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TOWARDS A 5C THEORY OF COMMUNICATION FOR SCRUM-BASED DISTRIBUTED PROJECTS

Scrum-based distributed projects face numerous challenges and failures due geographical, dispersed, times and cultural differences. To improve the success of such software development projects, there is a need to identify factors crucial to achieving the required level of communication between the distributed stakeholders. In this paper, we reviewed the issues and challenges associated with communication in scrum-based distributed projects and explored factors that could improve communication for scrum-based distributed projects. A total number of 25 interviews were conducted in various geographical regions which helped to identify five major factors, i.e. competency, correlation, comprehension, contentment and commitment, crucial to the success of scrum-based distributed projects. Our identification of these factors presents a research and practice approach to developing a theory of communication that would help project managers, scrum masters and practitioners to improve practices while undertaking scrum-based distributed projects.

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Introduction

Communication in globally distributed projects operating under Agile principles is under discussion for more than a decade now (Daim et al., 2012; Duran and Popescu, 2014; Weimann, 2013). In organisational literature, communication which refers to “*a process in which participants create and share information with one another in order to reach a mutual understanding*” (Rogers, 2003, p.21); which is considered an important part of the team performance (Algesheimer et al., 2011). Over the years, studies have shown that Scrum methodology in distributed formats is one of the most suitable and appropriate method of Agile in the software industry (Sutherland et al., 2007; Paasivaara et al., 2009; and Shrivastava and Date, 2010). Accordingly, the literature on globally distributed projects offers several insights into the increasing need for communication among team members. Arikpo and Osofian (2011) suggest that teams act as ‘fulcrum’ on which the organisation apply efforts, and through which these efforts are converted into software products for the clients. Alzoubi et al. (2016) recommends considering the project team members’ composition and characteristics such as their cultural, linguistics and temporal orientations in project planning. Further, Heim and Peng (2010) suggest for a more diversified project team to meet performance and outcome; as such teams can bring innovative ideas and resources. On the other hand, the individual differences can lead to multiple complexities such as coordination difficulties, biasness and understanding the roles and responsibilities (Heim and Peng, 2010; Auramo et al. 2005). Hence, it becomes imperative for the project leaders to normalise relationships and build a cohesion, provide guidance and resources, and act as a mediator for managing conflicts. Consequently, Paul et al. (2016) argued that inspirational leaders ensure their availability for unknown situations throughout the project life cycle, facilitate the networking and trust building between the project teams and build trust. These initiatives are valued especially in the globally distributed projects when the tasks interrelated and interdependent.

Despite the increasing significance of integrating Agile methodology into distributed projects to increase communication among teams, there is no doubt that several issues and challenges still exist. Nerur et al. (2005) note that most of the issues in agile projects are related to the people and procedures undertaken in development process. Since Agile is a team-based approach, communication among people who work in teams has been one of the most dominant issue in distributed projects. As such, the literature provides few insights into different causes of these communication issues such as cultural conflicts, geographical locations, etc (Lee and Baby, 2013; Mockaitis et al., 2012; Shrivastava and Rathod, 2015). Most of the theoretical approaches and frameworks are based on primitive theories, yet there is no coherent theory that better helps in understanding the communication issues among team members in scrum-based distributed projects. It has been reported that 50% of Agile projects fail in distributed projects though previously the failure rate was less than 25% when undertaking development in co-located format (Shrivastava and Rathod, 2015). Another study by Rajpal (2016) reports failure in a distributed scrum project as it took over three years for the project team instead of one and exceeded five times the initial budget. The project was considered a failure at the end and criticism was made of Agile methodology. Similarly, Bossini and Fernández (2013) highlights that 65% of the software development projects under scrum are unable to meet the desired outcome because of the required communication level. Furthermore, the literature to date lacks in acknowledging the factors that can help improve communication for scrum-based distributed projects; though it does highlight the importance of communication with identification of cultural factors. We, therefore, pose the

follow research question to address: *What are the factors that influence communication in Scrum-based distributed projects?*

To answer our research question, we adopt an exploratory approach and identify factors which could impact communication in scrum-based distributed projects. Explanations have been provided based on participants' viewpoints, where they have acknowledged that how these factors influence projects across various boundaries and regions - development teams, clients and product owner, and project processes. The theories and frameworks currently available depend on pre-conceptual ideas and opinions due to which explanations for improving communication and team performance for scrum-based distributed projects largely remain unexplored. Our paper contributes to the literature in the following ways: first, the authors identify five distinct components, their interdependency and the consequences which they can impose to the overall communication norms in distributed projects. Second, the authors attempt to propose a 5C theory of communication by developing a conceptual framework which shows the areas require consideration from the project managers, scrum masters and organisational leadership. Our study thus enriches the literature on global distributed projects and deepens understanding that how communication patterns and norms can be improved within scrum-based distributed environments.

The paper is structured as follows: We begin with a review of the literature and highlight important theoretical concepts and problems in accordance with the communication and team performance in scrum-based distributed projects. We then present our methodology, sampling procedures and data analysis techniques. Finally, findings and discussion are presented together with a conclusion where we also offer some practical and theoretical implications.

