

Root Causes for the Failure of Communication in GSD

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Abstract

At the moment majorly software development organizations tends to obtain common interest by implying software development using global approach. Global software development (GSD) is the essence of this global approach. In practical GSD faces several challenges in different software development organizations. The core issue is communication which becomes more complex while using requirement change management (RCM). The focus of this work is to figure out different factors which are effected by RCM for GSD. Hypotheses are constructed and a framework architecture is proposed on which a mathematical/statistical/quantitative is applied to analyze the data. Multi-regression technique is used to analyze the hypotheses saying whether they are supported or not supported according to the developers of several software development organizations.

Keywords: Global software development; Multi-regression technique; Framework; Communication; Distributed software developments

Introduction

Software developments using global concept is acquiring the interest of many researchers. Global software development outlaws the barriers of boundaries like time differences, cultural diversity and language [1]. Additionally, as open source software developments hit the web; the trend of using Distributed Software Developers (DSD) reinforces up the method. Multiplicity of aptitude pool and minor development cost and wider developments are the main reasons for the selection of GSD [1]. A software development process can be definite, accomplished and dignified. Any process development which follows the same can be achieved continuously. The worth of software system is reliant on the worth of process followed to develop it [2]. Agile principles and its applications combined with Global Software Development (GSD) appears to offer numerous benefits like inferior production cost, round the clock development, and closer time to market. It also gives the authority of comprising the most endowed developers around the world [3].

Basically, GSD is an essential outsourcing technique whereas Distributed software development is the replacement term used by some researchers instead of outsourcing. Which means developers employed at distant localities with different time zones deliver their facilities to the customers. The developers in GSD environment come having multiple nationalities, cultural and religious experiences [4]. The crucial reason for the admiration of Distributed software development jobs is that GSD deals with the number of benefits over the conservative techniques. The utmost importance of these benefits are the significant discount in the development cost caused by inconsistencies in wages of software engineers. Communication is one of the main issue in RCM process in GSD. The core addressed communication issues are weak communication, lack of face to face meetings, poor business language skills, lack of mutual understanding, delay in responses, lack of trust, lack of cultural awareness, less time overlapping and dependency on asynchronous communication. In GSD software development requirement tend to constantly change from software requirements stage to the maintenance stage. RCM is one of the utmost thoughtful action which carriages major problems with DSD teams. The privation of appropriate RCM may lead towards software failure. It is very challenging to accomplish change requirement due to communication and coordination issues.

This paper contains the following sections. Section 2 describe the problem formulation about the factors of communication issue. The Section 3 gives the construction of framework and hypothesis. We

discuss the Research methodology to apply some techniques. Sections 5 discuss the result which we get from applied techniques. The potential future work to this research is described in section 6 and finally we conclude in the last section.

Problem Formulation

Haq S et al. [4] conducted a critical review on issues in GSD; they concluded a comparative metric for the benefits and challenges in GSD. They also highlighted communication as a major issue in GSD which effect the overall project life cycle. Khan RA and Khan SU [5] performed a systematic literature review to identify the communication and co-ordination challenges at vendor side in offshore development projects. In this study authors listed eighteen factors which are causing or caused by communication barrier. Factors which got more votes in this study were geographical, cultural and language diversity and lack of technological cohesion.

Social media is playing a vital role in every aspect of our daily life and we cannot ignore the role of social media in our everyday life. Teams and companies are adopting social media and using various social media channels in their day to day communication. As the GSD teams are adopting these channels for communication this opportunity created a new window for GSD researchers to examine the role of social media and its impact on communication and compare the results of the different social media platforms as a single one or multiple in combination. In this regard Manteli C et al. [6] conducted a study which reveals the importance of social media in GSD. Every communication channel and media has its own limitations. We need something that communicate instantly and more frequently on which we can reach to the person in offline hours. By offline hours here it is meant that if a resource is offline after his/her work hours and a bug in a production line happens to appear and it is urged to resolve immediately [7,8]. Another challenge is to keep track of all communications and discussions. Keeping in mind all these scenarios Media selection become a challenging decision. In this connection Gu R et al. [9] conducted a study on communication

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media selection. In this study they discussed about Media Richness Theory (MRT), Social Influence Perspectives (SIP), and Media Fitness Framework (MFF). These theories and techniques can help in taking the decision for media selection.

