Measure the impact of Social Media Applications on Global Virtual Teams

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Dedication

We dedicate this thesis to our parents for being great pillars of support and to our supervisor Matt Glowatz for his unconditional encouragement. We would also like to dedicate our work to all those people who make this world a better place through their work.

Table of Contents

List of Figures

List of Tables

Acknowledgements

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Abstract

Organizations continue to invest heavily on Virtual Teams in hopes of negating time & space barriers by bringing their employees, talent and expertise together on an online platform to solve complex business problems. Inspite of its obvious advantages, Virtual Teams have failed to replace conventional teams as it continues to be hampered by critical inadequacies such as lack of trust, lack of face to face synergies etc. Meanwhile, the reach of Social Media continues to grow on an unprecedented scale and influences everyday decision making despite it being virtual. This study makes an attempt to observe if the flaws of Virtual Teams can be surmounted by integrating with Social Media.

This study offers comprehensive insights on social media and virtual team amalgamations by gauging the current stance of people. Analysis revealed that there is a definite positive impact with 83% of the respondents affirming that Social Media could be the way forward in overcoming issues ailing Virtual Teams. Further investigations revealed correlation between social media usage and the extent of impact social media had. Greater social media presence resulted in higher satisfaction level. This increase however, was not statistically significant as compared to the overall sentiment of the population.

Keywords: Virtual Teams, Social Media, Lack of trust, Lack of face of face synergy, Lack of Social Interaction, Lack of Trust.

Chapter 1 - Executive Summary

1.1 Business Problem

This thesis conducts a comprehensive study that measures the impact of Social Media Applications on Global Virtual Teams. Despite there being a growing need for Virtual Collaborations across the globe, big and small organizations alike find it quite complex to work around its complications and achieve its objectives. Lack of trust, Lack of face to face synergies being a few examples. It's interesting to note that these complications exist with Social Media as well but surprisingly, people seem to be more at ease there than they are while working on Virtual Teams. Through this study, an attempt to identify these challenges and the extent to which they inconvenience was made. It also goes a step ahead in determining if social media has had an impact in overcoming these challenges and gauge if integration of virtual teams and social media could be the way forward. Should the study reveal positive results, this could benefit businesses in the long run.

1.2 Results and Interpretations

Initial exploration

In this phase, an understanding of the respondent's opinions on the different aspects related to the above business problem was accorded. The findings revealed that challenges such as lack of trust, lack of physical interaction, lack of social interaction and lack of face to face synergy cause greater inconvenience and social media had a positive impact in overcoming these glitches. Respondents expressed a positive sentiment with regards to Social Media being the key to address the shortcomings of Virtual Teams.

Classification

Classification models were built to generalize positive sentiment. These models were determined to be unreliable due to high misclassification errors.

Cross Tabulations

Results revealed that, users who use internet and social media on a regular basis are the ones who experienced a positive impact of social media in overcoming challenges such as lack of physical interaction, lack of social interaction, etc.

Trend Analysis

The indications that internet and social media usage could influence the impact of social media in overcoming the ailing's of virtual teams were found to untrue as most models had a very low p-value except in the case of overcoming face to face synergy issue.

Clustering

Group with higher social media presence (Higher frequency of social media usage and more number of social media applications active in and used) experienced a greater positive sentiment than the overall population. This increase in sentiment was not statistically significant than the overall populations sentiment.

From the above findings, it was evident that Social media definitely has a positive impact. Extent of social media presence has a role in it. Popular opinion is in favour of integration of social media and virtual team. There is however, an inkling of sceptism on this subject among people who found social media helpful and felt a positive impact.

Chapter 2 - Introduction

2.1 Opening Remarks

Virtual teams as a concept is widely sought after by every major organizations. Its benefits include less office space, lowered travel costs, easy availability of talents etc., amongst others. In the last decade alone, communication and technology has developed extraordinarily making the concept of working in distributed teams the new reality because of its efficient accessibility. However, they do have some grim setbacks, such as lack of trust and lack of face to face synergies (to name a few), that makes the execution and implementation of such teams quite complex.

Social Media, on the other hand, has undoubtedly affected every dimension of our lives today, despite it being virtual. It unites people behind different causes and fosters change. Social Networking sites have changed the cost and pace of traditional communication. Today, everyone is connected like never before in history. More importantly, it serves as the principal source of influence for important decision making that affects every facet of life.

Both Social Media and Virtual Teams exist on a virtual realm and yet people are more comfortable using one over the other. This study makes an attempt at discovering if Social Media could help overcome the glitches and bring about an effective re-structuring of Virtual Teams.

2.2 Aim

To measure the impact of Social Media applications on Global Virtual teams and gauge people's opinion on if Social Media and its related applications is going to be the way forward.

2.3 Practicum Outline

This study was initiated by sending out questionnaire to get acquainted with what people are thinking about the topic at hand. Chapter 3 provides an in depth research on the motivation of this thesis. Virtual Teams, Social Media and speculations about how the latter could help the former in conception are discussed at length in this chapter. Chapter 4 sheds light on the processes involved in designing the survey. This includes the kinds of questions to be asked, the number of questions to be asked etc.

and acknowledges the different biases and errors that could possibly put the analysis at jeopardy. This section also highlights the series of steps adopted in modifying the data to a form suitable for analysis. This includes weighting each record, identifying the missing value pattern and steps taken to impute them.

Chapter 5 offers a comprehensive account of the initial exploration phase, this involved ascertaining the following:

- How frequently do our respondents use Social Media? This would be an interesting place to start as it could give information on how social media savvy our poll takers are and perhaps if that could influence their judgment?
- The various challenges of virtual teams are drilled down based on age, gender and designation. This could help in understanding the mindset of the people
- How helpful social media was in overcoming the above challenges. This gives an hint on how effective social media has been and what sort of impact it could have in future
- The respondents were asked for their opinion on if social media helped in bridging the shortcomings of virtual collaborations

Responses to the above queries laid foundation for further investigations, where the findings from this conjecture were scrutinized to identify hidden patterns. This is documented in detail in Chapter 6. Analytical concepts such as Classification, cross tabulation, trend Analysis and clustering were used in excruciating detail to uncover any behavioural outlines. All the findings from this analysis are collated and reasoned with in the discussion section. Chapter 7 then concludes with an elaborate summary of the findings from the research. It also makes a quick note on the contributions to academic literature, limitations of the study conducted and possible future work.

2.4 Contributions

Researches on Social Media and Virtual Teams are very sparse. This project hopes at contributing significant insights from both, an academic and business point of view that could be used to explore the untapped potential of Social Media for effective virtual communication in the future.

Chapter 3 - Literature Review

3.1 Virtual Teams

In today's competitive world, virtual teams illustrate a growing response to multifaceted organizational problems. (Ale Ebrahim, Ahmed and Taha, 2009) Virtual teams allow businesses to overcome time and space barriers and procure their best employees and pool their talents and expertise to accomplish directorial tasks. Virtual teams are defined as a group of people who work on symbiotic tasks driven by a common goal negating time and geographical barriers with the help of communication technologies.

The characteristics of a virtual team are as follows:

- The teams should be dispersed over different time zones
- They are motivated by a common goal or purpose
- Sharing of ideas and talents are collaborated through communication technologies
- Team members are knowledge workers and are involved in cross-boundary cooperation

3.1.1 Virtual Teams Structure

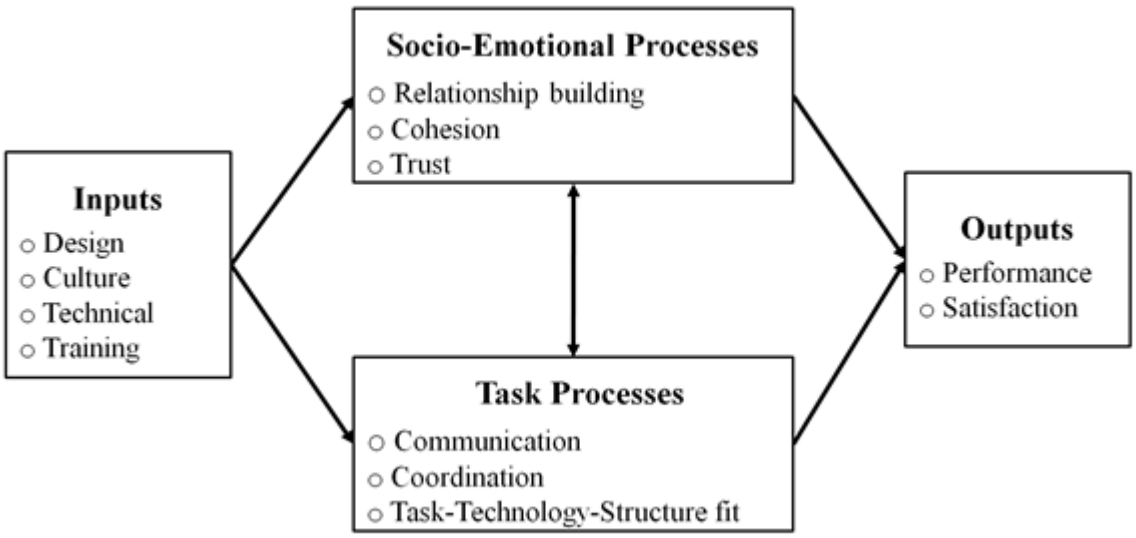

Figure 1 Structural Components of Virtual Teams (Wikipedia, 2015)

Virtual teams (Powell, Piccoli and Ives, 2004) have four main areas of focus (see Figure 1):

Inputs

- *Design*: It implies that the virtual teams should be formed after careful planning. Planning deals with the kind of communication tools to be used and the amount of overlapping face to face time that will be possible. Well-designed virtual team has a greater chance of accomplishing the task at hand than an ill planned one
- *Cultural differences*: It could cause issues with coordination and hinder communication. It is important to actively understand these differences and accept them
- *Technical Expertise*: It is critical to the success of virtual teams and has a positive bearing on the team's performance and gratification of belonging to the team
- *Training*: It is important that teams undergo consistent training as diverse technological skills could result in conflicts

Socio Economic process

This section presents the emotional problems associated with virtual teams and tactics required to achieve unity and trust among members of the team.