Literature Review

Literature to date provides several insights to understand the communication: Rogers and Kincaid (1981) designate communication as a two-way process of convergence, a linear act in which one individual contact another individual to attain certain effects whereas Roger's (2003) labels communication as the process of information exchange to reach a shared understanding. Fuks et al. (2008) recommend communication as the means of developing an agreement or reaching a mutual understanding about a problem. In accordance with the distributed projects, Alzoubi et al. (2016) argued that in globally distributed projects geographical differences, whether temporal or geographical negatively impact effective and efficient communication between project teams and the client. Team configuration such as team size and members, knowledge and coordination also impact the early flow of information and creating mutual understanding of the project aims and objectives (Agerfalk et al., 2009). Also, communication is vital for attaining goals or objectives as it provides opportunity for the team members to collaborate, team up, discuss and share information, take decisions and reduce confusions over tasks (Chhay and Kleiner, 2013). In contrast, geographically dispersed project teams require two and half times more resources as compared to delivering the same project in the co-located teams (Herbsleb and Mockus, 2003). Alzoubi et al. (2016) reported that geographically dispersed projects lack face-to-face interactions and synchronisation among team members, and due to the reason lack of understanding is found between development teams and client's requirements.

Communication can also play an important role in team development and formation (Bardhan et al., 2013). Scrum Master and teams interact using advance information and communication technologies where ethics of communication are provided to team members like replying to

emails on time, attending meetings, informing prior to absence and designing basic and secondary communication strategies (Ebrahim et al., 2009). It is obligatory for the team members to communicate and discuss their issues with the project leader or manager (Beranek et al., 2005); as extensive communication helps team members to digest more ideas, and then apply them using their skills. Meeting deadlines, understanding the scope of project, understanding roles and responsibilities are related to effective communication (Calloway and Awadzi, 2008). Effective use of communication also helps scrum master to track the team members, assess the performance and give feedback (Beranek et al., 2005). In accordance, Reed and Knight (2010) propose that the use of communication tools should be acknowledged in distributed projects because it helps creates high efficiency and reduces ambiguities within the team members. Korkala and Abrahamsson (2007) acknowledge that communication medium in distributed Agile developments can be categorised into two main types:

- i. *Synchronous* – Runs over real-time and includes video conferencing, phone calls, instant messaging services etc.
- ii. *Asynchronous* – Runs irrespective of the real time and includes email as the main application tool.

Green et al. (2010) further considering the use of synchronous and asynchronous communication, determined that synchronous and asynchronous means facilitate Agile development projects under the following four phases:

- **Phase I:** Release Planning – Includes the product planning, requirement descriptions, and stores the data in the form of User Stories
- **Phase II:** Iterations/Sprint Planning – Prioritization of tasks and analysis of User Stories
- **Phase III:** Scrum – Software Design and code, Integration and Test
- **Phase IV:** Product Release and Retrospectives – Document Preparation, Software release planning and demonstrations of the product.

Martini et al (2013) reported that large-scaled distributed organisations face five communication problems. First, communication challenges due to architectural characteristics such as unnecessary flows and misunderstanding. Second, technological issues due to differences in the tools and programming languages used by the project teams. Third, lack of clarity in processes. Fourth, organisational issues such as the structure of the task allocation, coordination and authority. Finally, the human related issues such as differences in personal or group behaviours, mind-set and knowledge. Paul et al. (2016) contributed that it is imperative to build highest levels of trust, cohesion, cooperation and collaboration between the distributed team members. These imperatives are not sufficient alone and further requires effort, timely decisions and actions to facilitate explicit flow of knowledge. The extant literature recommends also some techniques to address organisational factors for effective communication in distributed project teams. For example, using various communication and project management tools, employing scrum masters and product owner for each location, and enabling frequent visits of scrum master to other sites. However, the disadvantages associated with such strategies are mainly the additional costs associated with hiring experts, resources, and commuting (Korkala et al. 2010; Layman et al. 2006). In addition, using a customer representative to play the role of the client, active customer engagement and promoting the role of product owners or scrum roles can also facilitate effective communication, robust execution and the overall management of project teams (Alzoubi et al. 2016). The literature also

suggests solutions to overcome geographical differences and team configuration issues in project teams. These are mainly creating local teams or teams within the same time zone areas, acknowledging must-participate requirements, reducing the total number of meetings, minimising dependencies and using standardise tools, enhancing visits and arranging centralised experts in base countries (Agerfalk et al. 2009). However, Keshlaf and Riddle (2010) argue that organisations may not be able to facilitate all these due to short iteration times in scrum, i.e. 2 to 4 weeks, where the collaboration and communication between the distributed teams, product owner and client is required at highest.

Project characteristics such as its defining aims and understanding development code, project constraints and limitations also impacts the effectiveness and efficiency of the communication. For example, unclear project characteristics can lead to misunderstandings, unnecessary communication flows, decreases knowledge sharing, decreases integration of project processes and information sharing capabilities of team members (Dingsøy, et al. 2014). Bosch and Bosch-Sijtsema (2010) proposed strategies to overcome project characteristics, for example, providing overall architectural vision to the teams, building consensus on the project requirements between the teams and the relevant stakeholders at the beginning of the project and reducing conflicts which disrupts the teams' collaboration. However, time intervals (iterations) in Scrum between back-and-forth for sharing information and communication, arranging resources, and waiting for inter-related and inter-dependent tasks activities negatively impact the overall performance of the project and places diverse stress on diverse resources (Paul et al. 2016). Lamersdorf et al. (2011), while analysing the global software development projects, discovered issues related to work allocation within the distributed teams, such as inexperienced individuals handling complicated tasks or depending scrum master's support for task allocation. Lamersdorf et al. (2011) proposed that these actions could result in low productivity and have a negative influence on the project objectives. There are issues associated with work allocation in global software development and therefore he proposed of risk-driven model for systematic working which comprised of two main levels.