Construction of Framework and Hypothesis

A framework for the issues effecting communication in GSD is given in Figure 1. As discussed earlier there are nine issues of concern. These are shown as under:

In the above figure nine hypotheses are shown which the root cause for issues in communication [10]. We have taken two hypothesis for each factor the one is null hypothesis (H0) the other one is alternative hypothesis (H1).

The detail of the Figure 1 is defined below:

Poor communication

Poor communication basically occur due to geographical distance between software development teams. It is obvious to communicate at the initial level between the team members [11]. Therefore, poor communication may lead towards diverted communication issues. It is understood that due to poor communication the relationship between remote team members becomes poor causing repeated rework [11]. Therefore, we could suppose hypothesis as given below:

H0=Poor communication is not directly affect overall communication in GSD.

H1=Poor communication directly affect overall communication in GSD.

Delay in response

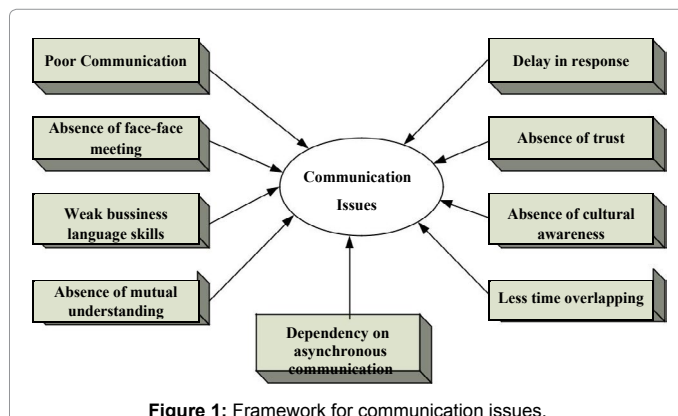
Delay in response occurs due to temporal distance. It is because of distance factor effected by different time zones giving issues to get fast response [11]. It may be a serious problem in distributed software development because delay in response make team members unable to discuss their overall development procedure [11]. Therefore, we could suppose hypothesis as given below:

H0: Delay in response is not directly affect overall communication in GSD.

H1: Delay in response directly affect overall communication in GSD.

Absence of face-face meetings

In GSD absence of face-face communication is always been a major



concern in GSD. Geographical locations always provide opportunity which could easily create misunderstanding in design patterns. Face-face meetings are mandatory to overcome these misunderstandings of the process requirements [12]. Therefore, we could suppose hypothesis as given below:

H0: Lack of face-face meeting is not directly affect overall communication in GSD.

H1: Lack of face-face meeting directly affect overall communication in GSD.

Absence of trust

Trust wordiness between team members is the core factor raised due to geographical locations in GSD. It is hard to establish trust among newly spread teams due to communication issues [11]. Absence of trust and absence of readiness are parallel factors occurring due to communication issue. Therefore, we could suppose hypothesis as given below:

H0: Lack of trust is not directly affect overall communication in GSD.

H1: Lack of trust directly affect overall communication in GSD.

Weak business language skills

In recent time, English has been used as a business language at national and international level, but still language is an issue for communication in GSD. Due to weak business language skills, communication hazards arise [13]. The understanding of such language depends upon organizational, cultural, circumstantial and occupational structures. Therefore, we could suppose hypothesis as given below:

H0: Weak business language skills is not directly affect overall communication in GSD.

H1: Poor business language skills directly affect overall communication in GSD.

Absence of cultural awareness

Transnational companies are hiring staff from various places across the globe. But, due to cultural multiplicity various challenges are faced. Individuals from different cultural circumstances have different behaviors, views and thinking's which leads towards issues in GSD [14]. In GSD, due to the increase in geographical and temporal locations, cultural distance becomes effected which can make the communication and development process more challenging. Therefore, we could suppose hypothesis as given below:

H0: Lack of cultural awareness is not directly affect overall communication in GSD.

H1: Lack of cultural awareness directly affect overall communication in GSD.

