Further, the author also states that in agile more studies with respect to communication have been conducted on XP and not scrum. So the researcher for this topic has decided to focus solely on scrum to be specific and not include other agile methodologies as a part of this research.

According to (Jalali S, Wohlin C, 2012) in scrum standup meetings, sprint iterations and backlog are mainly carried out in scrum projects which clearly shows communication is vital in scrum distributed teams. The author further states that such distributed scrum team projects are extensively conceded in the USA. To support this evidence (Passivaara M, Durasiewicz S , Lassenius C, 2009) suggested scrum practices in distributed projects mainly included daily

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stand-up meetings, sprint iterations, backlogs, retrospective meetings due to which open communication was key to improve maximum benefits of the scrum.

There are less empirical studies for a scrum in distributed settings as well as the adoption of scrum practices needs a regular and proper way of communication for dispersed projects (Passivaara M, Durasiewicz S , Lassenius C, 2009). In another research paper by (Passivaara M, Durasiewicz S, Lassenius C, 2008) mentioned communication as an important subject in the agile scrum which needs further attention.

Figure1 below clearly shows that the practices related to scrum predominantly has stand-up meetings to keep track of the project work. As distributed scrum teams do not have a face to face communication it is important to cope the challenges faced while executing scrum.

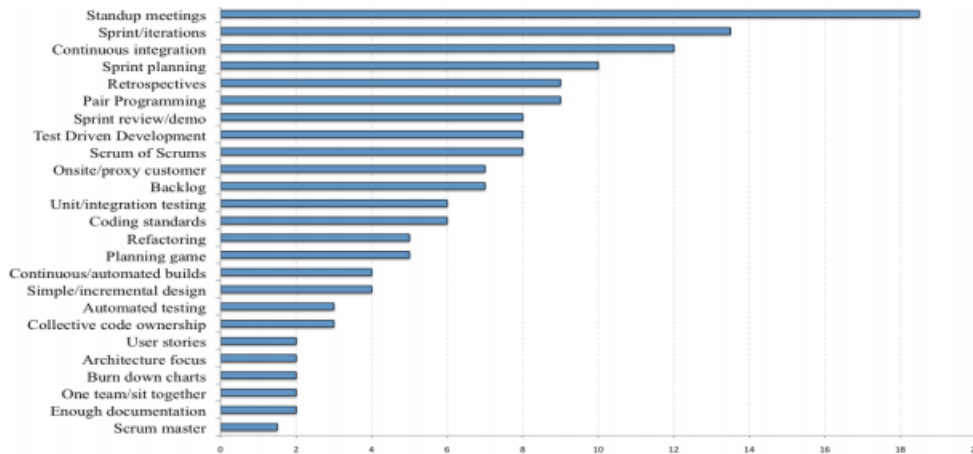


Figure 1. Scrum practices in distributed teams (Adapted from Jalali and Wohlin, 2012)

In the study (Weimann P, Hinz C, Scott E, Pollock M, 2010) stated the use of frequent communication is more in agile scrum projects than in traditional projects. However further the author argues that that due to lack of face to face contact in the scrum the desired consequence related to team performance are comparatively fewer than those of traditional projects.

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People with different cultural backgrounds and knowledge interpret software terminologies in diverse ways which can create many issues in communication the right message within the team (Jimenez M. Piattini M, Vizcaino A, 2009). Due to cultural diversity, language barriers, lack of proper organizational culture, lack of communication rules and not having a fixed ground and common meaning context can cause a lot of communications issues. Also, when there is less or no communication among distributed teams, in general, it results in low team performance. However, when distributed team communicate frequently it has shown to upsurge team performance, build relationships and significantly lessen task issues. Therefore, using right mode of communication for both formal and informal type of communication is important while working in distributed scrum projects.

Figure 2 below shows the frequency of the use of tools used for communication in dispersed teams. In dispersed teams in general email and regular phone calls as a communication tool is widely used on a daily basis (Weimann P, Hinz C, Scott E, Pollock M, 2010)

Tool	Daily	Weekly	Monthly	Every half a year	Never
Team meeting			x	x	
Video conference				x	
Net meeting					x
Telephone conference (at least 3 people)		x	x	x	
Phone	x				
Chat					x
Email	x				

Figure 2. Frequency and usage of communication tools used in distributed teams. (Taken from Weimann et al, 2010)

In the study conducted by (Passivaara M, Durasiewicz S, Lassenius C, 2008) suggested challenges related to communication in scrum distributed teams were the absence of tools like video conferencing, hampered network facility, misinterpreted requirements and initial short

daily standups as people found it awkward to spontaneously communicate due to the geographic and cultural barrier.