- Task allocation to teams based on the project and site characteristics
- Observation of the task allocation with respect to potential risks

Similarly, several other frameworks by Mudumba and Lee (2010), Shrivastava and Rathod (2015; 2017) and Betz et al. (2011) lacks in providing coherent and explicit guidelines for managing communication issues within scrum-based distributed projects. Most of the literature to date depends on pre-conceptual ideas and primitive theories. The issues which are mainly found are the dependence on conventional concepts which makes them difficult for the project managers and organisational leadership to applying in the distributed contexts. We, therefore based on literature review decided to go for an exploratory type research which comprehends and justify our initiative to develop a theory.

RESEARCH DESIGN

This study is an exploratory type where the authors collected their data mainly based on interviewing professionals, scrum masters and project managers having experiences of working distributed scrum environments. Semi-structuring interviewing style was preferred as it allowed the participants to contribute and share from their experiences. A total number of 25 interviews were conducted in the countries of namely, United Kingdom, USA, Germany, Pakistan, Kuwait, Romania and UAE. Cavana et al. (2001) highlighted that interviews in qualitative research are a

unique form of revealing rich, rigorous and complex knowledge from a participant. All the interviews included open-ended questions and provided an opportunity to each of the participants to contribute as much insights as possible in relation to their knowledge and experience. The main goal of the interviews was to investigate the opinions, knowledge and beliefs of individuals to exploring the components/factors which could build a strong communication structure between the entities operating from different geographical boundaries.

Sampling

The researchers used purposeful type sampling to identify the participants close to the area of study. Purposeful sampling is a procedure which supports to select the participants having knowledge or experience of the process (Hood, 2007). Purposeful sampling helped to identify and select individuals that were knowledgeable and experienced about the scrum-based project. Hood (2007) further adds that in purposeful sampling it is also important to know the availability and willingness of the participants, together with their ability to communicate their knowledge in an expressive and reflective manner which was acknowledged by the researchers by getting a signed consent from each of the participant and in the beginning of each interview. While sampling, the focus was to ensure that the participant meet the criterion of 1) mainly have experience of scrum-based distributed projects rather targeting any specific region or country' 2) and experience of working in multinational or foreign-based organisations for collecting relevant data. For example, while selecting the participant from Germany, one of the previous colleagues from our professional network was consulted who recommended the Participant#4 from the IT (software) department of his organization. Similarly, while selecting participants from other regions, pre-interview discussions were conducted to analysing the pertinency of the participants. In all the interviews, one of the basic factors which was considered was that the participant should be experienced, have worked in managerial or lead position and should have experienced of managing distributed and Agile (Scrum) projects This helped to find appropriate samples from the target location. Table 1 shows the details of the participants.

Table 1: Details of Participants

Interview #	Participants (Pseudonym)	Code	Designation	Field	Country
1	Participant 1	P1	Technical Support Manager	IT Support Services	United Kingdom
2	Participant 2	P2	Risk Compliance Lead	Information Security Projects	United Kingdom
3	Participant 3	P3	Senior Business Analyst	UK Public Sector	United Kingdom
4	Participant 4	P4	Senior Principal Manager	Software Development	Germany
5	Participant 5	P5	IT Project Management Consultant	Software Development / IT Consultant	United Kingdom

6	Participant 6	P6	Team Lead	Software Development	Germany
7	Participant 7	P7	Senior Project Manager	IT Projects	United Kingdom
8	Participant 8	P8	QA Lead	Software/Web Development	Pakistan
9	Participant 9	P9	Managing Director	Software/Web Development	Pakistan
10	Participant 10	P10	Program Manager	Software/Web Development	Pakistan
11	Participant 11	P11	Senior Project Manager	Software/Web Development	Pakistan
12	Participant 12	P12	Project Manager	Software/Web Development	Pakistan
13	Participant 13	P13	Senior Program Engineer	IT Services	Pakistan
14	Participant 14	P14	Project Manager	Software/Web Development	UAE
15	Participant 15	P15	Principal Product Manager	Financial Solutions	Kuwait
16	Participant 16	P16	Project Manager	Automobile Industry/ Consultant	USA
17	Participant 17	P17	Operations Manager	Software Development / IT Services	Pakistan
18	Participant 18	P18	Senior Project Manager	Software Development / IT Services	Pakistan
19	Participant 19	P19	Team Lead	Software/Web Development	UAE
20	Participant 20	P20	Lead Software Manager	Software/Web Development	Pakistan
21	Participant 21	P21	Project Manager	IT Consultancy	Romania
22	Participant 22	P22	Project Director	Software Development / IT Solutions	Pakistan
23	Participant 23	P23	Principal Engineer	Software/Web Development	Pakistan
24	Participant 24	P24	Senior Program Manager	Telecom Sector	UAE
25	Participant 25	P25	Project Manager	IT Consultancy / Software Development	Pakistan

Data Collection: Why Interviews?