Absence of mutual understanding

Basically, lack of mutual understanding occur due to socio-culture differences. In GSD, software engineers come across from different cultural backgrounds having their own view and thinking's. Language is the basic part of communication and difference in languages may create misinterpretation between team members by which communication can be negatively affected in GSD [15]. So, due to absence of mutual understanding we could suppose hypothesis as given below:

H0: Absence of mutual understanding is not directly affect overall communication in GSD.

H1: Absence of mutual understanding directly affect overall communication in GSD.

Less time overlapping

Due to temporal distance less time overlapping occur. Between sites, the number of overlapping hours are reduced during a workday which may lead to miscommunication. So, in GSD less time overlapping is considered a positive stimulus issue for communication challenge [16]. Therefore, we could suppose hypothesis as given below:

H0: Less time overlapping is not directly affect overall communication in GSD.

H1: Less time overlapping directly affect overall communication in GSD.

Dependency on asynchronous communication

It can be risky to use asynchronous communication tools for communication and coordination purpose. Email may get lost or unnoticed. Therefore individual have doubt of whether or not a reply is coming and there is also a need to resend email after number of days. The chance of misunderstanding between team members is high due to asynchronous communication [17]. Therefore, we could suppose hypothesis as given below:

H0: Dependency on synchronous communication is not directly affect overall communication in GSD.

H1: Dependency on synchronous communication directly affect overall communication in GSD.

IF ($\alpha > 0.05$), where α = Significance level

Then H0 will be supported and our hypothesis will be not supported.

IF ($\alpha \leq 0.05$)

Then H1 will be supported and our hypothesis will also be supported.

Research Methodology

This quantitative study consist of two approaches. Web-based questionnaire and self-administered based questionnaire. The target population included developers from software houses at different locations in Pakistan. Total questionnaires distributed were 400 in which 196 responses came back, 166 responses were complete and hence are selected whereas the rest were discarded [18]. This respondent data was evaluated by keeping statistical, reliable and regression analysis for the hypothesis was done in SPSS version-19 (Table 1).

Model for data analysis β

Data analysis includes multiple linear regression analysis that attempts to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to the observed data [19]. The population regression line for 'p' explanatory variables x_1, x_2, x_p is defined to be:

$$\mu_y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_9 x_9. (1)$$

As the mean response μ_y change with the explanatory variables therefore the observed values for 'y' vary about their means μ_y that have the same standard deviation σ . So for the variance of means μ_y , the multiple regression model includes term for its variation. This model is expressed in words as:

$$\text{DATA} = \text{FIT} + \text{RESIDUAL} (2)$$

Where 'FIT' is the term that represents the expression $\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_9 x_9$ and 'RESIDUAL' is the deviation of the observed values y from their means μ_y . Now formally, the model for the multiple linear regression for n observations is:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_9 x_{i9} + \epsilon_i$$

For $i = 1, 2, \dots, n$ (3)

Results and Discussion

Questionnaire result

The questionnaire results are represented in Graphs 1-12.

Reliability analysis

To analyze the reliability of the questionnaire Cronbach Alpha test has been used. As by [20], depending on the estimation procedure used, estimates of alpha value may take on any value less than or equal to 1 for reliable analysis. Using the fact of reliability test having value 0.812 near to 1 in positive direction show that 81.2% of the data is reliable (Table 2).

Hypothesis testing

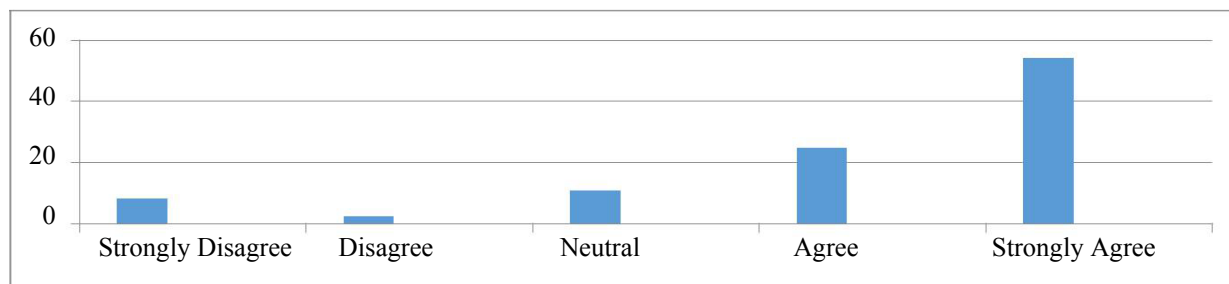
In this section the results of the study obtained is presented. Multilinear regression analysis has been used to analyze the data and get the desired results in terms of relationship between several variables [21,22]. To determine the strength, direction and impact of relationship it is also very important to present the interpretation for different correlation and regression coefficients. To analyze the results different values of R, R² and significance value P have been used (Table 3).