- *Relationship building*: Geographical distribution of virtual teams results in weaker social relationships and leads the members to become more job focused. This allows for trust issues to creep in and affects the quality of work done by the team
- *Cohesion*: This implies unity within the team and is an important parameter. It has a direct impact on the performance of the team
- *Trust*: This is the Achilles heel of virtual teams and can be argued that since people in virtual teams have never met face to face, how can they trust each other? Strong trust, like cohesion, has a direct impact of the team

Task Processes

These are tasks and actions carried out by the members of virtual teams in order to meet their deliverables:

- *Communication*: It is essential that team members have excellent communication within the team. This will ensure that roles and tasks are clearly laid out for each member

- *Coordination*: This represents the amount of combined effort existing between different members of virtual teams. It is positively associated with the virtual team performance
- *Task-technology-structure*: This scrutinizes the various technologies available for virtual team communication. A good fit will result in less documentation, easy adaptation and quick completion of task

Outputs

This represents all the things that can come out of the work practices of the virtual team:

- *Performance*: It is a measure of success. Parameters such as training, goal setting, team building, communication, team cohesiveness, commitment and coordination of teams determine the performance of virtual teams
- *Satisfaction*: This rates the experience of virtual teams and the work accomplished by it

3.1.2 Virtual Teams Advantages

Benefits of working in a virtual team are documented as follows (Staff.com, 2013):

- Office costs are lowered
- Efficient utilization of resources. By eliminating space barriers, we have greater availability of talent. This makes meeting project deliverables easier
- Employee satisfaction. By giving them the opportunity to work from home, they remain loyal and committed to the cause
- Lowered employee expenses by cutting down on travel, accommodation and relocation costs
- Transitioning between business environments is made much simpler
- Increases employee productivity. By giving them opportunity to work from home, they are more relaxed and this satisfaction increases employee efficiency to a great extent
- Gain access to multiple markets and talent by eliminating the need to open multiple markets. Experts from highly specialized fields are united electronically from great distances to work together
- R&D continuation decisions are made more well-organized

- Increases client satisfaction

3.1.3 Virtual Teams Disadvantages

While the advantages are plenty, virtual teams as a concept has some serious shortcomings. (Ale Ebrahim, Ahmed and Taha, 2009) They are explained as follows:

- Lack of face to face synergy. Some problems are better tackled in person to develop an elemental understanding of the problem
- Monitoring of activities and project management decreases
- Lack of trust leads to communication gaps and conflicts among team members
- Language barriers and cultural differences creates challenges in the work environment
- Conflict management becomes a messy affair
- Different work practices and methodologies creates chaos and confusion amongst workers

3.2 Social Media

Social media has taken the current generation by a storm. Social Networking as a tool is primarily used by people across the globe to promote and aid communication. (Society, 2015) Social Media has affected every facet of our lives including communication, self- expression and possibly our own sense of humanity to a large extent. These networks do not just limit communication between friends but also provides a podium to meet new people with common similarities and interests. While the concept seems simple, the ideology behind such a conception is a game changer. It has not just revolutionized the business setting but has also revamped the way we live our lives. Social media differs from traditional media in that social media is a dialogic transmission system and traditional media is a monologic transmission model. Social media also differs from traditional media by ways of quality, reach, immediacy and permanence. Blogging, forums, social networking, wikis, social curation and social book marking are some of the different types of social media.

3.2.1 Definition

In novice terms, social media is a collection of online communication channels built on technological and ideological foundations of web 2.0 dedicated to community-based input, collaboration, interaction and sharing. However, the broadly accepted

definition is *"Social media refer to 'the many relatively inexpensive and widely accessible electronic tools that enable anyone to publish and access information, collaborate on a common effort, or build relationships'* (Wikipedia, 2015).

3.2.2 Social Media Ecology

The social media revolution began as early as 1997 with the creation of Sixdegrees. At the time it allowed people to create profiles, connect with friends and also add friends of a friend to their own list. Today, there exists a rich and diverse ecology of social media applications with far more functionality, affluence and intelligence. Some applications serve general masses, like Friendster, Hi5 and Facebook. Others focus on professional network, like LinkedIn. Applications like YouTube, Myspace and Instagram concentrate on providing a medium for sharing videos and photos. Blogs serve as the single largest pool for public opinions and Microblogging applications like Twitter offer real time updates about what users are doing, how they are feeling, where they are, etc. (Kietzmann et al, 2011).

Some of the social media applications considered in this study are mentioned below:

Facebook

This is an online social networking platform where people create, share and respond to information. The reach of Facebook on a global platform is unprecedented. The traffic to Facebook is increasing exponentially on a daily basis. As of today, Facebook has 1.49 billion active monthly users making it world’s top social networking site by a huge margin (Statista, 2015).

YouTube

YouTube is the world's most popular online video community where millions of people watch and share user-created videos. It provides an incredible podium for people to share and inspire millions of others across the globe. As of today, YouTube has surpassed 1 billion active users and 300 hours of video get uploaded every minute. (Youtube.com, 2015)

Twitter

Twitter, called the "SMS of the internet", allows users to send and receive messages called "tweets" that are 140 characters long. As of today, this micro blogging service has about 304 million active users per month and has stirred up the society by acting as a powerful medium to express public opinions on matters of the government, public interests, society etc. (Statista, 2015)

LinkedIn

LinkedIn is an online network of influential and authoritative people from all over the world, and not just a social network for corporate users. It works around the conventional real life obstacle by bringing business people of every level together in an innovative way so that individuals seeking to meet or obtain contacts of professionals can be made easier. (Relevance Web Marketing Blog, 2011) As of today, LinkedIn has about 380 million users with 3 million active job listings and about 94% of recruiters use LinkedIn to hire qualified candidates. (Smith, 2015) (Smith, 2014)

Skype

Skype, (Smith, 2014) which now belongs to Microsoft corp., is a simple telecommunication software tool that makes text, video and voice communication possible for people who seeking to connect with their loved ones. It also facilitates sharing of files, images, conference calls and video messages. As of today, Skype has about 300 million users with 14 trillion minutes being spent on voice and video calls on an average day. (Wikipedia, 2015)

3.2.3 Social Media Functional blocks

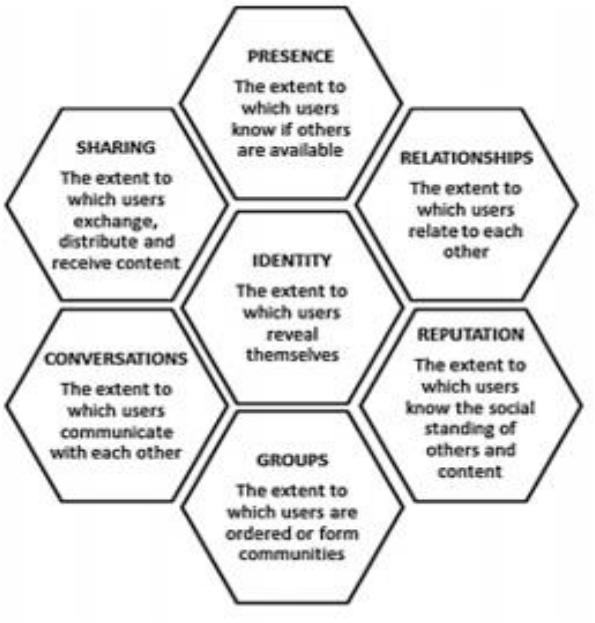

Figure 2 Functional Block of Social Media (Kietzmann et al., 2011)

As shown in Figure 2, social media has seven functional blocks: identity, conversations, presence, sharing, reputations, groups, and relationships. These blocks are not conjointly exclusive and does not have to be present in all the social media. Through these blocks one can unpack, examine and make sense of different facet of social media experience. (Kietzmann et al., 2011)

Identity

This functional block characterises the magnitude to which users disclose their identities in a virtual social environment. Identity includes information such as name, age, gender, location, profession and information that exposes users in a certain light. Presentation of user's information could happen through conscious or unconscious 'self-disclosure 'of personal information such as thoughts, likes, dislikes and feelings (Kietzmann et al., 2011).