As informed, the data collection in this study has been mainly based on interviewing. The researchers looked for various strategies that can be used to gather relevant data. This included getting data through observations, focus groups or carrying out individual interviews. Observations were time-consuming and required the researcher to be a part of those settings or situations where he can take descriptive and lengthy notes of the issues found in communication (Creswell, 2007). In observations, the researchers presumed that they might not be able to observe the perception of the participants if they do not perform any action or take part in a situation. Another reason for not going with observations was that the researchers wanted to get access to multiple organisations from different parts of the world. As the researchers were based in the UK, they, therefore, couldn't travel to different locations and look for organisations that would allow them to be the part. The researchers also tried to look for relevant documents to observe but found out that those reports were confidential and could not be shared with the third parties. Focus group could have been beneficial (Bell and Bryman, 2011), but as the researchers preferred to interact with appropriate participants around the globe, it became then difficult for the researcher to gather all the respondents to be present at the conference call at the same time. The researchers after conducting initial interviews also tried to arrange a conference call for four of the participants but due to participants' busy schedule, a mutual time couldn't be decided.

Rigor and Credibility

One of the most common critiques qualitative researchers face is to demonstrate the trustworthiness in the study conducted (Silverman, 2001). However, Norris (1997) argues that there is no definite solution or paradigm to avoid bias and errors in qualitative research. Norris (1997) further elaborates that biasness can be reduced to authenticate the research process by following methodological processes and procedures. The researchers have taken all the necessary measures to reduce bias in the study and achieve rigor and richness. Following are some of the steps taken by the researchers to avoid biases during data collection.

- i. ***Acquiescence bias*** (Dodou and Winter, 2014) was reduced by asking several questions in between the interviews to ensure that respondent elaborates his thoughts with an honest and confined point of view. For example, using the '5 whys' technique helped to get deep insights of a problem or issue.
- ii. ***Confirmation bias*** (Nickerson, 1998) was reduced by comparing the responses of one participant with the other with respect to the number of interviews. Similarly, confirmation bias was avoided by peer reviewing where the findings were shared with the peer authors and experts in field for getting the feedback for improvement.
- iii. ***Leading questions and working bias*** (Malhotra et al., 2004) was reduced by asking a variety of questions in between the conversations. During the research, leading questions and working bias was constantly avoided by the researchers. The researchers inquired very simple and straightforward questions to his respondents such as inquiring the role of communication in building correlation, the role of contentment and satisfaction in Where an explanation was needed, the researchers explained about the philosophy behind the question. For example, when asking to participant#8 about scrum-based distributed projects, the researcher inquired participants of the locations of the distributed team members to ensure that the participants share highlights from distributed-based projects.

Similarly, a hint or direction was given to avoid noises in the data which helped respondents to focus and contribute extensively from their experiences.

iv. ***Member Checking***

According to Lincoln and Guba (1985), member checking depends upon two criteria: checks relate to the accuracy of the data and verification of the emerging findings. In regard to checking the accuracy of the data or captured articulations, the verbatim transcriptions (Davidson, 2009) from recorded audio were sent back to the participants for verification to ensure that their speech or words have been accurately captured and have not been misinterpreted. Another feature of member checking was the validation of the emerging concepts and the interpretations after they emerged (Lincoln and Guba, 1985). The researchers after developing initial findings went back to the respondents and got a formative feedback to evaluate the interpretations of their findings. This provided a formal opportunity to previous respondents to assess the results of the study. This was an additive feature which proves or disproves the investigator's assumptions about a phenomenon which has been examined (Shenton, 2004). The researchers in order to avoid bias, contacted 8 participants randomly from various regions to get diverse feedback. Out of 8 interactions, 4 were live interview sessions whereas 4 of them were provided with a structured questionnaire/feedback form. The discussion time for the live interviews was 25–35 minutes, where structured questions were inquired, such as requesting commentary on the competency of team members to managing communication and then inquiry about commitment to achieving deadlines etc. These strategies helped to add credibility and validation throughout the study.

v. ***Tactics to help ensure honesty of informants***

Another factor which helped to attain credibility was to ensure honesty in the informants' attitude (Lincoln and Guba, 1985). Every participant who was approached was given opportunity to express his/her consent for participation in the study to ensure genuine participant without any constraint. In regard, all the 25 participants were sent a Consent and Information sheet before the interviews. Additionally, before the proceedings of the interview sessions, the researchers highlighted the terms and conditions, mainly getting their willingness to participate and informing them of their right to withdraw at any stage of the interview or research project. This provided each participant a secure and free environment to talk, providing them maximum opportunities to express their thoughts and experiences about the phenomenon.

Data Analysis

The data for this study has been analysed using thematic analysis approach Braun and Clarke (2006). The *unit of analysis* for this study was the study of entire communication' network/structure or communication norms, affected by the actions or interactions of distributed team members. Thematic Analysis helped to extract themes or patterns that were prominent in the data at different stages and thematic networks thus facilitated to assemble and illustrate the identified themes. Underpinned by interpretivism, the researchers analysed the data by following steps: Getting familiar to data is first the initial step for all qualitative researches (Denzin and Lincoln, 2005). Verbatim transcriptions for all the 25 interviews were done by the researchers themselves which helped to analyse and extract the themes in relation to the research question. In

addition, audio recording was also listened various times to observe the analytical responses of participants (Braun and Clarke, 2006; Davidson, 2009). Coding was the next stage where the author coded or labelled for significant concepts in the data relevant to research question. Further, the authors used their analytical thinking to interpret the data that represented an overall concept or information against each code. For example, Correlation interprets that the relationship can be built between teams when trust and social interactions are promoted as well as discrimination is reduced. The next stage was to recognise the themes behind all the codes generated. The themes were again reviewed and compared with data having a broader perspective in relation to the research question. Few of themes were eliminated and some new were added to ensure effective data interpretation (Braun and Clarke, 2006).