As we know the value of R shows the strength of the relationship between variables having ranges from +1 to -1. As the value of R approaches '+1', it shows the strength of the correlation relationship whereas a value of R closer to '0' shows a weaker or no correlation relationship [23,24]. For R having value below '0' means that there is negative correlation relationship. The direction of the relationship is determined by the positive or negative value. So a positive sign show direct relationship in which we have increase in 1 may also increase the other. To present the percentage of variance caused due to independent variable within the dependent variable is R² value. P value is used for significance of the relationship in which if it is less than 0.05 then we may say that the relationship is significant [25]. The results in the significance value is shown in Table 4.

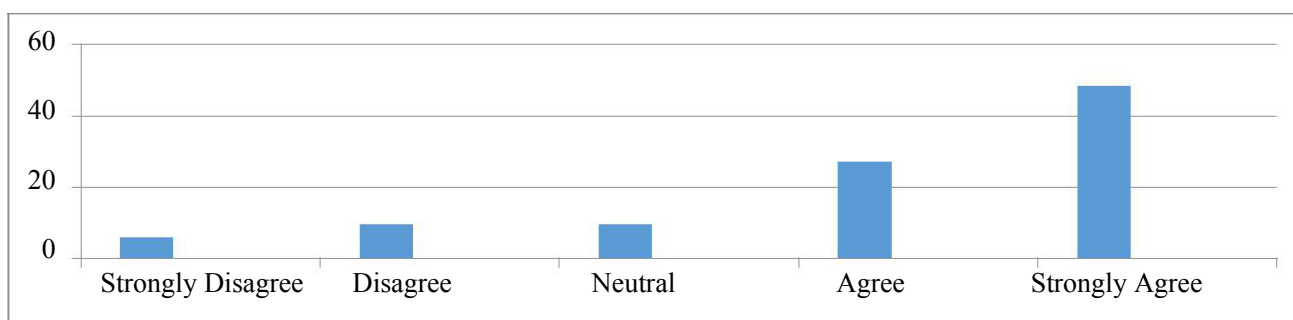
The significance of each hypothesis with clear verdict whether it is supported or not supported is illustrated in Table 5. When the significance value P is below 0.05 it show that hypothesis is supported whereas others values show that hypothesis is not supported [26]. The result for poor communication having significance value 0.016 illustrates a positive influence over communication issues and supports hypothesis of this research. The value for delay in response

Cities	No. of Respondents	Developers Experience	
		3 year experience	More than 3 year experience
Islamabad	33	20	13
Mardan	57	40	17
Rawalpindi	26	15	11
Peshawar	20	13	7
Faisalabad	30	18	12
	166		

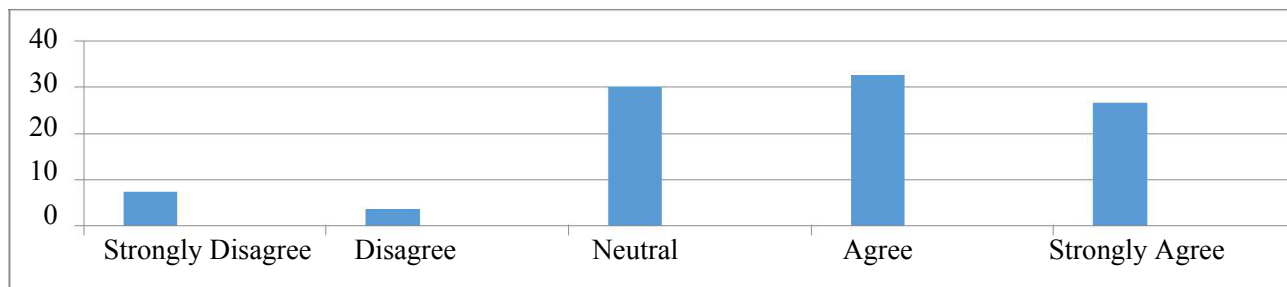
Table 1: Responses from different software houses.