Conversations

This block represents the degree to which users in a social media locale communicate with other users. Most social media sites are deigned to primarily ease conversations among individuals or groups. The conversation could happen for any reason such as to meet like-minded people, be on the cutting edge of new ideas, build self-esteem or discuss environmental issues, humanitarian causes, economic issues and political debates (Kietzmann et al., 2011).

Sharing

This represents the level to which the users distribute, exchange and receive content. Sharing, in social media is a way of interacting which could lead to conversations or build relationships (Kietzmann et al., 2011).

Presence

This represents the degree to which users can identify if other users are accessible. This is inclusive of where the other users are, in the real or virtual world, and if they are available. Given upsurge in the connectivity of people on the move, presence is critical in bridging virtual and real. Higher levels of social presence is likely to make conversations more stimulating (Kietzmann et al., 2011).

Relationships

This block represents the magnitude to which users can be associated to other users. Association implies that users have some form of relationship that paves them to converse, meet up or share objects and list the other person as a friend. Research shows that, the larger a user's assortment of relationships is, the more influential he or she is as a member .Flow of resources between the relations determines the strength of relationship. Strong relationships are enduring and affect-laden (Kietzmann et al., 2011).

Reputations

This represents the extent to which users identify themselves in a social media setting with respect to others. Reputation for all intents and purposes is a matter of trust. Social media sites use user generated information to automatically determine trustworthiness (Kietzmann et al., 2011).

Groups

This represents the magnitude to which a user can form communities. The kind of groups the user supports and the level of engagement could provide a means to gauge his/her adaptability to virtual settings.

3.2.4 Social Media Impact

Social media tops the chart for many business executives these days. Abundance of information is an inexorable reality for most professionals. Making timely and informed decisions has never been more complex than it is today. It is no surprise that decision makers, especially from the Information Technology domain are heavy users of Social Networks. According to a LinkedIn research, around 73% have engaged with IT vendors on a social network thereby re-affirming the fact that that social media is indeed a critical source of influence across the entire decision making process and not just in the initial research phase. The research also states that while considering making business purchases, around 59% of respondents are influenced by at least one social platform. Social media influences nearly 50% of each of the five facets of decision making - awareness, scope, plan, select & implement. (Weir, 2015) Professional networks are currently more authoritative than other networks (like blogs and personalized websites). With this alteration, social media has proven to be a more efficient and productive resource.

3.3 Social *Media and Virtual Teams*

Virtual teams have several advantages over conventional teams. Having well established virtual teams can significantly increase the throughput of organizations while reducing costs. This is an ideal combination and organizations are heavily investing in such teams. Virtual teams, however have critical shortcomings. These shortcomings have prevented them from completely replacing conventional teams. Social media on other hand, despite being virtual is flourishing.

The impact social media has on every facet of life is making people sit up and notice. The statistics seen earlier show how almost everyone seeks out social media for opinions on important decision making matters. Careful examination of functional blocks of social media and structural component-socio-emotional processes of virtual teams, it is clear that social media builds trust, cohesiveness and bridges virtual and

real which are the requisites of socio-emotional process of virtual teams. Thus, Social media definitely has the potential to help virtual meetings surmount the issues ailing it. In this study, the possibility of virtual teams finding its salvation by incorporating itself with Social media is explored.

Chapter 4 - Research Methodology

4.1 Hardware and Software Specifications

4.1.1 Workstation

Two workstations were used to carry out the analysis of this study. The hardware specifications are quoted below (see Table 1):

Specification	Workstation 1 - HP Notebook	Workstation 2 - Dell Notebook
Operating System	Windows 10	Windows 8.1
Processor	Intel® Pentium® CPU N3530 @ 2.16 GHz	Intel® Core™ i7-4510U CPU @ 2.00 GHz
RAM	4.00 GB	8.00 GB
System Type	64 - bit operating system	64 - bit operating system

Table 1 Hardware Specifications

4.1.2 Software Specifications

The following software were used to carry out this study:

Qualtrics

Qualtrics provides a convenient and a user friendly platform for students, lecturers and market researchers alike to gain valuable insights. Once the survey is designed, it is then uploaded to Qualtrics which immediately generates a link to take the opinion poll. The link is compatible across all platforms- laptops, desktops, tablets and mobile phones. It also provides excellent features such as cross - tabulations for post analysis.

IBM, 64 bit, SPSS Statistic Software 23

IBM's SPSS is one of the world's leading software to solve business problems through predictive analytics and hypothesis testing. It was used for Imputations, missing pattern analysis and reliability testing.

Tableau version 9.0

Tableau is primarily a business intelligence software that facilitates easy access to data and data visualization. It provides an excellent platform to create interactive dashboards. Tableau was extensively used in this project for data explorations and to further gain valuable insights.

Microsoft Excel 32 bit

Excel is the fundamental software used by most tools for exporting data and converting it into a standard format that is easy to analyse. It was then extensively utilized for data coding and building data dictionaries.

4.2 Pre Collection

4.2.1 Sampling

Staying in line with the purpose of this practicum that primarily targets at finding how influential social media is in overcoming the barriers associated with virtual meetings, it was decided that a survey relevant to the objective should be sent out to the following target population:

- Lecturers
- Students (Full Time and Part Time)
- Corporate Employees

The above sampling frame forms the majority of users that use virtual meetings as part of their daily routine across numerous horizontals and verticals. We believe that it is pertinent to the survey to have representations from various age groups as each of these demographics offer an assortment of opinions which could be crucial in deriving our final conclusion. The obvious generation gap could reflect how susceptible people are to rapid changes in technology. The final survey was sent out to ex- colleagues, friends and friend of a friend on various social networks, systematically selected to ensure equal or specific representation of age, gender and occupation dynamics.

4.2.2 Potential Biases and Errors

Before proceeding with the designing, it is essential to be acutely aware of the possible biases that could creep in while drafting a survey. Some of which are discussed below:

Researcher's Bias

As the name suggests, every researcher deciding to work on a project has their own opinions and viewpoints which crawls into the designing of questions and later with the analysis. They are human and even the most senior and practiced researchers could have subtle biases in the way the results are interpreted. While one can argue that such subtle biases are indeed essential, it could affect the purity of the study.

Sample population may not match the actual population

This is possibly one of the major sources of error while conducting an opinion poll. It is inevitably present in most of the studies because the sample population is almost never a perfect match for the actual population. The target audience is just as important as the sanity of the questions that finally provide insights on the goals of the project.

Lack of Random samples

Having a random sample is very crucial for the study to be statistically relevant and the odds are that, in most case, it lacks one. These errors are usually ignored because it becomes too expensive to correct them later.

Failure to weight data

The researcher in most cases has a general idea of his/her target audience are and how willing they are to take the survey. For example, a female is more likely to patiently take the poll than a male. Having such kind of knowledge makes it very important to weight the data to compensate for lack of balance in the sampled quota. This is possibly one of the most important steps in analysing survey data.

Over thinking

Sometimes, a statistician is more focused about correcting every possible bias that it compromises on the other areas of the survey. While being aware of potential biases before designing a poll is critical, it is just as important to not overdo it.

4.2.3 Initial Questionnaire design

Before designing the survey, a brain storming session was held to review the goals of the project. The questions that then went into the survey were broadly divided into the following focus points:

- A list of frequently used social media applications in facilitating virtual meetings

- How frequently does the survey taker use Social Media applications on a day to day basis?
- Challenges faced while working in virtual teams
- How Social Media helped in overcoming those challenges
- Finally, whether or not Social Media is the way forward for effective virtual team communications, given how it has managed to conquer every facet of our lives

Once the key points are noted, the opinion poll was designed keeping the above biases in mind. The number of questions were kept to as limited as possible so as to not take up too much of the responders time but also to strike a balance to cover most of the important focus points. It was decided that the majority of questions should be close-ended. This way, the respondents are forced to choose among a set of answers. This makes the data easier to analyse. Moreover, given how busy people are, closed questions are comparatively simpler for the respondents to take the survey.

A couple of open-ended questions were included as well. This was done to get opinions from the survey takers, possibly lengthy answers to know what the broader population thinks from this sample. Once the initial draft is ready, the next step was to proceed to the pre-testing phase.

4.2.4 Pre Testing and Final Questionnaire

Pre testing of survey is done to ensure that the questions are clear and the response choices are appropriate. A review session with supervisor was held to test the sanity of questions. The survey is interpreted from the standpoint of the responder to check if it makes sense or whether it was too complicated to progress until the very end. The consistency, coherence and the time to complete the survey is verified and corrected if necessary. A quick spell check and grammar check was conducted as well. The questionnaire is then edited to accommodate the above changes.

The final draft of 11 questions was then uploaded to Qualtrics (refer appendix for final questionnaire), an online survey hosting website. The survey link was then sent to the target audience mentioned in section 4.2.1.