FINDINGS AND DISCUSSION

Our results show that communication in Scrum-based distributed projects vary in several dimensions and supports engaging distributed teams in various project processes. Maintaining high level of communication has an imperious position in enduring day-to-day project affairs, thus, aiding in harmonising the overall distributed environments. According to few of the participants,

“The key thing is communication because you know when your team is virtually sitting, virtual apart from you, you cannot see them, you cannot meet them, might be sometimes when you are working with the team you have never seen your life you know, yet you build up a relationship with them.” [P14]

“I mean that there is pretty much change in everything from day to day structure that how you organise communication, how do you organise spend over, and especially when you are going from design to implementation or execution phase.” [P6]

As the entire basis of Scrum-based distributed projects relies on technical resources which serve as the basis of integration and networking between the dispersed stakeholders, the researchers claim that effective utilization of technology is an initial step in building up communication. Lee and Baby (2013) have also acknowledged that use of technology for networking have an imperative role in developing an effective communication structure between global IT project teams. The organisation must standardise the tools for communication/conferencing and code development between the interdependent teams. Reed and Knight (2010) further propose that the use of communication tools should be acknowledged in distributed projects as it helps developing high efficiency and reduce ambiguities within the team members. The entities who are distributed cannot interact physically; to overcome such challenges, the scrum masters, and decision-makers should focus acknowledging and provide training to the team members for using specific tools to build up strong communication. According to the results of this study, communication in scrum-based distributed projects is influenced by five major components:

- Competency
- Correlation
- Contentment
- Comprehension
- Commitment

These components in the scrum-based distributed environment affect the working of project team and their performance, and ultimately lead the project to failures. In order to meeting the project targets, the project leaders or managers must ensure taking measures to restraint the negative effects from the above factors, so that distributed environments could be harmonised. The findings emerged in the form of pentagon of communication due to the interdependency of tasks shown in the figure below:

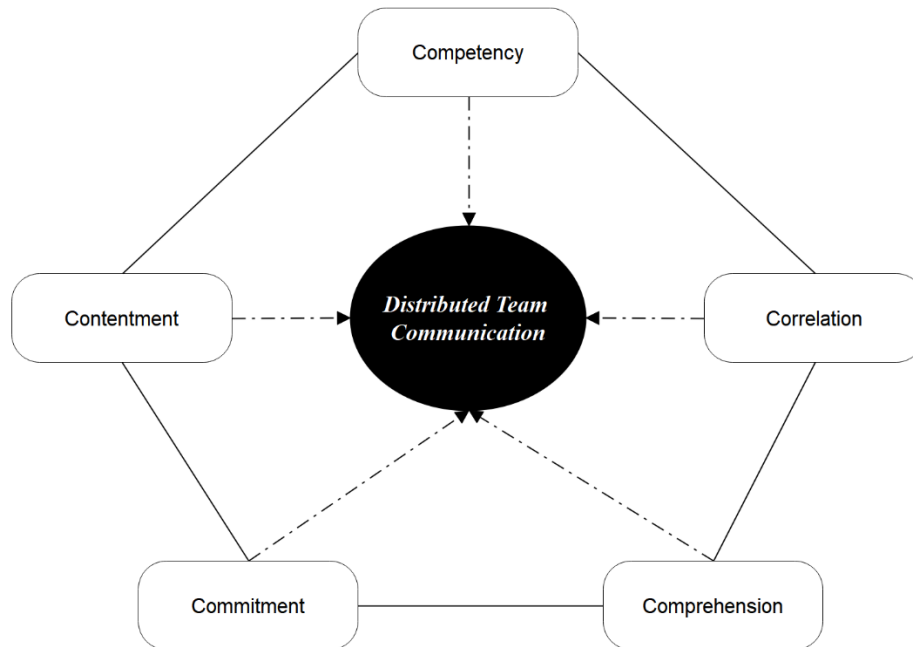


Figure 1: The Pentagon of Communication

Competency

The requirement of competency has evolved as one of the key dimensions which contributes to maintaining a high level of communication. Either the project manager or scrum master, a technical team lead or a team member, his performance can be estimated from his competence. Competency is further divided into three major factors.

Competency	Managing workload
	Creativity
	Skills and Abilities

The analysis suggests that the individuals involved in Scrum-based distributed projects may belong to other organisations or work on a part-time basis, therefore they are unable to manage their workload, and this ultimately affects the project progress, and affects communication. It has been revealed from the data that team members are usually busy on other assignments or projects

because of which they cannot attend meetings and share their work on time. One of the participants mentioned:

“Individuals may be busy on other assignments or projects. It’s up to their ability how they manage work routines and deliver their work on time.” [P19]

Scrum-based distributed environment requires high competency, experience and knowledge of the Agile principles. Most of the projects fail as people are not able to understand the philosophy of working, therefore lack showing productivity. Lee and Baby (2013) have acknowledged the development of interpersonal skills to ensure the smooth flow of distributed projects. Further, Persson et al. (2009) advocate that in distributed software development projects, interactive skills can help to generate understanding among distributed members in relation to tasks and reaching a mutual consensus. Interactive skills can be attained by training or having previous experiences of working under such dynamic circumstances. Consequently, Mudumba and Lee (2010) argued that in global software development, individuals could not give sufficient time to the working environment due to their busy routines. This gives rise to evolving risks where the gap exists between distributed entities on mutual understanding of the project scope. Another aspect which evolved from the analysis of data is the required ‘creativity’ of the developers or programmers working in distributed project which helps to develop creative solutions for the client. Creativity is a necessary requirement of the scrum projects, as customers/clients’ demands are changing, so in order to catch up with the customers’ requirement, creativity should exist within an individual. A participant while acknowledging creativity mentioned,