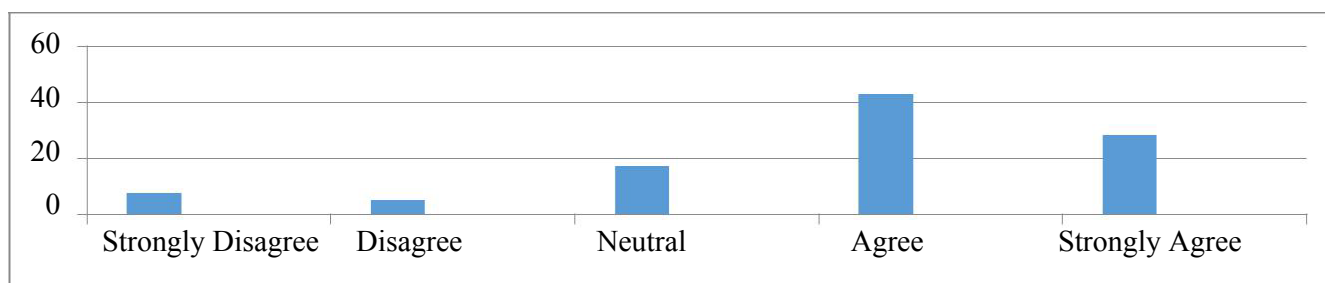
Graph 1: Weak communication affects the overall development process.



Graph 2: Face to face meeting can directly affect communication.



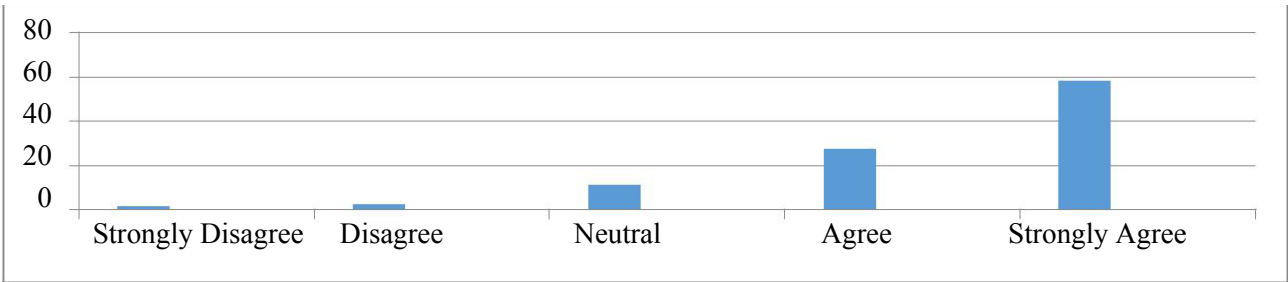
Graph 3: Voice calls can also affect communication and trust.



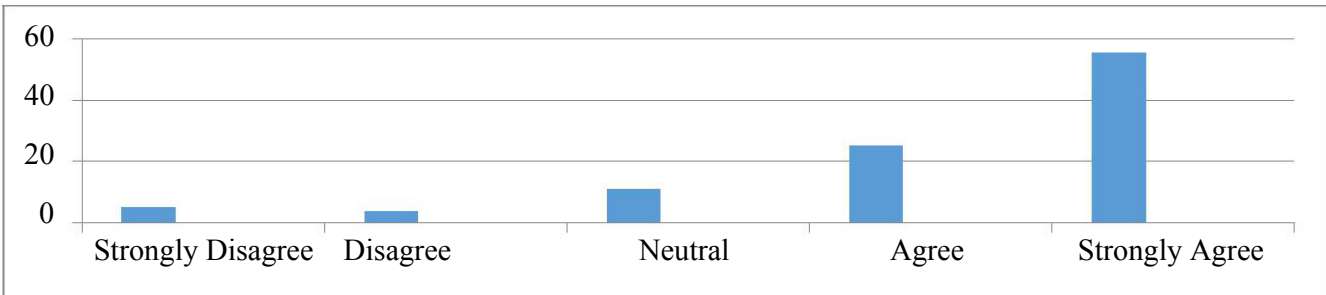
Graph 4: Face to face meetings can also be held by using any kind of social media.