The literature review studied by (Hossain E, Babar M, Paikh H, 2009) stated communication issues arise when there are differences in culture, dissimilar time zone, due to improper management of teams and also when there are no suitable meeting rooms at distributed sites. According to (Weimann P, Hinz C, Scott E, Pollock M, 2010) in any organization scrum teams which are newly formed require more communication channel to avoid misunderstandings and conflicts. Also, the author states team meetings which have no agenda or purpose do not appeal team members to actively participate in meetings.

In the research conducted by (Hossain E, Babar M, Paikh H, 2009) proposed few ways to overcome communication challenges like controlling work hours as per different time zones with little more durations, use of fixed time boxed meeting, composing backlog list prior to scrum meetings, enhancing the internal team communication by appointing team leaders to address issues. (Hossain E, Babar M, Paikh H, 2009) also suggested having secured communication rules to avoid lags in responding to emails etc.

Among the communication tools video conference is highly appreciated to exchange information as it gives access to eye contact and this also generates more informal communication among the employees at different sites (Piattini E, Pino F, 2011). Further, the author suggested the use of a common network like Wiki keep everyone updated on the project work and the primary introduction of team members before the start of the project which has proven to be beneficial to improve both formal and informal communication.

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Improving organizational culture is useful to improve communication within teams which can further advance team performance. (Weimann P, Hinz C, Scott E, Pollock M, 2010) stated scrum teams should be given proper training about scrum subject and the communication tools to reduce the gaps in current knowledge to enhance communication.

In this research, the main focus will be on the impacts of other challenges like lack of trust, cultural differences, collaboration, different time zones on communication. The researcher is aware that communication as a whole challenge can be solved after acknowledging other challenges in the scrum.

To summarize there are less primary studies to establish the relation among scrum framework and its application in distributed teams. Further the employees working in a scrum in dispersed location have to face many challenges related to coordination, trust, cultural differences, and maintenance of team productivity. But among all the challenges faced communication remains the most challenging issue ever because dispersed team's lacks face to face contact. Absence or less communication raises several other issues while implementing scrum because the core principle of adopting scrum in organizations is to facilitate a free flow of communication. Also, the literature shows there are very few studies which have been conducted to discover precise solutions to specific communication challenge in dispersed scrum teams.

3. Methodology

(Description of Approach)

3.1 Conducting Further Literature Review

The researcher will be conducting a further literature review by critically examining 15 papers on the topic of communication in distributed scrum. The main aim of conducting a literature review is to see the present information available around the topic, to study if there is any framework, examine the findings of numerous researchers and to complete the existing gaps in that research topic. The papers for this research were selected from various databases after thoroughly reading the content of each paper which would help the researcher to answer the research question.

3.2 Inclusion and Exclusion Criteria

As a researcher, I had read a significant amount of information on this research topic. Then to stay focus and specific to the research question inclusion and exclusion criteria was set to this agile scrum topic. The inclusion criteria include distributed teams that use only scrum framework in their projects will be analyzed in this research. The exclusion criteria include the use of all other agile methodologies like Extreme programming, Kanban etc in distributed projects.

3.3 Formation of Themes from the Selected Articles.

Themes are drawn after evaluating the findings of all the selected articles. The researcher has looked for the common data among these findings to create a framework. The developed framework can be effectively used in general even by other researchers to study the communication challenges in distributed scrum projects.