“Communication is the wellspring of creativity in distributed teams. It helps in information sharing and interaction among team members. Teams can be linked with clients to resolve complications within a development code” [P15]

Consequently, the participants highlighted that during the execution of Scrum-based distributed projects, team members should be able to analyse the problems they face and utilize their natural tendency or ability to understand and then communicate the circumstances. The reason this concept is significant because the teams are not able to identify the problems or complications occurring the projects. According to one of the participants,

“While I am doing the weekly meeting with all my stakeholders. Many guys will record ok they are facing this issue but if I ask them had they done the root cause analysis of the problem why that are facing this issue? Have they tried to reach the person who is core responsible for that? Have they done that? Most of the time around 80 to 90 percent, their response is low means they have not done the initial basics.” [P24]

The participant wanted to mention that whenever the team members face issues during the projects, they do not pay attention towards them, and do not know how to counter them. This issue when comes to him (being a project manager), he becomes proactive and communicate them to the product owner or client. The team members do not ponder that their one late response can delay the whole development process. He also mentioned that it depends on the situation and settings of the projects but still varies from person to person how he handles the problems or complications. Not all the individuals have the same capacity to estimate or judge the situation, rather it varies from individual to individual that how he takes up the problem into consideration. Dorairaj et al.

(2012) suggest that in order to reduce the failures, the individuals should have previous experiences and knowledge from a particular field and ability to work under pressure. Similarly, they recommend that the entities involved should know about how to apply the technical resources in project work. Such abilities can help to respond to alterations and developing challenges more positively and thus enhance opportunities for a project. In respect of potential issues, the data specifies that responding to risk events depends upon the natural tendency and ability of each person where they can handle the situations and do not let the project progress be harmed.

Correlation

Strong relationship between the distributed teams’ support in building up a strong communication structure. As Scrum-based distributed project comprise of diverse people from different geographical locations, they vary in culture, language and working practices. Strong relationships between teams help in maintaining high communication level. Strong correlations between entities can reduce conflicts and supports team formation. Correlation can be attained using following parameters:

Correlation	Trust
	Social Interaction
	Equality/Reducing Discrimination

The data indicates that the trust-building process between the team members and clients is problematic as they are anonymous and new to each other. Correspondingly, if the customer/client is positioned at a different location, he does not trust the project team easily and this may lead to the development of new uncertainties; communication breaks down and affect the developing process. A participant while highlighting the importance of trust building process mentioned,

“Its {trust} very important when you are working offshore, and your team is placed in another country.... It takes time to build {trust} when you fulfil your commitments” [P17]

One of another aspect of correlation is to promote and offer opportunities to have social interaction. Nowadays, multiple social platforms help team members to communicate through different channels, thus supporting to build a strong relationship. Similarly, social interaction can be promoted when inviting distributed team members to another location to give them a chance for having face to face meetings with their folks at different stages of the project. Alzoubi et al. (201) recommended the use of multiple communication channels to interact, as it helps the frequent flow of information and aids in the building of trust. Dorairaj et al. (2012) endorse the application of communities of practice where individuals can share information, experiences and technical skills on an issue, which helps them to create team formation among them. Similarly, Rogers (2003) recommends that in a social system where new people interact, several new challenges grow; the best way to deal with them is to create formation in the social system through extensive communication.

“Obviously, we had cultural issues because we had developers in India as opposed to the UK. However, the company was very good in actually getting some of the Indian developers to come

over to London, so they would spend time with us and sometimes they are collocated and sometimes they would obviously remember where they lived, it would be great because you have that personal relationship with them.” [P5]

Consequently, some of the people involved in distributed projects may have previous affiliations or relationships due to which the product owner or individuals may have some unusual feelings of being discriminated. Project leaders or organisations should keep this issue into consideration and maintain a balance rapport while dealing with a diverse group of people. If the people are not being treated with equity, this can lead to the development of isolation, thus affecting the communication badly. The teams and stakeholders need to maintain a steady relationship, so that project performance could be achieved. Correspondingly, a participant highlighted,

“Affiliations or relationships can sometimes produce bad or harmful impact on the distributed teams.” [P11]

Contentment

Contentment has emerged as one of the most critical components of communication. As the teams are dispersed, where no physical interaction exists. As per data, issues related to getting contentment are expected to occur in such project environments very commonly which tends to affect the team bonding and communication. Contentment includes the following sub-components:

Contentment	Motivation
	Facilitation
	Consent

The participants suggested that by motivating the team members, potential issues in overall project environments can be reduced and controlled. Similarly, when the teams are not satisfied, they could not perform their jobs more actively. The better the motivation level is, the better the communication and better the tendency to manage the conflicts. In regard, one of the participants mentioned,

“The team needs little bit motivation and then I realise my team is having conflicts and things like that where I feel there is kind of the team is going to depart.” [P14]

Moe et al. (2012) suggested that where the shared decision-making process is under consideration, motivation helps to keep morale high. Similarly, the data suggest that there can also be several personal reasons where individuals do not seem to be willing to correspond or communicate extensively; it becomes a need to motivate them towards their work and socialisation.