4.3 Data Dictionary and Coding

4.3.1 Data Dictionary

The original crude data was modified to a form more suitable for analysis. A comprehensive description for the modified version was built. This description maps each modified variable to its corresponding original crude data variable in its question and answer form. Table 2 illustrates further details

Original Field	Modified Field	Data type	Description
Which age group do you belong to?	Age	Text	Respondent's age.
Kindly specify your gender?	Gender	Text	Respondent's gender.
Which of the following describes your current position?	Current_Position	Text	Respondent's occupation
What Social media application have you used for effective virtual / communication? Internet-Select whichever applicable	Usage_Internet	Text	Indicates whether the respondent has used internet or not for the purpose of virtual communication
What Social media application have you used for effective virtual / communication? Google+youtube+Google Plus-Select whichever applicable	Usage_GoogleApplications	Text	Indicates whether the respondent has used Google applications(combined field: google + YouTube + google plus) or not for the purpose of virtual communication
What Social media application have you used for effective virtual / communication? Facebook -Select whichever applicable	Usage_Facebook	Text	Indicates whether the respondent has used Facebook or not for the purpose of virtual communication
What Social media application have you used for effective virtual / communication?	Usage_Twitter	Text	Indicates whether the respondent has used Twitter or not for the purpose of virtual communication

Twitter -Select whichever applicable			
What Social media application have you used for effective virtual / communication? LinkedIn -Select whichever applicable	Usage_LinkedIn	Text	Indicates whether the respondent has used LinkedIn or not for the purpose of virtual communication
What Social media application have you used for effective virtual / communication? Video Conferencing -Select whichever applicable	Usage_Video Conferencing	Text	Indicates whether the respondent has used Video Conferencing or not for the purpose of virtual communication
What Social media application have you used for effective virtual / communication? Other -Select whichever applicable	Usage_Other	Text	Indicates whether the respondent has used additional application or not for the purpose of virtual communication
What Social media application have you used for effective virtual / communication? Other -Select whichever applicable	Usage_Other2	Text	Indicates whether the respondent has used an additional application or not for the purpose of virtual communication
How frequently do you use Social Media?-Internet	Frequency_Internet	Text	Indicates respondents frequency of usage of internet
How frequently do you use Social Media?-GoogleApplications	Frequency_ GoogleApplications	Text	Indicates respondents frequency of usage of GoogleApplications
How frequently do you use Social Media?-Facebook	Frequency_ Facebook	Text	Indicates respondent's frequency of usage of Facebook.
How frequently do you use Social Media?-Twitter	Frequency_ Twitter	Text	Indicates respondent's frequency of usage of Twitter.
How frequently do you use Social Media?-Internet	Frequency_ LinkedIn	Text	Indicates respondents

			frequency of usage of LinkedIn
How frequently do you use Social Media?- Video Conferencing	Frequency_ Video Conferencing	Text	Indicates respondents frequency of usage of Video Conferencing
Categorize the challenges you face while working with virtual / teams. Select whichever appropriate.- Collaborating solutions/interacting with your colleagues from around the globe	Challenge_Collaboration	Text	Indicates the sentiment of respondent with respect to the following challenge
Categorize the challenges you face while working with virtual / teams. Select whichever appropriate.-Help in getting in touch with each other especially when there is a geographical barrier	Challenge_Communicating	Text	Indicates the sentiment of respondent with respect to the following challenge
Categorize the challenges you face while working with virtual / teams. Select whichever appropriate.- Overcoming cultural/Language barriers	Challenge_Overcoming culture	Text	Indicates the sentiment of respondent with respect to the following challenge
Categorize the challenges you face while working with virtual / teams. Select whichever appropriate.-Lack of physical interaction	Challenge_ Physical Interaction	Text	Indicates the sentiment of respondent with respect to the following challenge
Categorize the challenges you face while working with virtual / teams. Select	Challenge_SocialInteraction	Text	Indicates the sentiment of respondent with

whichever appropriate.-Lack of social interaction			respect to the following challenge
Categorize the challenges you face while working with virtual / teams. Select whichever appropriate.-Lack of trust	Challenge_LackofTrust	Text	Indicates the sentiment of respondent with respect to the following challenge
Categorize the challenges you face while working with virtual / teams. Select whichever appropriate.-Lack of face to face synergy	Challenge_LackOfSynergy	Text	Indicates the sentiment of respondent with respect to the following challenge
How did Social Media help in overcoming the following challenges? Select the appropriate choice.-Lack of Physical Interaction	Social Media_Lack of physical interaction	Text	Indicates the sentiment of how helpful social media has been in tackling the following challenge
How did Social Media help in overcoming the following challenges? Select the appropriate choice.-Lack of face to face synergies	Social Media_Lack of face to face synergies	Text	Indicates the sentiment of how helpful social media has been in tackling the following challenge
How did Social Media help in overcoming the following challenges? Select the appropriate choice.-Lack of Trust	Social Media_Lack of Trust	Text	Indicates the sentiment of how helpful social media has been in tackling the following challenge
How did Social Media help in overcoming the following challenges? Select the appropriate choice.-Lack of Social Interaction	Social Media_Lack of Social Interaction	Text	Indicates the sentiment of how helpful social media has been in tackling the following challenge
Do you think Social Media is the way forward for effective	Verdict	Text	Indicates response whether social media

virtual / team communication	is the way forward or not

Table 2 Data Dictionary

4.3.2 Data Coding

The questionnaire involved both Likert and Check all that apply questions. Both these questions were coded for qualitative data analysis. Table 3 illustrates the details of coding

What Social media application have you used for effective virtual / communication?	Text	Numeric
	Yes	1
	No	0
How frequently do you use Social Media?	Text	Numeric
	Several Times in an hour	4
	Several times in a day	3
	Few times a Week	2
	Rarely use Social Media	1
	Do not use Social Media	0
Categorize the challenges you face while working with virtual / teams.	Text	Numeric
	Most Significant challenge	3
	Medium Challenge	2
	No Challenge at all	1
How did Social Media help in overcoming the following challenges?	Text	Numeric
	Very helpful	2
	Somewhat helpful	1
	Neutral	0
	Not Helpful	-1
	Did not help at all	-2
Do you think Social Media is the way forward for effective virtual / team communication	Text	Numeric
	Yes	1
	No	0

Table 3 Data Coding

4.4 Post Collection: Survey Response Investigation

4.4.1 Eliminating Meta Data

The initial survey response data downloaded from Qualtrics had a total of 146 records with 56 variables. Of the 56 variables, 42 variables are associated with the questionnaire and the remaining 14 variables were added by Qualtrics. These variables

form Meta data and hold respondent information such as location, email address, response Id, status, and start & completion date of the survey. Initial investigation revealed several records with missing data of varying degree. 14 records were identified with only Meta data, implying respondents did not answer any of the survey questions. These records added no real significance to data and filling or imputing them would amplify the bias, if any, already present in data. Hence, the chosen course of action was to delete them.

4.4.2 Missing Pattern Analysis

132 records with 31 variables were analysed. 70 of these records had atleast one missing value (53.03%) and 62 records had complete data (46.97%). Of the 31 variables, 28 variables had atleast one missing value (90.32%) and only 3 variables had complete data (9.67%). In terms of missing values, 991 values of 4092 were missing (24.22%) as illustrated in the Figure 3.

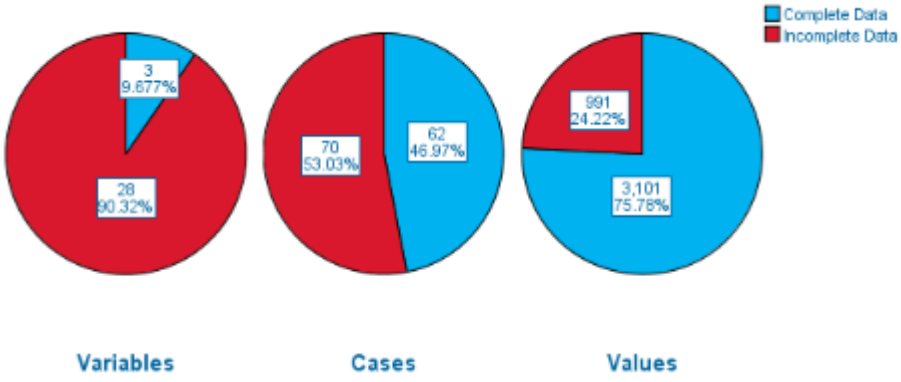

Figure 3 Summary of Missing Values

Further analysis revealed that each record had varying degrees of missing data resulting in distinct missing patterns. The patterns formed are as shown in Figure 4. Variables Age, Gender and N_CurrentPosition had no missing data. The remaining variables had data missing in them with N_Frequency_Twitter having a maximum missing data of 40.9% followed by N_Frequency_LinkedIn and N_Frequency_VideoConferencing with 36.4% and 38.4% respectively, and N_Region had the least missing data of 12.1%. Figure 5 shows characteristics of all the missing data variables. Pattern 31 and 32 were the most frequently occurring missing value patterns.