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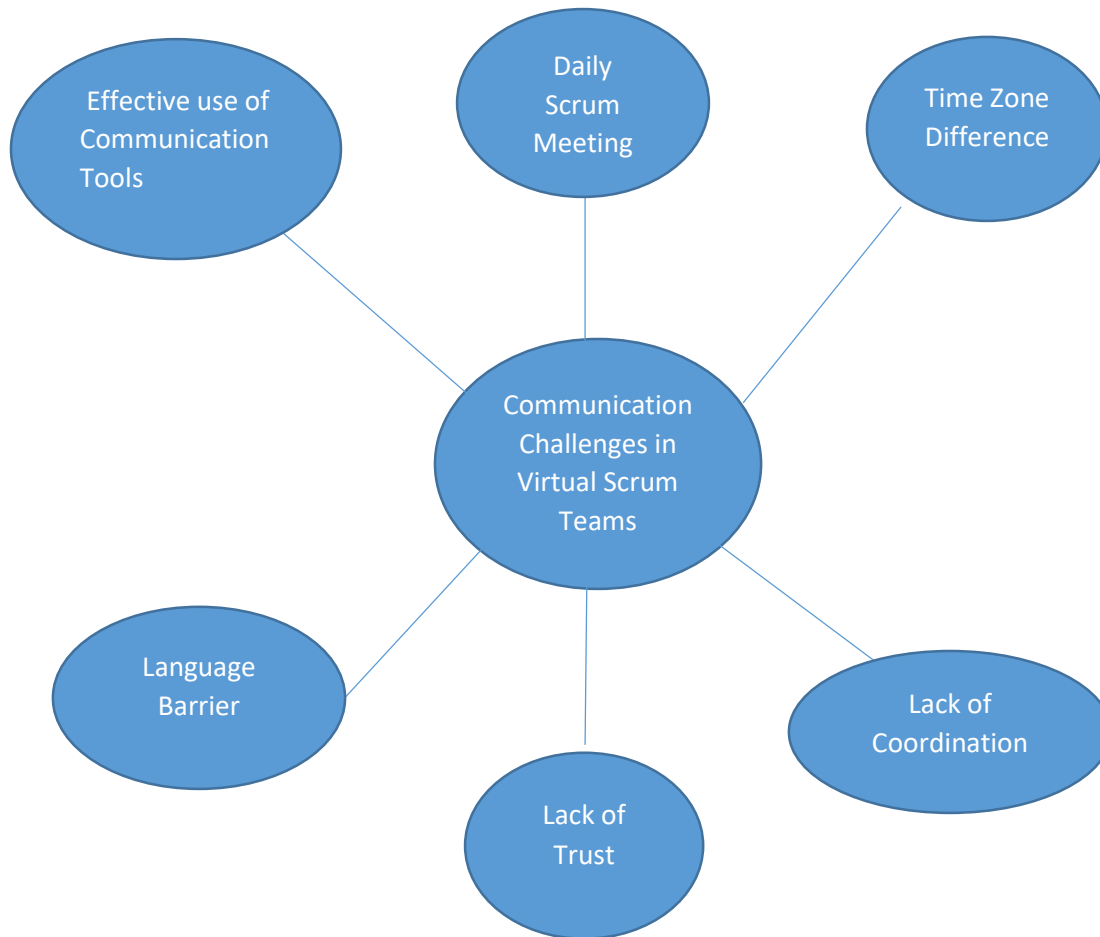


Figure 1. Conceptual Framework for Communication Challenges in Distributed Scrum Teams.

- **Effective use of Communication Tools.**

In another study (Alotaibi A, Qureshi M, 2014) mentioned the use of Cisco TelePresence Tool to manage communication issues in distributed projects. In the study (Raty P, Behm B, Dikert K, Paasivaara M, Lassenius C, Damian D, 2013) reported the benefits of using various communication tools like Email, Google+, Internet relay chat and Hangout. Similarly, (Niinimaki T, 2011) studied the use of another communication tool like Instant messaging. In the study (Bannerman P, Hossain E, Jeffery R, 2012) mentioned using various communication tools like video conferencing, email, Wiki etc to solve the issue of lack of face to face contact with distributed teams. The concept of using

a global scrum management to synchronize communication was studied by (Qureshi M, Sayid I, 2015).

- **Daily Scrum Meetings**

In the research conducted by (Noordeloos R, Manteli C, Vliet H, 2012) reported the use of daily scrum meetings to improve communication at work. In another study (Stray V, Lindsjorn Y, Sjoberj D, 2013) stated various ways like having fix meeting time, team members reporting to scrum master to improve daily scrum meetings. In addition, (Zieris F, Salinger S, 2013) mentioned the numerous benefits of having Scrum Master to facilitate communication in daily scrum meetings.

- **Time Zone Difference**

According to (Dorairaj S, Noble J, Malik P, 2011) decreasing time zone difference using some common communication plan is an effective way of enhancing communication across distributed teams. In the research conducted by (Bannerman P, Hossain E, Jeffery R, 2012) suggested regulating working hours as per the different locations or conducting meetings from home to resolve the issue of time zone difference. In the study (Sutherland J, Schoonheim G, Kumar N, 2009) suggested using one team engagement model where all team members work on related work items.

- **Language Barrier**

To avoid the issue of language within the virtual team (Stray V, Lindsjorn Y, Sjoberj D, 2013) suggested the use of virtual aids. According to (Kilpa M, Karkkainen T, 2015) cultural or language barrier issue can be solved by generating trust and open communication within the teams. In the study (Hummel M, Rosenkranz C, Holten R ,

2016) suggested effective ways or strategies in order to improve the level of understanding among team members with different cultural background.