Another factor which contributes to achieving contentment is to provide appropriate facilitates to the distributed teams around the globe. The management or the parent organisation should undertake sufficient measures to ensure establishment and consumption of facilities at all the locations. Consequently, the data also suggest that people in the leading positions should ensure

that their teams are well-equipped with all the requirements to undertake the project work. Reed and Knight (2010) further indicate that sometimes the technical resources such as webcam for video conferencing are not available at the individual's end. Similarly, equipment like scanners, printers or software licenses are not available for people from diverse territories. Hence, it becomes the obligation of the project manager to provide such equipment and tools and ensure that the teams can utilize them in a proper manner. They should ensure that the team members should be present in daily meetings to undertake their work properly. A participant in this regard mentioned,

“What my responsibility is to make sure that my whole development team is you know ready and equipped for the latest strengths.” [P17]

Teams who are scattered may not agree to undertake the work happily, and this leads to disruption in project processes. The data also suggest that before giving jobs or tasks to team members across the globe, project manager, scrum master or technical team lead should be able to get a consent from individuals. They should discover that whether the individuals know about the work they are undertaking or are they skilful enough to take the work? Do the individuals know about the job they are undertaking? Correspondingly, by getting their willingness and consent, they can be more productive, and this will help to encounter dynamic challenges in the environment. While acknowledging the willingness of teams, a participant mentioned,

“Before giving tasks to individuals, it's always good to know about their willingness.” [P18]

Powell et al. (2004) propose that in the distributed projects, team members become isolated from the environment; therefore, the need for restoring their enthusiasm and interest towards project work becomes mandatory to achieve project objectives. Lilian (2014) further suggest that team cohesion and trust can be helping to increase motivation within the virtual team members. Likewise, Reed and Knight (2010) propose that the rise of conflicts between teams can give rise to several misunderstandings between team members; therefore, motivating them towards team cohesion and formation may help achieve project goals more positively.

Comprehension

Comprehension links to the experience and knowledge of working in distributed environments. By having the knowledge and understanding of scrum-based project, work can be more effectively executed. Scrum-based distributed projects which are mainly based on the principles of Agile methodology, achieving them in distributed format become difficult as the team members cannot interact physically, and depend upon computer-mediated technologies for communication. People shifting from the traditional format of working (co-location) are not able to change their mindset which affects the project environment and performance. Traditional project environments are based on conventional working models where the interaction and collaboration level are low, thus, the need for teams and clients to the network is less until and unless the product is fully developed for testing. Dorairaj et al. (2012) also suggested that in order to reduce the failures, the individuals should have previous experiences and knowledge from the same field and ability to work under pressure. Comprehension includes the following sub-components:

Comprehension	Knowledge Sharing
	Scope Management
	Feedback

The process of knowledge sharing in distributed scrum projects is difficult to comprehend and stimulate. The explanations are mainly the differences in mindsets, level of knowledge and understanding between the project stakeholders. Knowledge sharing in distributed projects differs to the context of traditional projects in several ways. The required frequency of knowledge is high and varies along project settings and requirements; thus, creating more difficulties to adapt the ideas, notions, and concepts. If the teams' or entities would have an understanding about their work, they would be in a better situation to communicate the problems. A participant while acknowledging the importance of knowledge sharing mentioned,

“Sharing knowledge and communicating problems in the scrum projects which are virtually based is critical. The developers are from different regions or say cultures, they do not understand or sense the importance to share the forthcoming problems and then keep on working. So, whenever there is a failure in the code, it delays the overall project and affect relationship with the client” [P21]

According to Dorairaj et al. (2012), knowledge sharing between the dispersed teams is significant for the success of Agile development. Information sharing between the teams and customer can increase the level of understanding of tasks. Similarly, the data emphasize the information sharing process by highlighting that the discussion between the teams should be very precise and comprehensive so that the people having different mindsets should be able to understand the ideas and notions of others. Rogers (2003) further acknowledges that in a social system, knowledge sharing process is crucial as several entities are involved which might restrict their ability to understand the innovations going on in the social system. Therefore, the process of communication should be effective enough to attain the mutual consensus of the people involved in developing issues.

One of another aspect of comprehension which has emerged from the data is scope management. As scrum development allows alterations and flexibility, participants have shown concerns over the mutual understanding of the aims and objectives between the distributed team members. Scope management becomes an issue when the understanding of individuals differs in relation to the project work. In accordance, participants have suggested ensuring extensive communication to develop a mutual consensus. A participant in regard mentioned,

“Ensure the communication between the team members discusses the key milestones, aims, and objective to reduce scope creeps into the projects” [P7]

The data also suggest for keeping an extensive feedback loops to facilitate the comprehension process. The feedback loop in scrum-based distributed projects create better understanding among clients and project team, and they can come to know about the gaps in their work. Shrivastava and

Rathod (2015) suggested that frequent feedback in distributed projects helps the teams and clients help to develop an understanding on various issues and get to know about the causes of failures in the projects. Layman et al. (2006) suggest that active feedback helps to respond to alterations to minimise failures. He also acknowledges that in global software development projects feedback is vital from a customer point of view where they provide the feedback to developers over prototype test runs. Mudumba and Lee (2010) also advocate that feedback from previous iterations/sprints aids in performing the task planning for following sprints. This helps to know about the changes, mistakes and improvements that may be required to be undertaken in a project. Further, it helps to know about the errors in the source codes and perform improvements by testing the codes at various levels. A participant in regard mentioned,

“We use some methodology of Agile like the way we use for scrum then we show early alternations to the client and we get early feedback.” [P12]

Korkala and Abrahamsson (2007) suggested that requirement exchange between the teams and customer should occur accurately as this is one of the most critical processes of software development. Layman et al. (2006) advocated this viewpoint and recommends that a well-scoped project helps to create precise user stories based on the customer involvement. According to Chin (2004), user stories comprise of the simplified requirements needed by the users in Agile software development. Reed and Knight (2010) further acknowledged that in distributed projects too many scope changes produce numerous difficulties for the development teams. Lee and Baby (2013) also recommended to avoid frequent scope changes as they create several difficulties for the distributed team members; though Agile supports alternations, the scrum master must take actions to ensure a common understanding among team members and customer at all locations.