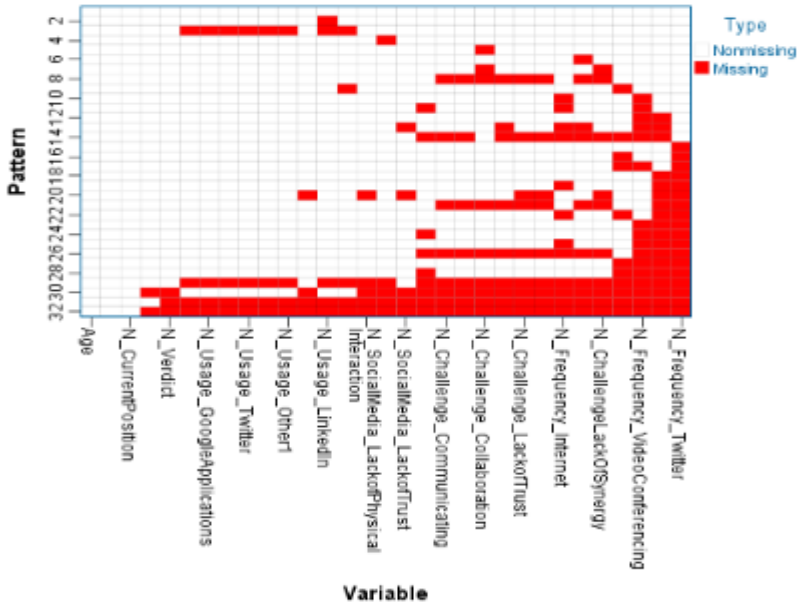

Figure 4 Missing Value Pattern

	Missing		Valid N	Mean	Std. Deviation
	N	Percent			
N_Frequency_Twitter	54	40.9%	78	1.51	1.235
N_Frequency_LinkedIN	48	36.4%	84	1.92	1.153
N_Frequency_VideoConferencing	46	34.8%	86	1.67	.913
N_Frequency_Facebook	41	31.1%	91	2.69	.997
N_ChallengeLackOfSynergy	39	29.5%	93	2.17	.732
N_Challenge_Overcomingculture	39	29.5%	93	2.05	.649
N_Frequency_Internet	39	29.5%	93	3.65	.583
N_ExtraChallenge	38	28.8%	94		
N_Challenge_LackofTrust	38	28.8%	94	1.96	.717
N_Challenge_SocialInteraction	38	28.8%	94	2.00	.718
N_Challenge_Collaboration	38	28.8%	94	1.99	.680
N_Challenge_PhysicalInteraction	37	28.0%	95	2.15	.757
N_Challenge_Communicating	37	28.0%	95	1.97	.706
N_Frequency_GoogleApplications	36	27.3%	96	3.27	.801
N_SocialMedia_LackofTrust	32	24.2%	100	.33	.922
N_SocialMedia_LackofSocialInteraction	32	24.2%	100	.82	1.048
N_SocialMedia_LackofPhysicalInteraction	32	24.2%	100	.63	1.236
N_Usage_Other2	32	24.2%	100		
N_Usage_LinkedIn	32	24.2%	100		
N_SocialMedia_Lackoffacetofacesynergies	31	23.5%	101	.44	1.034
N_Usage_Other1	31	23.5%	101		
N_Usage_VideoConferencingApplications	31	23.5%	101		
N_Usage_Twitter	31	23.5%	101		
N_Usage_Facebook	31	23.5%	101		
N_Usage_GoogleApplications	31	23.5%	101		
N_Usage_Internet	31	23.5%	101		
N_Verdict	30	22.7%	102		
Region	16	12.1%	116		

Figure 5 Variable Summary

4.4.3 MCAR Test

MCAR test is a popular test used to identify the missing value pattern from MCAR (Missing completely at Random), MAR (Missing at Random) and MNAR (Missing not at Random). Significance value obtained from Little's MCAR test was 0.766 .Thus, the missing value pattern was identified as MCAR (Missing completely at Random).

4.4.4 Manual Coding and Multiple Imputation

Manual Coding

Upon deciphering the pattern of missing values, the first course of action was to manually code all the implied answers which turned up as empty fields in the data.

For example question 6, a check all that apply question, unchecked options remained empty and were manually coded as a negative response. Similarly all the other questions whose response was implied were coded manually.

Multiple Imputation

Multiple Imputation technique is a standard statistical technique to replace the missing values in a dataset. After manual coding, multiple imputation using SPSS statistical tool was carried out on the dataset.

The following steps were undertaken as part of multiple imputation:

Setting a seed value

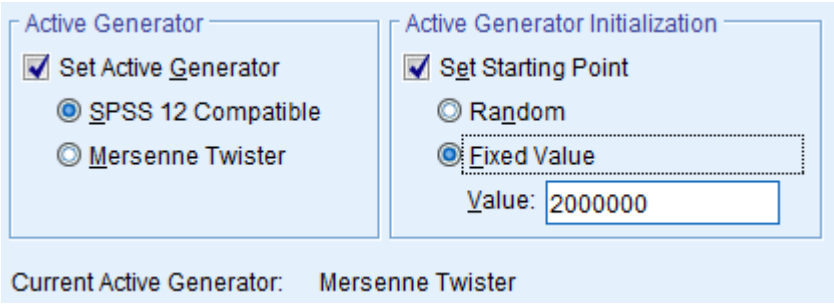

Figure 6 Parameter Settings in SPSS

The parameter settings used for setting a seed value are as shown in Figure 6.

Imputation

As the missing value percentage was high (12% to 30%), the number of imputation was set to 10 and fields such as Age, Current Position and Gender were used as the

predictor variables to impute the missing values. Further imputation constraints are as depicted in Figure 7.

Pooling

The previous step resulted in ten data sets as per design. Each of the datasets were similar to the original dataset. For the purpose of analysis and gaining insights, all the above datasets were pooled into one. The pooled dataset was used for further analysis.

	Role in Imputation		Imputed Values		
	Dependent	Predictor	Minimum	Maximum	Rounding
Region	Yes	No			
Age	No	Yes			
Gender	No	Yes			
N_CurrentPosition	No	Yes			
N_Frequency_Internet	Yes	No	0	4	Integer
N_Frequency_GoogleApplications	Yes	No	0	4	Integer
N_Frequency_Facebook	Yes	No	0	4	Integer
N_Frequency_Twitter	Yes	No	0	4	Integer
N_Frequency_LinkedIN	Yes	No	0	4	Integer
N_Frequency_VideoConferencing	Yes	No	0	4	Integer
N_Challenge_Collaboration	Yes	No	1	3	Integer
N_Challenge_Communicating	Yes	No	1	3	Integer
N_Challenge_Overcomingculture	Yes	No	1	3	Integer
N_Challenge_PhysicalInteraction	Yes	No	1	3	Integer
N_Challenge_SocialInteraction	Yes	No	1	3	Integer
N_Challenge_LackofTrust	Yes	No	1	3	Integer
N_ChallengeLackOfSynergy	Yes	No	1	3	Integer
N_ExtraChallenge	Yes	No			
N_Usage_Internet	Yes	No			
N_Usage_GoogleApplications	Yes	Yes			
N_Usage_Facebook	Yes	Yes			
N_Usage_Twitter	Yes	Yes			
N_Usage_LinkedIn	Yes	Yes			
N_Usage_VideoConferencingApplications	Yes	Yes			
N_Usage_Other1	Yes	Yes			
N_Usage_Other2	Yes	No			
N_SocialMedia_LackofPhysicalInteraction	Yes	No	-2	2	Integer
N_SocialMedia_LackofSocialInteraction	Yes	Yes	-2	2	Integer
N_SocialMedia_LackofTrust	Yes	Yes	-2	2	Integer
N_SocialMedia_Lackoffacetofacesynergies	Yes	Yes	-2	2	Integer
N_Verdict	Yes	No			

Figure 7 Imputation Constraints

4.5 Weighting

Base weight

Each record was assigned a base weight. The base weight was calculated using the current position and designation fields. Table 4 illustrates the base weighting

Current position	Designation	Weight
Full-time Student		0.5
Part-time Student	Lower Management	0.75
Employee	Mid Management	1
Other	Senior Management	1.25

Table 4 Base Weight

Non-response weighting

This was used to align the responses with the desired response rate. The non-response weighting was done for variables such as age, current position and gender. Table 5 illustrates the desired response ratio. Final weight for each variable was calculated as per the following formula:

Weight = Expected Value (Percentage) / Response Value (Percentage).

Category		Expected Response Rate
Age	Less than 21 years	0.1
	Between 21 and 34 years	0.3
	Between 35 and 49 years	0.3
	Between 50 and 64 years	0.3
Gender	Female	0.33
	Male	0.33
	Do not wish to specify	0.33
Position	Full-time Student	0.25
	Part-time Student	0.25
	Employee	0.25
	Other	0.25

Table 5 Non-Response Weighting

Stratified weighting

This was used to extrapolate survey response to reflect the general population. This weight was accorded as per two variables, age and gender. The world data was taken from International Database – Census by United States Census Bureau (Census.gov, 2015). For the age group of less than 21years, population from 15 years onwards was

considered. The general population percentage values for each variable category considered is as illustrated in Table 6.