is 0.028 which is less than 0.05, the hypothesis is supported and there is a positive relationship. From the Table 5 the significance value for absence of face-face meetings is 0.019 showing that the hypothesis for this research is supported. Here the factor 'absence of trust' is having a strong significance value of 0.019 hence supporting the hypothesis having value less than 0.05 [27].

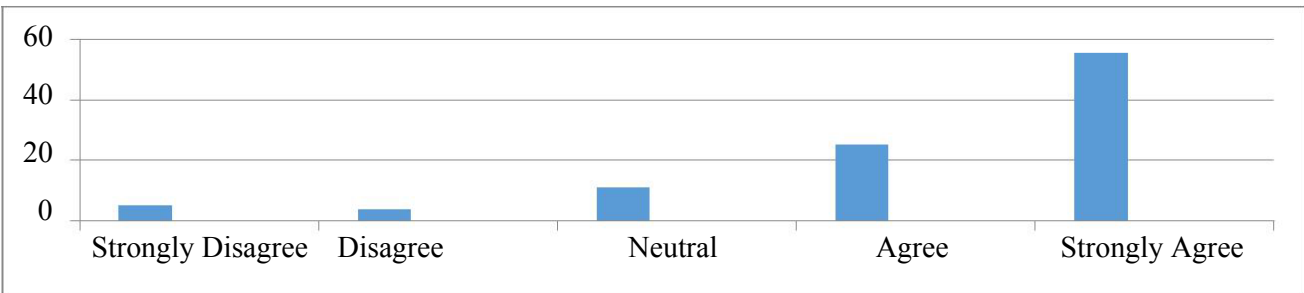
In Table 5 we have results that do not support the hypothesis such as weak business language skills that have beta value of -0.099. It shows a negative influence over communication issues. It is also noted that the value of significance P is 0.142 which is greater than 0.05 implies that there is no correlation between weak business language skills and communication issues that is not supported at all [28,29]. The



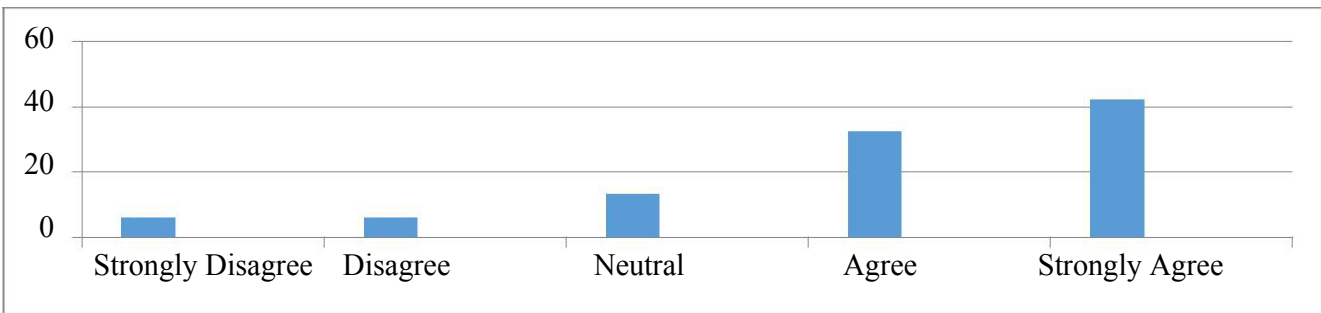
Graph 5: Frequent communication can help to build trust.



Graph 6: Training for technical communications and presentations and business goals can play a vital role.



Graph 7: Mutual understanding about requirements and business goals may have direct impact on project success.