- **Lack of Trust**

In the study (Moe N, Dingsoyr T, 2008) suggested various ways enhance trust among distributed teams by acknowledging team member's suggestions, enhancing coordination among the teams etc. According to (Cho, 2007) trust among team members can be enhanced by creating a suitable environment to know each other better. In addition, the author also suggested scrum master can play a major role to eliminate impediments and give the entire team confidence and motivation to perform better as a team.

- **Lack of Coordination**

Coordination can be improved through numerous ways as stated by (Moe N, Dingsoyr T, 2008) within teams when teams share analogous mental models, generate more feedback loops and when all team members take their responsibility for their work. In the study (Cho, 2007) suggested the use of Version one and JIRA tool improve coordination among the team member. In the study (Usman M, Abbas Q, Akram B, Hussain J, 2016) suggested having alike working hours and generating team awareness to develop solid coordination among team members.

Next steps to carry on work

Next, the researcher will look in depth at the results and the findings of the selected articles. Based on these results the researcher in discussion section will talk extensively about results in detail and provide more solutions to solve the research question.

4. Results

The Result section will briefly discuss the framework of communication as stated in the methodology section. The fifteen papers selected for this research study will be thoroughly evaluated using the communication framework.

- **Effective use of Communication Tools**

In the study (Alotaibi A, Qureshi M, 2014) mentioned Cisco TelePresence Tool usage and benefits to handle actual communication problems in virtually located scrum projects. The foremost advantage of using this tool is that it can be effectively used to conduct remote meetings which enhance the productivity of team members. It is also crucial to make active use of other communication tools like phone, web camera, net meeting, IM, SMS, internet relay chat to make better communication during the entire project (Alotaibi A, Qureshi M, 2014).

In the research conducted by (Qureshi M, Sayid I, 2015) identified the numerous benefits of global scrum management web application such as the application are easy to use and access, it has features to update information instantly and it has a discussion board where many questions can be posted to resolve communication issues. Another communication tool like Skype or Hangout is suggested to promote easy going transfer of information within virtual teams (Qureshi M, Sayid I, 2015).

According to (Raty P, Behm B, Dikert K, Paasivaara M, Lassenius C, Damian D, 2013) mentioned too many emails during sprints and the use of tool Flow dock is not an effective way to maintain coordination and communication. In another study (Niinimaki T, 2011) mentioned nearly 80-100 IM were exchanged within virtual team members as well as 40-50 emails per day were frequently used to distribute major information.

In the study (Kilpa M, Karkkainen T, 2015) mentioned the use of Hangout and Flow dock which is widely used instant messaging tool to maintain a continuous flow of important information across various locations. In the study (Dorairaj S, Noble J, Malik P, 2011) suggested the efficient use of video conferencing and writing the data on boards during the online meeting is very useful to transfer knowledge among virtual teams. In the study (Hummel M, Rosenkranz C, Holten R , 2016) suggested the benefit of email, phone, instant messaging and Skype on a larger scale to communicate successfully in distributed scrum projects.

- **Daily Scrum Meetings**

Misinterpretation in scrum teams can be effectively resolved during the daily scrum meetings (Usman M, Abbas Q, Akram B, Hussain J, 2016). Having short daily scrum meetings twice a week, giving replies to email within 12 hours and conducting retrospective meetings by using Wikis is a real way to mitigate communication challenges (Alotaibi A, Qureshi M, 2014). According to (Raty P, Behm B, Dikert K, Paasivaara M, Lassenius C, Damian D, 2013), daily stand-up meetings help team members to solve important issues and it is very useful to transfer significant project information.

In the study (Stray V, Lindsjorn Y, Sjoberj D, 2013) mentioned daily, scrum meetings should not be too long and should only last for 15 minutes. The author also suggested daily scrum meetings should be well organized in terms of timing, frequency, use of proper communication tool and finally the procedure to communicate information (Stray V, Lindsjorn Y, Sjoberj D, 2013). In the study (Noordeloos R, Manteli C, Vliet H, 2012) suggested each team member should communicate with each other in distributed projects through video conferencing

to maintain trust and understanding among each other. In the study (Dorairaj S, Noble J, Malik P, 2011) suggested daily scrum meetings should be designed in such a way that every team member could provide valuable information and not waste time on the meaningless transfer of data. The author further suggested every team member should make maximum use of daily scrum meetings by asking important questions so that they need not wait for feedbacks or suggestions through emails later (Dorairaj S, Noble J, Malik P, 2011).