Category		Population percentage
Age	Less than 21 years	0.0818591
	Between 21 and 34 years	0.23914855
	Between 35 and 49 years	0.19840069
	Between 50 and 64 years	0.14078521
Gender	Female	0.49662802
	Male	0.50337198

Table 6 Stratified Weighting

Final weighting

Final weight was calculated using the following formula:

Final weight = Base weight * Non response weight * Stratified response.

This value was used for the purpose of analysis and to assess overall sentiment to different questions.

Chapter 5 - Results

5.1 Data Analysis

Critical to our study was to gauge each respondent's sentiment and opinion on different queries of the survey and be able to trace each respondent's point of view all the way up to final query. Since the questionnaire was not conditional, the approach adopted was to analyse the data in a sequential manner and break down each query by independent variables such as Age, Gender and Occupation to ascertain the opinions and variance in them across different demographics.

5.1.1 Respondents

Age groups, gender and occupation were used as the variables to identify the respondents. Figure 8, Figure 9 and Figure 10 illustrates the respondents details based on each identifier variable. The breakdown is as described in Table 5.

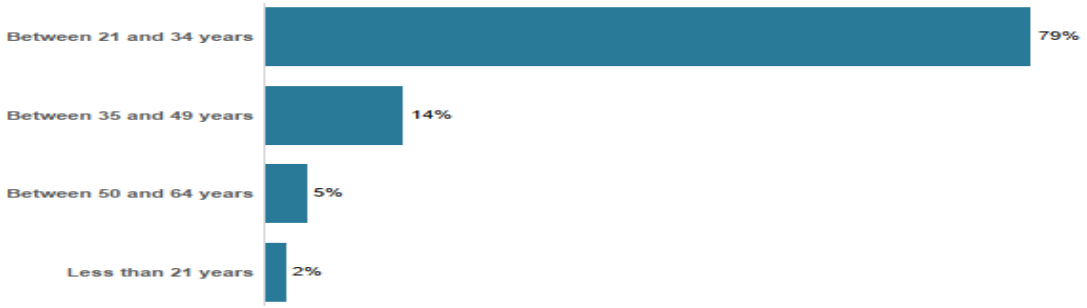

Figure 8 Respondents Age Distribution

Figure 9 Respondents Occupation Distribution

Figure 10 Respondents gender distribution

Majority of the respondents are from the age group between 21 and 34 years. Employees and full time student's occupations form the majority in the career category and Men are in majority in gender category.

5.1.2 How frequently do you use Internet and Social Media?

The above question was a Likert question. Respondents could choose their responses from one of the following options: do not use social media, rarely use social media, few times a week, several times in a day and several times in an hour. The weighted responses for each social media is shown in Figure 11. Among social media, Facebook is the most frequently used and Twitter is less frequently used. The respondents use Internet and google applications repeatedly. The most important inference is the clear disparity in the use of internet and social media applications such as Facebook, Twitter, LinkedIn and video conferencing tools.

Statistical details are provided in the Table 7.

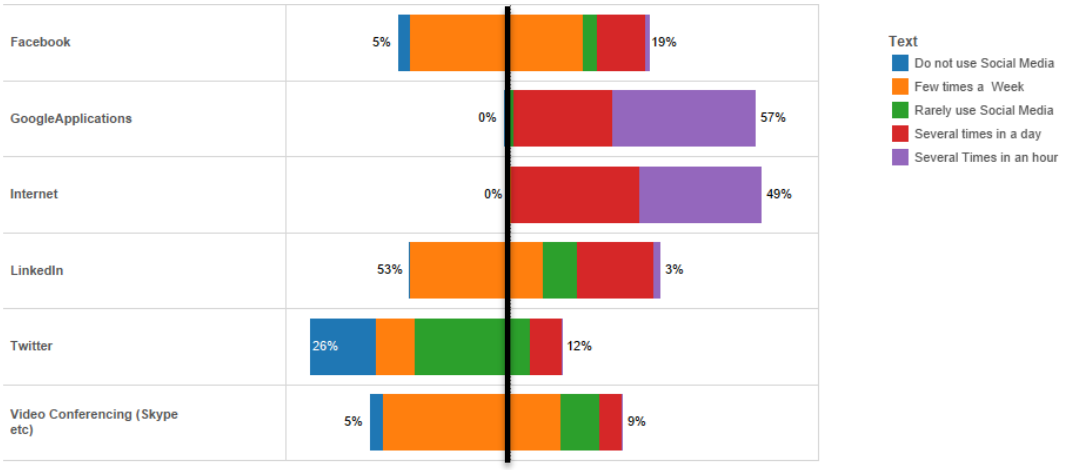

Figure 11 Gantt Chart – Social Media Frequency

Applications	Do not use social media	Rarely use social media	Few times in a week	Several times in a day	Several times in a hour
Facebook	5%	5%	69%	19%	2%
Google Applications	0%	1%	2%	39%	57%
Internet	0%	0%	0%	51%	49%
LinkedIn	1%	13%	53%	30%	3%
Twitter	26%	46%	16%	12%	0%
Video Conferencing (Skype etc.)	5%	15%	70%	9%	0%

Table 7 Social Media usage

Deeper analysis by using a break down parameter for age, gender and occupation ascertained the following interesting insights:

- The age group between 35 to 49 years have the least internet and social presence
- Men are more social savvy than women. Only 32% of females use internet several times in a day as opposed to 61% of men
- Employees inclusive of part time students are least active on social media

5.1.3 *Categorize the challenges you face while working with virtual teams?*

The above question was a Likert question. Respondents could choose their responses from one of the following options: no challenge at all, medium challenge and most significant challenge. The weighted responses for each challenge is shown in Figure 12. Among the challenges, lack of physical interaction, lack of social interaction, lack of face to face synergies and lack of trust are the ones with maximum negative sentiment implying that these are indeed the most significant shortcomings. Statistical details are provided in the Table 8.

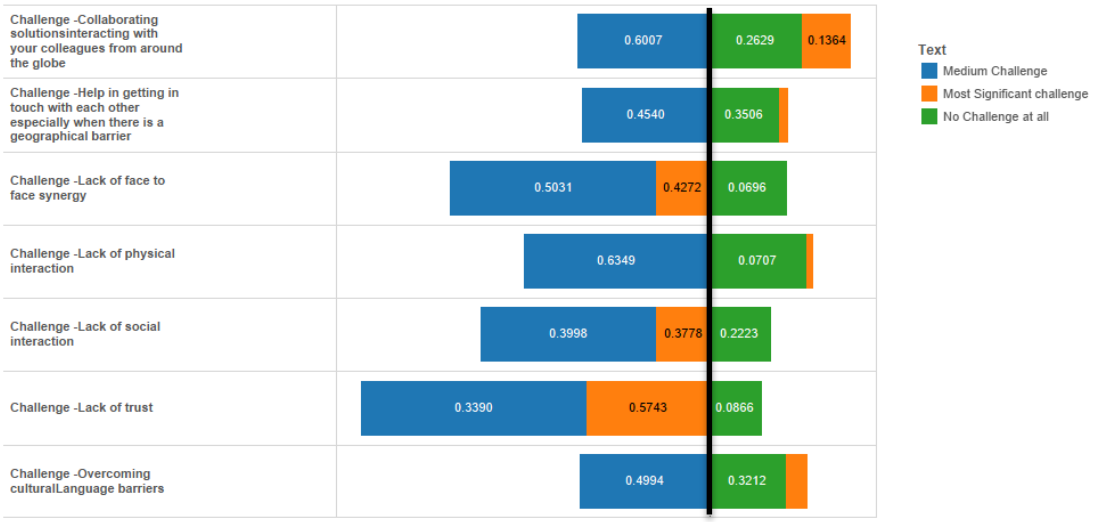

Figure 12 Gantt chart- Challenges and the level of inconvenience

Deeper analysis by using a break down parameter for age, gender and occupation ascertained the following interesting insights:

- The age group between 50 and 64 years have the maximum issue with the challenges stated
- Men in general are more sceptical except for Lack of trust, to which women are more uncomfortable
- Working professionals inclusive of part time students have more difficulty with the challenges

Challenges with Virtual Teams	No challenge at all	Medium challenge	Most significant challenge
Collaborating solutions with colleagues from around the globe	26.29%	60.07%	13.64%
Help in getting in touch with each other especially when there is a geographical barrier	35.06%	45.40%	19.54%
Overcoming cultural barriers	32.12%	49.94%	17.94%
Lack of physical interaction	7.07%	63.49%	29.44%
Lack of social interaction	22.23%	39.98%	37.78%
Lack of trust	8.66%	33.90%	57.43%
Lack of face to face synergy	6.96%	50.31%	42.72%

Table 8 Challenges with Virtual Teams and the level of Inconvenience

5.1.4 *Have you used Internet for virtual communication?* and *What social Media have you used for effective virtual communication?*

The above question is a check all that apply question. The weighted response is shown in Figure 13. Among these applications, video conferencing tools are the most used followed by Facebook and LinkedIn. 6% of the total population have used atleast 7, while 29% of the total population have used 6 and the rest have used 5 or less social media applications for virtual communication.