Commitment

Scrum-based distributed project comprises of entities who are geographically dispersed and depend upon the technological means for interaction; therefore, commitment to working support frequent and well-organized flow of information. It also helps in decision-making and fulfilling timelines. Commitment includes the following components:

Commitment	Planning and Scheduling
	Promptness
	Flexibility/Accessibility

Commitment depends upon proper scheduling and planning of the project work. To meet the deadlines, the data suggests that if any of the team is based in a different time zone, time management for any other fellow becomes very difficult. In this regard, self-organising the tasks and responsibilities can help overcome challenges and reduce potential risks. The teams who are allocated interdependent tasks needs to have an efficient plan among themselves so that they could be able to complete shared tasks on time. One of the participants highlighted,

“You have to spend more time on the things that are happening more normal in non-virtual projects but in virtual projects you have to spend let say just 5mins or you can figure the communication in your free time or in your break. So, there you need a strict tool for meeting or touch point or schedule than in local based project.” [P4]

Verner et al. (2013) argued that agile methods bring new challenges when tasks are distributed between entities in different time zones. The need to manage then requires efficiency and clear approach. Cho (2008) further acknowledged that when the sprint backlog is created from main product backlog, team members try to split the tasks as small as possible, so each task could be completed within three days’ time. The data also emphasizes on promptness in responding to facilitate communication. This promptness can be in terms of responding to the queries raised by the team members and clients. It is responsibility of all the stakeholders to respond promptly to the queries or observations of each other. The participants have acknowledged to resolve the situation as soon as it evolves within a project environment. Such situation could be like, if the product owner or client doesn’t respond to the query on time, this is a developing issue where the project team has to wait for a response which delays the overall project activities. Lee et al. (2006) have also suggested for quick and prompt response to sensing the uncertainties and challenges in Agile project management. Consequently, participants have highlighted the need to respond to queries and problems on a prompt basis rather than leaving them until the last moment. They further highlighted that the entities in the distributed scrum projects are sometimes lazy to respond to their emails and queries which delays work and affect sprint deadlines. Further, several authors like Smite and Borzovs (2008), Verner et al. (2013) and Shrivastava and Rathod (2017) have advocated for promptness and rapidness for performing activities and raising issues in order to complete the sprints targets. A participant mentioned,

“We communicate with our other team members on daily basis and we stand up and we try to assess who, what are the blockers for them and try to mitigate all those blockers so that they are happy in their work environment and there are no flight risks.” [P9]

The difference in time-zones can bring several complications in the project environments. The participant suggested that this issue can be overcome by adapting yourself (flexibility) in accordance with the requirement of the project environment. This applies to both the project team and product owner/client so that they could facilitate an effective communication process. Team members and clients who are not based at one location can help each other by overlapping their working hours so that they could interact timely. Further, managing time is imperious and the scrum master has to come up with some mechanism of changing the working hours of the people. This certainly reduces the challenges as the dispersed team members can interact, collaborate and share their work on time. Similarly, having a flexibility in routine helps to reach any individual whenever he is needed beyond the working hours or schedule. A participant highlighted,

“If you need to communicate something you need from your product owner, so for you to work with him, you have to work when he is online as well, and you are online as well. You cannot expect everything to happen smoothly you know, if he is in different time zone.” [P17]

Verner et al. (2013) endorsed that the scrum master in this regard should produce shared time plans so that it may not create uncertainties in the project environment. This viewpoint by Verner et al. (2013) is commendable as it will help to create a common starting and finishing points for

individuals. Similarly, the teams and individuals should share their personal contact details in case they are on vacation or based in another time zone where the schedule of holidays is different to the one of the primary location of operations. Therefore, keeping in consideration the opinions of the respondents, it can be deduced that by spreading knowledge of adjusting according to project environments, the issue of time shift can be managed to a great extent. Shrivastava and Rathod (2017) further acknowledged that the issues of time zone difference between individuals can be overcome by using pair programming. Pair programming in Agile development allows the individuals to work on the same workstation even when operating from different locations. This reduces hassles and uncertainties where the developers can share their opinions and ideas even though being dispersed at the same time.

Conclusion

Overall, our paper identified the factors that can be used to improve the communication structure between distributed team members. Communication, which is considered to be the most critical component in distributed environments has been discussed in relation to achieving the expected outcomes of the projects. Communication is of great significance between the distributed stakeholders; such as product owner, development team and client need to give high consideration and put efforts for improvement. We identified five major factors of communication and offer a 5C theory of communication in Scrum-based projects. Our findings in this paper are more pertinent to the project stakeholders who are in decision-making and planning positions, such as organisational leadership, project managers, senior-level directors and team leaders. We hope that future studies will provide an in-depth understanding of the issues and challenges that might be associated with the proposed pentagon of communication and draft their strategies accordingly to encounter them.

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