- **Time Zone Difference**

In the study (Bannerman P, Hossain E, Jeffery R, 2012) mentioned time zone issue was solved as teams met online and they scheduled work that orchestrated with a time of other locations. In the research conducted by (Dorairaj S, Noble J, Malik P, 2011) mentioned scrum teams can effectively work together in a diverse time zone which has less time zone difference. The author further mentioned scrum teams should be allocated at the start of the project itself in such a way that time zone difference can be easily minimized (Dorairaj S, Noble J, Malik P, 2011). In the research conducted by (Sutherland J, Schoonheim G, Kumar N, 2009) it is very clear that if possible teams should be kept collocated at the beginning of the project to develop coordination, trust and to increase team productivity.

- **Language Barrier**

According to (Usman M, Abbas Q, Akram B, Hussain J, 2016), scrum teams can post certain answers related to scrum questions on communication tool like Wiki to solve language issue. In the study (Stray V, Lindsjorn Y, Sjoberj D, 2013) suggested having a common language example English which may be understood by many team members working in distributed scrum projects. In the research (Hummel M, Rosenkranz C, Holten R, 2016) suggested virtual teams

should be created on basis of common language. The author further suggested to make use of video conferencing or email to overcome language impediment while communicating. In the study (Bannerman P, Hossain E, Jeffery R, 2012) reported the discussion of the scrum meetings or the important outcomes from the meetings were posted on the wiki which made all team members understand the outcomes of meetings very easily.

In the study (Dorairaj S, Noble J, Malik P, 2011) suggested team members should try to speak slowly to make good pronunciations of words which can be easily understood by people with different accents. In order to disentangle the problem of language difference (Hummel M, Rosenkranz C, Holten R , 2016) suggested hiring at least one team member who competently understands the language spoken at the scrum team of opposite location. The author also mentioned at the start of the projects team members should communicate the project work mostly through emails to evade the unwanted misunderstandings and errors due to improper communication (Hummel M, Rosenkranz C, Holten R , 2016).

- **Lack of Trust**

In the study (Moe N, Dingsoyr T, 2008) stated trust among team members in scrum can be difficult to achieve if the scrum master overreacts to small issues during meetings. It was also reported team members do not speak out of the problems due to fear of scrum master getting too much overstretch over the topic (Moe N, Dingsoyr T, 2008). Also, it was seen that problem of trust arises when the developers in the team focus on their own strategies and not listen to the scrum master (Moe N, Dingsoyr T, 2008). In the study (Dorairaj S, Noble J, Malik P, 2011) mentioned when team members try to know each other better they actually create the bond of team relationship which is very significant to gain the trust of each other. In the study (Cho, 2007) suggested team members should finish their assigned tasks on time and also the scrum

master must work together with other team members to quickly resolve their issues to build a strong trust relationship.

In another study (Zieris F, Salinger S, 2013) suggested a lack of trust among developers arises when they were ambiguous about their future prospects in the company. The author further stated such employees had an absence of motivation and were certainly not felt responsibility for their own work (Zieris F, Salinger S, 2013). In the research conducted by (Kilpa M, Karkkainen T, 2015) stated trust in teams can be highly constructed by helping each other, solving each other's issues and by displaying positive attitude and sense of responsibility towards each other.

- **Lack of Coordination**

In the study (Usman M, Abbas Q, Akram B, Hussain J, 2016) stated use of collaboration tools, regular visits, reviewing the work can improve communication within teams. In addition, the author further suggested the use of regular live chats, video calls and emails to maintain suitable coordination. It is equally important to form a set of standards and procedures during the initial planning phase of the project which can be followed throughout the project by the team members to increase work coordination (Usman M, Abbas Q, Akram B, Hussain J, 2016).

In the study (Kilpa M, Karkkainen T, 2015) mentioned scrum masters played exceptional roles in maintaining coordination and informed communication within the diverse teams.

5. Discussion

The discussion section is divided into two parts- Part A is the discussion of the final views expressed by the researchers whose case studies have been selected for this research. Part B which will comprise of the views of the author of this research in general to overcome the issue of communication in virtual scrum teams.

Part A: Discussion of the views of the researchers of the case studies studied in this research.

Case Study	Studied the effect of	Special Suggestions
(Usman M, Abbas Q, Akram B, Hussain J, 2016)	ICT mediated asynchronous tool – Wiki email, Instant Relay Chat Use of ICT mediated Synchronous communication tool- Teleconference, Web conference, Skype, Sharing desktop.	Information Computer Technology-mediated asynchronous tool – Wiki (to post question and answers). An application to regularly update standards and procedures which should be fixed in the planning phase.
(Alotaibi A, Qureshi M, 2014)	Cisco Tele Presence video conferencing tool to be effective. Other tools- Web camera, Teleconference, Email, Net-sharing, SMS.	Daily scrum meetings to be held twice a week. Replies of emails should be done within 12 hours. Found cisco telepresence to be a useful tool.
(Qureshi M, Sayid I, 2015)	Studied Global Scrum management application	Global Scrum management application is effective to update data for virtual teams.