Deeper analysis by using a break down parameter for age, gender and occupation ascertained the following interesting insights:

- The age group between 21 & 34 years, and between 35 & 45 years are the only ones to use atleast 7 social media applications for the purpose of virtual communication
- Among all the age groups, the group between 50 and 64 years mostly are majority users of an application
- Men are more exhaustive users of an application as compared to women
- Working professionals inclusive of part time students use more applications as compared to full time students

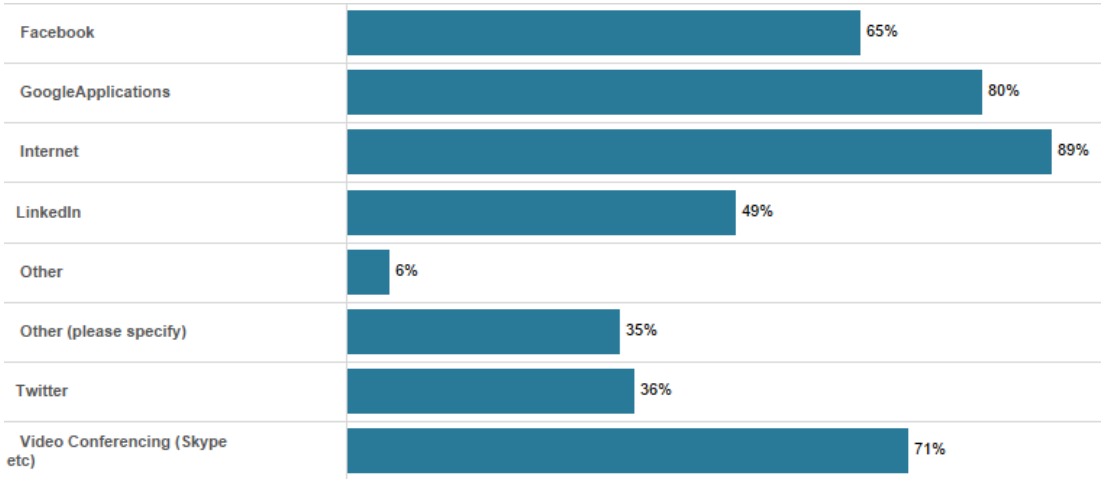

Figure 13 Social Media popularly used

5.1.5 How did social media help in overcoming the following challenges?

The above question was a Likert question. Respondents could choose their responses from one of the following options: did not help at all, not helpful, neutral, somewhat helpful and very helpful. The weighted responses for each challenge is shown in Figure 14. Social media seems to be most helpful in overcoming lack of physical interaction and lack of social interaction followed by lack of face to face synergies. Lack of trust is the least resolved issue by social media.

This	Did not help at all	Not helpful	Neutral	Somewhat Helpful	Very helpful
Becomes This	-2	-1	0	1	2
Sentiment	Negative	Negative	Neutral	Positive	Positive

Table 9 Likert scale to sentiment

Mean scale values of the population for the above Likert question are as follows

- Lack of physical Interaction - 0.61363636 indicates social media being somewhat helpful
- Lack of social interaction - 0.803030303 indicates social media being somewhat helpful
- Lack of face to face synergy - 0.30303030303 indicates social media being somewhat helpful
- Lack of trust - 0.3939393939 indicates social media being somewhat helpful

Thus, the overall sentiment is positive for the above Likert question, shown in figure 14. Statistical details are provided in the Table 10.

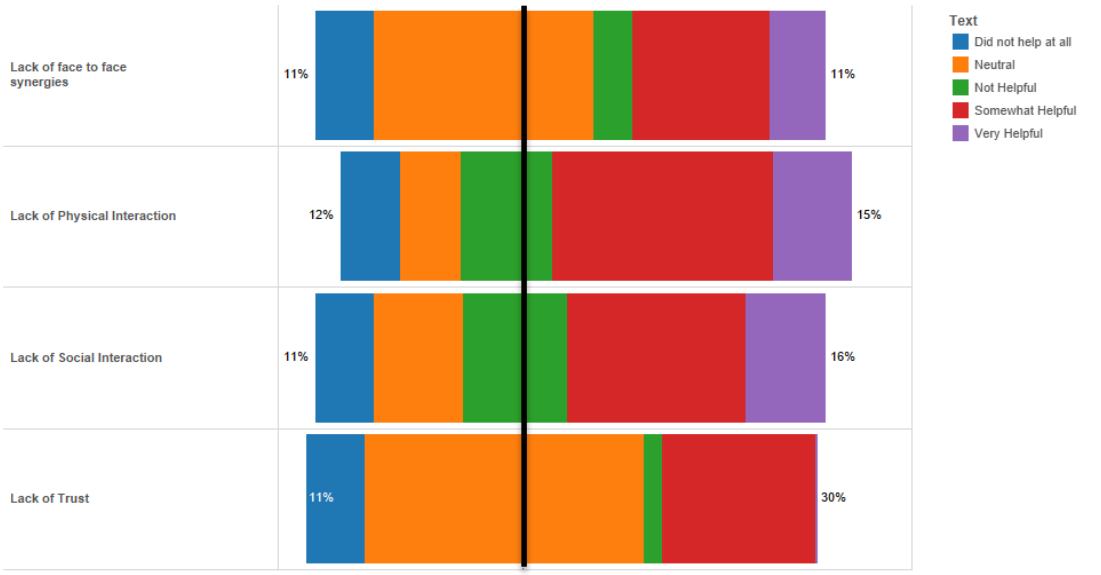

Figure 14 Gantt chart –Social Media help in overcoming challenges

Challenge	Did not help at all	Not helpful	Neutral	Somewhat helpful	Very Helpful
Lack of face to face synergies	11%	8%	43%	27%	11%
Lack of physical interaction	12%	18%	12%	43%	15%
Lack of social Interaction	11%	20%	11%	35%	16%
Lack of Trust	11%	3%	55%	30%	0%

Table 10 Social Media help in overcoming challenges

Deeper analysis by using a break down parameter for age, gender and occupation ascertained the following interesting insights:

- For age group between 35 and 49 years, lack of trust and lack of face to face synergies are the two challenges resolved to a lesser extent. For age group between 50 and 64 years, lack of physical interaction and lack of trust are the least resolved. Age group less than 21 years takes a neutral stand on majority of challenges being resolved through social media
- Men think social media is slightly less helpful in overcoming the shortcomings as compared to women
- Working professionals inclusive of part time students felt social media was more helpful in overcoming the challenges as compared to full time students

5.1.6 *Do you think social media is the way forward for effective virtual communication?*

The above question had two possible responses: Yes or No. Figure 15 shows the weighted response for the above question. 77% of the records in the weighted data are in favour of social media being the way forward for effective virtual communication as opposed to 33% who think otherwise. The sample response however, goes upto 83% in favour and only 17% against.

Figure 15 Social Media is the way forward

Deeper analysis by using a break down parameter for age, gender and occupation ascertained the following interesting insights:

- Age group less than 21 years is the most in favour of social media being the way forward followed by age group between 21 and 34 years
- More men are in favour of social media being the way forward than women
- Full time students and working employess exclusive of part time students predominently think that social media is the way forward. Part time students are split in their opinion

5.1.7 Summary

The following are the overall insights ascertained from the analysis of weighted data:

- There exists a clear disparity in the amount of time spent by people on the internet and the proportion of internet time spent on social media. Nevertheless, social media has become an inevitable part of majority of the people belonging to different age and gender, who have access to internet
    - Age group 35 to 49 years uses internet and social media the least
- The challenges that people are mostly concerned with while working in virtual teams are Lack of face to face synergies, Lack of Physical Interaction, Lack of Social Interaction and Lack of Trust
    - Age group 50 to 64 have the most issues with the above challenges
- Majority of the respondents have used social media for virtual communication with video conferencing applications being the most popular
    - Men use social media more exhaustively as opposed to females
- The overall sentiment for social media resolving the four critical challenges is on the positive side
    - Age group 50 to 64 is the age group that least shares the above sentiment
- Majority of the respondents definitely think social media is the way forward for virtual communication.
    - Younger generation are major contributors to the above result.

Chapter 6 - Analysis and Discussion

In this chapter, an attempt to dissect patterns leading to a positive sentiment, on social media helping overcome challenges such as lack of physical interaction, lack of social interaction, lack of trust and lack of face to face synergy, is made.

6.1 Classification Model for social media in resolving the issues

From the insights ascertained in the previous section, respondents have taken a negative, neutral or positive stance on social media being helpful in overcoming challenges such as Lack of Physical Interaction, Lack of Social Interaction, Lack of Trust and Lack of Face to Face Synergies.

In this section, the possibility of identifying patterns based on the following parameters is explored:

- How frequently social media and internet was used
- Number of social media applications active on, amongst those featured in the questionnaire
- Number of social media applications used for virtual communication
- Respondent's stance on social media overcoming the challenges of virtual communication

These patterns are then exploited to build a classification model to serve as a reference point for virtual communication.