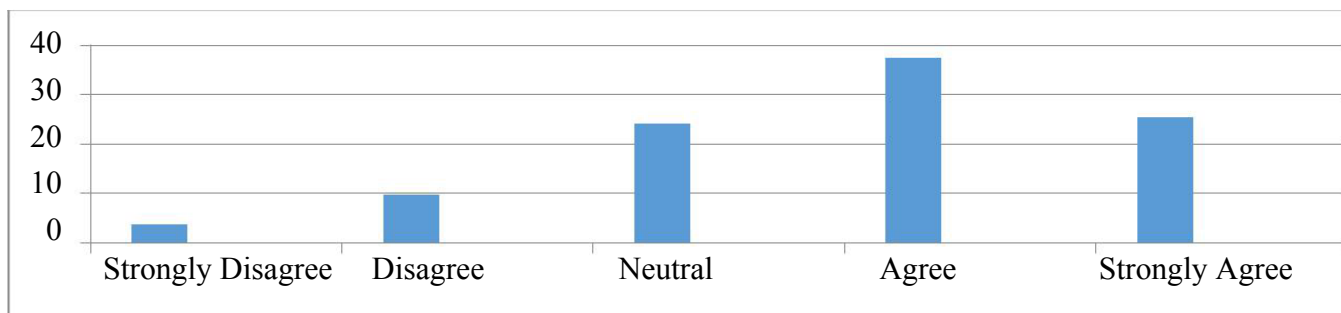
Graph 8: Mutual understanding is difficult when there is a language barrier.

significance value for absence of cultural awareness is 0.017 which is also a supported hypothesis that predicts the strong relationship for absence of cultural awareness with communication issues in GSD. The same is the case with the independent variable with absence of mutual understanding by having significance value equal to 0.05. Here we have another case that rejects the hypothesis for less time overlapping by having significance value 0.531 that is greater than 0.05. Finally, the

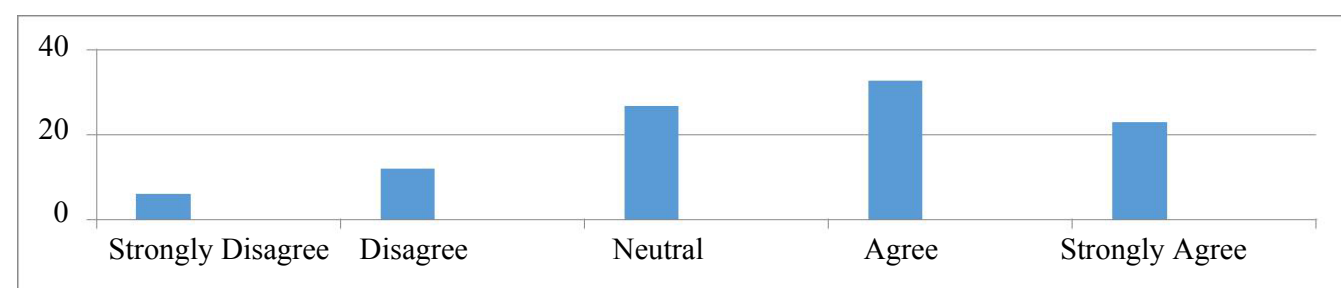
last variable Dependency on asynchronous communication gets 0.008 significance value that helps the hypothesis to be supported for this research [30].

Directions for Future Research

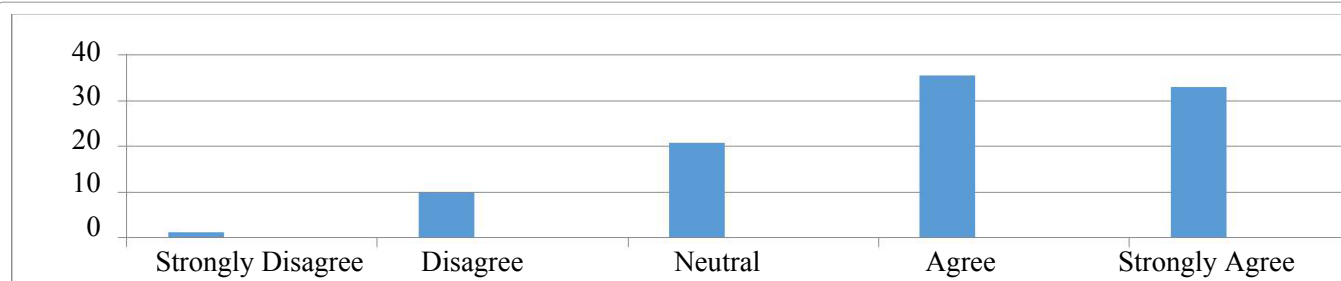
Typical solutions for the research conducted in the area of GSD have mostly focused the issues related to the challenges faced by the