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<p>(Raty P, Behm B, Dikert K, Paasivaara M, Lassenius C, Damian D, 2013)</p>	<p>Effects of Altering communication practices in virtual scrum teams.</p>	<p>Reducing Email Traffic by 20% as sprint advanced improved communication. Choose synchronous communication instead of email. Developer in the position of a facilitator. Flow dock is not found useful. Google plus and Hangout useful.</p>
<p>(Stray V, Lindsjorn Y, Sjoberj D, 2013)</p>	<p>Improve daily scrum meetings to generate a flow of information.</p>	<p>Alternate the role of scrum master so everyone gets a chance to talk.</p>
<p>(Niinimaki T, 2011)</p>	<p>Using dissimilar media for communication.</p>	<p>80-100 IM sent per day. 40 Emails sent per day.</p>
<p>(Moe N, Dingsoyr T, 2008)</p>	<p>Ways to enhance teamwork</p>	<p>Daily scrum meetings must not be just focused on general issues. Sprint review, retrospective and planning meetings are an excellent mode to give useful feedback to each other.</p>
<p>(Zieris F, Salinger S, 2013)</p>	<p>Studied scrum practices.</p>	<p>Synchronous Meeting to be managed 15 minutes in advance of daily scrum meetings. (No need of product owner to attend this meeting).</p>

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(Bannerman P, Hossain E, Jeffery R, 2012)	Studied characteristics of scrum framework.	Use of Wiki to inform opposite team the meeting results.
(Noordeloos R, Manteli C, Vliet H, 2012)	Communication in RUP and Scrum.	Communication is increased due to rapid feedback.
(Kilpa M, Karkkainen T, 2015)	Communication in scrum	Use of Hangout as video conferencing tool is useful. No improvement was seen in the problem of cultural difference.
(Dorairaj S, Noble J, Malik P, 2011)	Ways to create effective communication	Use of Skype as a communication tool.
(Cho, 2007)	Adjustment in scrum practices to manage communication issues.	Video conferencing instead of phone calls for daily scrum meetings. Web demo tool was used for communication ahead of emails. Other scrum meetings should be conducted to resolve issues.
(Hummel M, Rosenkranz C, Holten R , 2016)	Studied importance of shared understanding in virtual teams.	Video conferencing was preferred to communicate. Employ at least one person who understands the language spoken by the offshore team.
(Sutherland J,Schoonheim G, Kumar N, 2009)	Ways to enhance scrum process in dispersed teams.	Wiki (report data), Skype (video conference), Adobe Acrobat connect to share desktop was used.

Effective Use of Communication Tools

It is seen from the studied case studies that use of various synchronous tools like Teleconference, Skype, as well as asynchronous communication tools like email, instant relay chat, and wiki is effectively used to improve communication in dispersed teams. Generally, team members choose tools to which they are not quite acquainted with and this can cause loss of crucial information if the correct mode of communication is not used. The project team members should not only depend on daily emails to transmit free flow of data as that is proven not to be beneficial for the virtual scrum teams. On average 40-50 emails are sent per day in distributed projects and in one case study reducing email by 20% showed improved results with project work as the developers were not burdened to answer too many questions through emails. Also, video conferencing tools has more benefits than regular phone calls as through video conference team members can directly have face to face contact which is not available with regular phone calls. Video conferencing should be principally used for daily scrum meetings as it is noted key communication takes place during the regular stand up a meeting which is attended by the product owner, scrum master and the team members. Similarly, in the literature review video conferencing tools are preferred to communicate or transmit important data in virtual scrum projects. Using a global scrum management application was proved handy to inform all the project team members the regular updates in virtual scrum projects. More applications need to be created like global scrum management which can be easy to operate and understand to all the virtual scrum teams.

Daily Scrum Meetings

It is also exceptionally important for all team members to participate in daily scrum meetings. It is seen in one of the case study conducted that had short daily scrum meeting was not effective to discuss the daily project work. The daily scrum meetings should be held with a proper agenda or purpose and should be for fifteen minutes. It is also reported that conducting short or long daily scrum meetings has failed to create a proper flow of beneficial information within distributed scrum teams. In advance all the attendees of the meeting must be informed to the scrum master and the product owner should also be present regularly for such meeting. It is also important to understand the daily scrum meetings should not concentrate on common issues and must strictly focus on the work needs to be done for that day. It is reported in one of the studies if the daily scrum meeting focuses on overall problems then the developers get distracted from their work. To discuss general issues a separate meeting can be placed ahead of daily scrum meetings and should be attended by the team members who needs to discuss general issues. In addition, the scrum master's role can be alternated daily in the virtual teams so that each and every team members gets the opportunity to explicitly express their views.

Time Zone Difference

To evade time zone, the most effective way is to regulate working hours as per the locations of the virtual teams. In addition, the project team members must be provided flexibility to work from home to maintain the necessary synchronous flow of communication. It is also important to create virtual scrum projects within dissimilar locations whose time difference is comparatively less. Having less time zone difference will bring teams together to work cooperatively at a steady pace that will help further to boosts team's productivity. It is seen that

managing works hours as per different locations was the best possible solution provided by previous researchers to solve the problem of time zone difference in virtual scrum projects.

Language Barrier

To manage the problem of the language barrier the teams must make use of right communication tools like video conferencing or email to rule out any misunderstandings within teams. If possible the teams should hire scrum master or a team member who understands the language spoken by opposite teams. Also, the project team's members should try not to speak fast or hurriedly so that the opposite team members easily comprehend the language spoken. It is also noted in various case studies that using Wiki tool to post the meeting reports or important answers to scrum questions can be a useful way to ease the issue of language barrier. If possible, this information should be posted in the native language of the offshore team to make them understand easily the content of the message.

Lack of Trust

To build solid trust among project team members it is first important to meet at least once to know each other better. In collocated scrum projects this is possible as project team members can introduce each other at the kick-off meeting and then interact regularly at the workplace. In distributed or virtual scrum projects this is not practically possible as project team members are situated at diverse locations. Actually, at the start of the project, it is a wise idea that all the project team members must surely create a plan to travel to the offshore team. However, if all the team members can't travel then in such cases at least the scrum master should plan to travel to the offshore location at the initiation of the project. This will give encouragement, confidence,

generate mutual respect and most important increase level of trust at work among project team members.

To gain trust within teams every team member must take the effort to generate maximum their mutual interaction during project work. The trust within project team members can be generated easily over time when they mutually understand each other, respect each other, bond over work, help each other and try to focus not to focus just on their individual work. The role of the scrum master is very valuable as a facilitator to build trust among virtual scrum teams. It is seen in many case studies that the scrum master plays a bridge with whom every team member can comfortably discuss their issues. It is also noted due to fear of scrum master project team members are hesitant to freely express their problems. Also, it is also seen sometimes the developers are so engrossed in their own work that they fail to interact with others. To avoid this and to ensure proper implementation of scrum process it is mandatory to have experienced scrum master in virtual scrum projects. It is the basic responsibility of the scrum master to make sure the best practices are evenly practiced so that project team members would be further inspired to work harder for the overall success of the project.

Lack of Coordination

In almost all the case studies that I reviewed for coordination problem in scrum use of collaboration tool was the best option stated in those results section. There are various collaboration tools like Wiki or emails which can be specifically used improve coordination during the entire project. To increase the frequency of coordination the scrum master can fix a rule that answer to emails should be done within less than twelve hours. This will make all project team members responsive of their work responsibility will which further boost mutual cooperation. Just like trust having a good coordination at the workplace is always advantageous

for each and every project team member. But this coordination also just like trust can be generated better when project team members attempt to make more interaction with each other. So regular visit at each other's location and greeting each other can also enhance the level of coordination among project team members at distributed sites. It is equally central to arrange standards and procedures at the creation of the virtual scrum projects so project team members are responsive to their actions.

Additional Ways to Solve Communication Issue in Virtual Scrum Teams

Training to Scrum Teams

As stated in the literature review providing training to virtual scrum teams is a good way to solve communication issue. In distributed scrum, in particular, the newly formed scrum teams are sometimes devoid of experience for working in the scrum. It is also seen sometimes the novice team members have never worked on specific tools especially used by organizations as a part of their best practices. This training will enhance the skill sets needed to communicate accurately using various communication tools. Mature scrum teams generally may not require training but due to growing technology sometimes this training can keep them aware of changes in the communication tools.

Proper Feedback

Giving each other proper and continuous feedback is a vital part of communication in virtual scrum projects. It is clear till now that most of the communication takes place during the scrum ceremonies in distributed scrum projects. It is expected that each project team member gives instant replies and valuable suggestions whenever needed to build good team productivity.