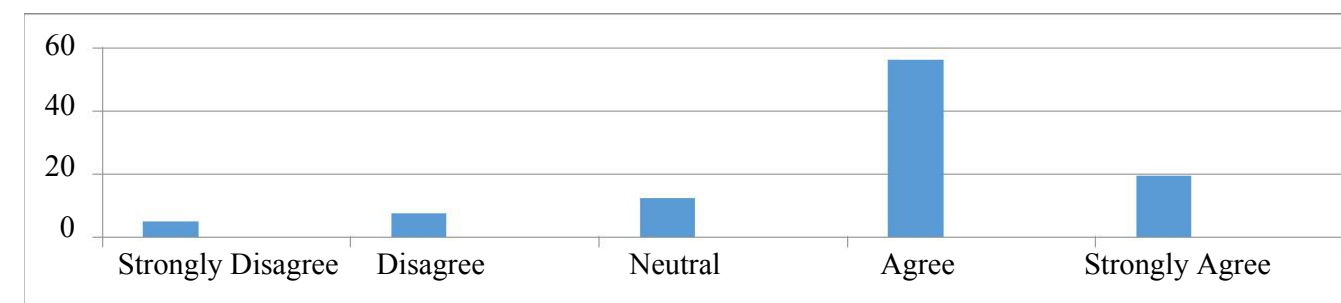
Graph 9: Informal discussions and chats via using social channels can boost the confidence level of weak communicators.



Graph 10: Delay in response occurs due to communication channel which we use to communicate.



Graph 11: If we use multi channels to communicate with other team members then delay in response issue may be resolved.



Graph 12: If team members follow agile methodology technique like daily scrum/stand up meetings then it can help in resolving the communication issues upto some extent.

Cronbach's Alpha	N of Items
0.812	14

Table 2: Reliability statistics.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.633(a)	0.400	0.357	0.924

Table 3: Multilinear regression analysis.

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	87.807	11	7.982	9.344	0.000(a)
Residual	131.566	154	0.854		
Total	219.373	165			

Table 4: ANOVA.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Hypothesis
	B	Std. Error	Beta			
Poor Communication	1.232	-0.044	-0.014	2.442	0.016	Supported
Delay in response	0.177	-0.107	-0.044	-0.389	0.028	Supported
Absence of face- face meetings	0.155	0.085	-0.107	-1.086	0.019	Supported
Absence of trust	0.086	0.136	0.085	1.020	0.049	Supported
Weak business language skills	-0.099	-0.014	0.136	1.474	0.142	Not Supported
Absence of cultural awareness	-0.019	0.297	0.297	2.407	0.017	Supported
Absence of mutual understanding	0.245	0.171	0.171	1.936	0.055	Supported
Less time overlapping	0.245	0.171	0.171	1.936	0.055	Supported
Dependency on asynchronous communication	0.280	0.265	0.265	2.679	0.008	Supported

Table 5: Coefficients (a) dependent variable: overall communication in GSD.

software developers at vendor organizations. However the stakeholder side have been overlooked. Keeping in view this fact, there is a need to conduct a survey to collect data from clients having information about the different problems faced while working on GSD projects. A new framework that duly provides the solution set to account for the issues faced by GSD clients is needed [31].

Conclusion

In this research study communication challenges in GSD with factors which effects the RCM process has been assessed. These are Poor communication, delay in response, absence of trust, absence of cultural awareness, absence of face-face meetings, weak business language skills, absence of mutual understanding, less time overlapping and dependency on asynchronous communication. This paper proposed a framework with 9 hypothesis which examined the effect of various factors. Out of these 9 hypothesis 7 are supported and 2 are not supported. It means that weak language skills and less time overlapping did not make any issue in communication while others 7 issues impacted the communication in one way or the other.

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