Organizational Culture

Organizational culture is also another important aspect in virtual scrum projects for enhancing the flow of open and honest communication. In my view, change in organizational culture just does not mean the introduction of new beliefs or values. However, it means developing pure transparency, recognizing the hard work of the employees, generating trust and providing employees autonomy at the workplace. A good organizational culture will focus on refining the existing operating efficiencies, paying more attention to the bottom line of employees and finally making effort to keep the customers happy. Also, when a communication flow is more bottom- up i.e. from employees to executives this is considered upright for the prospects of the organization.

Part B – My Views as a Researcher

Effective Use of Communication Tools

The overall scrum practices should be adjusted as per the requirement of the scrum projects. Using accurate communication tools to maintain proper flow of important data should be decided as per the team convenience and their experience on that tool. Training should be given to team members if any new communication tool is introduced within virtual scrum teams.

Daily Scrum Meetings

The daily scrum meeting should be focused on the work done or the work that needs to be accomplished by the teams. It is seen nowadays projects are of short durations or there are less project team members in virtual scrum projects. However, the duration of the daily scrum meetings should not be altered as per the number of team members attending the team meeting. In my view, on an average, the daily scrum meetings should not exceed fifteen minutes. This is

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because it is observed too long daily scrum meetings do not provide any additional benefit for the project. However, it was detected in one of the study the team members especially developers in team meeting lose their focus as they are more interested to know about their part of the work.

Time zone difference

As suggested by various researchers the best way overcome time zone issue is to regulate overlapping working hours. Also, I feel every employee should be given the flexibility to work from home to maintain synchronous communication as per the timing of other located teams.

Language Barrier

To overcome language barrier, the scrum master especially in the daily scrum meetings can ask the teams to make clear they exactly understood what is spoken. Also, if possible the meeting reports or important data should be posted in the language spoken by opposite teams.

Lack of Trust

To generate trust every team member should understand their responsibility and try to create both formal and information communication with each other. Again, the scrum master should also act as a bridge within team members to expedite open communication and the bond of trust within teams. The teams should meet face to face at least at the start of the project to generate mutual trust and coordination of work.

Lack of Coordination

As stated by the other researcher's various collaboration tools should be used to improve coordination. In my view when trust and informal communication is build that helps to create good coordination among teams.

6. Conclusions

The best practices listed below are the final conclusions drawn after evaluation of numerous case studies on communication in distributed projects. These conclusions are generated after thoroughly examining the results and the specific views of the former researchers on this research topic. The best practices are specified as per the framework created in the methodology section which contains following points – effective use of communication tools, daily scrum meetings, time zone difference, language barrier, lack of trust and lack of coordination.

Effective use of communication tools

- Accurate communication tool should be selected as per the workload of the project and as per the team's experience or comfort of using the tool.
- Video conferencing tool Skype, Google Hangout, Email and Instant Messaging are certainly preferred mode of communication tools.

Daily Scrum Meetings

- Daily scrum meetings must not exceed more than 15 minutes and the format of the meeting should be very precise. This meeting should focus on the tasks that need to be completed and not general project issues.

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- Synchronous meetings should be kept forward of daily scrum meetings which need to be attended to solve regular project issues.
- Video conferencing tools like Skype or Hangout should be favored as a mode of communication instead of phone calls, especially for daily scrum meetings.
- The role of scrum master just for the daily stand-up meeting should be rotated within the distributed scrum teams to make it more interactive and meaningful.

Time zone difference

- The overlap of working hours of virtual scrum teams among teams should be adjusted.
- Project team members should be permitted to manage their work from home to overcome time zone issue.

Language Barrier

- Important data should be posted on the wiki like the meeting reports, etc.
- Hire scrum master who speaks the inherent language of the virtually located scrum teams.
- Team members must speak slowly and must do proper pronunciation so that every project team member effortlessly understands the language spoken.

Lack of Trust -

- Regular visit at least by the scrum master to the offshore teams to create informal communication and trust should be conducted at the beginning of the project.
- The scrum master must adapt the best scrum practices to create the bond of trust. These best practices will create motivation, responsibility towards work which in turn will build trust in relationships.

Lack of coordination

- Use of proper collaboration tools and communication plan for the project is needed to maintain coordination among teams.
- A specific set of standards and procedures should be determined at the initial phase of the project to generate coordination among virtual scrum teams.

7. Recommendation for Future Work

This study completed highlighted the various ways to overcome communication challenges in virtual scrum teams. The study was emphasized on conducting a thorough literature review. The literature review focused on the various opinions of the researchers to mitigate communication issues in dispersed scrum teams. In addition, this study analyzed the 15 case studies for finding the best solutions to overcome the communication issue. These papers were analyzed as per the framework created and at last best practices have been selected which should be beneficial to solve communication issues. However, more research is needed on the application of these best practices in diverse scrum teams which can be an interesting work for further researchers.

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