6.1.1 Data Modelling

The following additional variables were created from the existing variables in the data:

- *SocialMediaPresence*: This variable represents the cumulative frequency of social media use. Variables such as Frequency_GoogleApplications, Frequency_Facebook, Frequency_Twitter, Frequency_LinkedIn, and Frequency_VideoConferencing were added to gauge variables value
- *SocialMediaActive*: This variable represents the number of social media networks the respondent is active on among those asked in the questionnaire. If the response to *'how frequently do you use Social Media?'* was *'do no use social media'*, implied respondent not being active on this application
- *SocialMediaUsed*: This variable represents the number of social media the respondent has used. Its value was determined by using the information from what social media applications have you used for virtual communications variables
- *SocialMedia_Used_Active*: This variable is the ratio of SocialMediaUsed and SocialMediaActive.
- The five original response options were classified as follows

Did not help at all Not very helpful	Negative
Neutral	Neutral
Somewhat helpful Very helpful	Positive

Table 11 Response Categorization

6.1.2 Lack of Face to Face Synergy

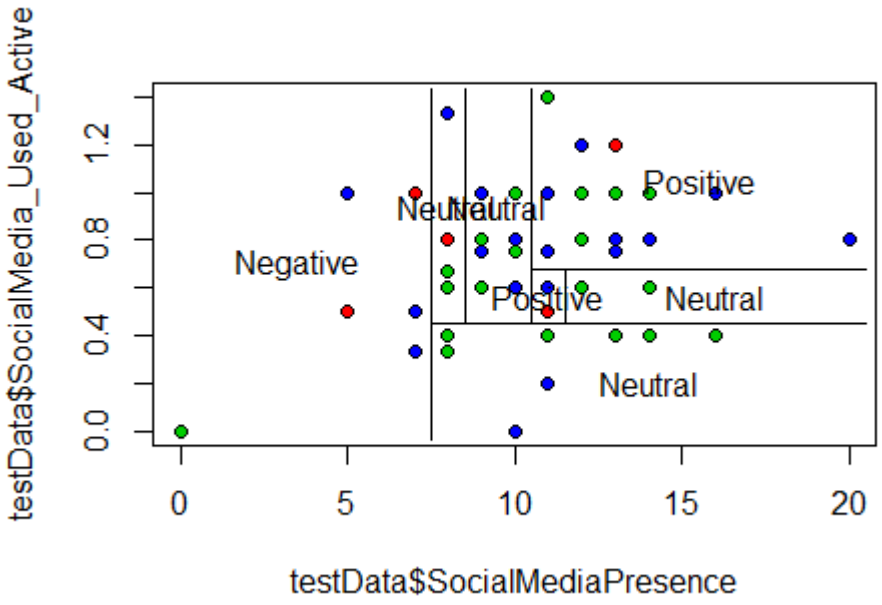

Figure 16 Classification Model for lack of face to face synergy

Figure 16 shows the classification model for overcoming lack of face to face synergy using social media. The initial classification model had a high misclassification error. Pruning was employed to reduce this error. However, the error remained unchanged at 37.88%. This implies that the findings from the model cannot be generalized.

6.1.3 Lack of Physical Interaction

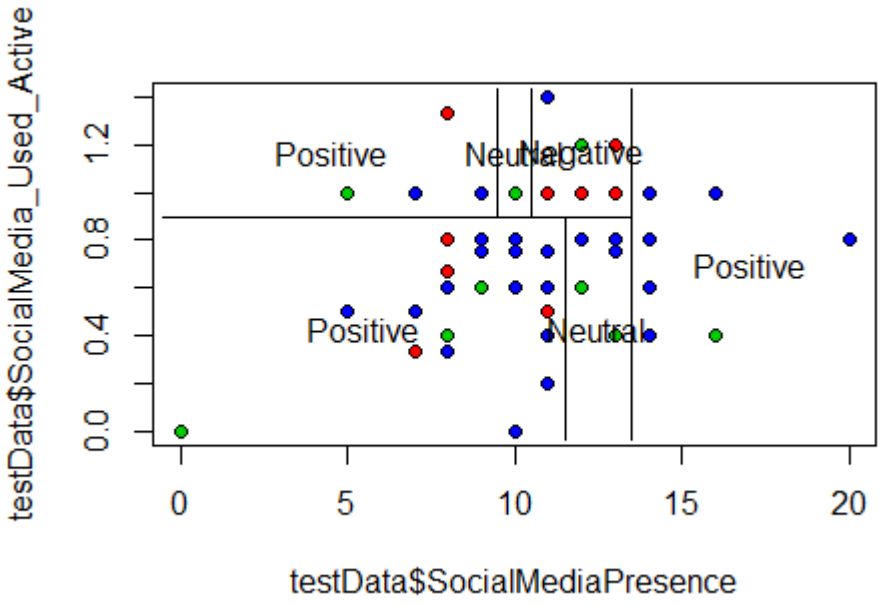

Figure 17 Classification Model for lack of physical interaction

Figure 17 shows the classification model for overcoming lack of physical interaction using social media. The initial classification model had a high misclassification error. Pruning was employed to reduce this error. However, the error remained unchanged at 34.85%. This implies that the findings from the model cannot be generalized.

6.1.4 Lack of Social Interaction

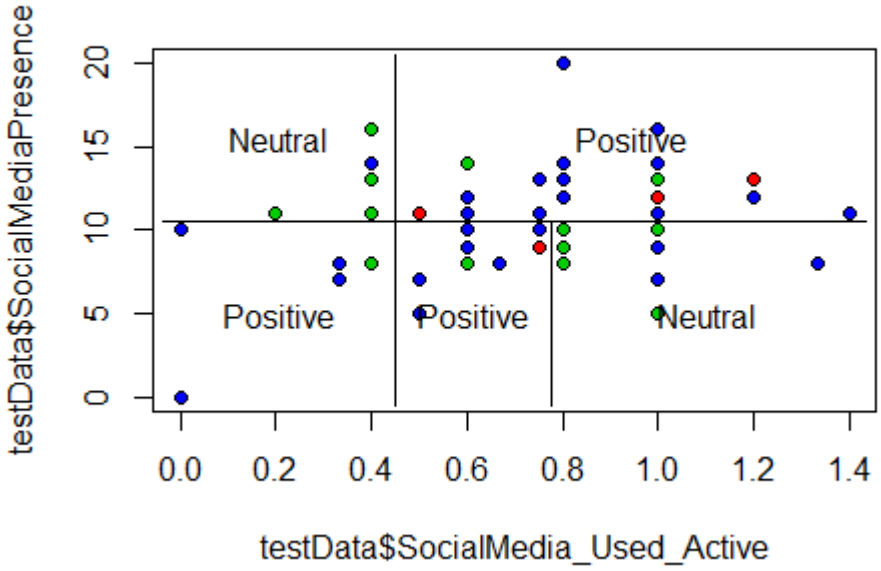

Figure 18 Classification model for lack of social interaction

Figure 18 shows the classification model for overcoming lack of face to face synergy using social media. The initial classification model had a high misclassification error. Pruning was employed to reduce this error. However, the error remained unchanged at 30.30%. This implies that the findings from the model cannot be generalized.

6.1.5 Lack of Trust

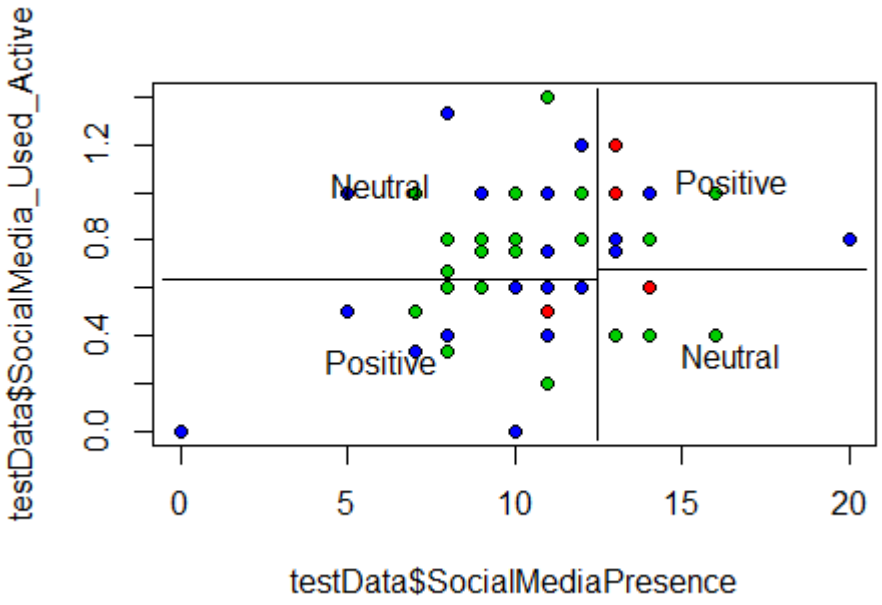

Figure 19 Classification model for lack of trust

Figure 19 shows the classification model for overcoming lack of trust using social media. The initial classification model had a high misclassification error. Pruning was employed to reduce this error. However, the error remained unchanged at 37.88%. This implies that the findings from the model cannot be generalized.

6.1.6 Summary

Classification models were built successfully by identifying the patterns based on the parameters mentioned in the introduction of this section. All the Models indicated that a greater social media presence and usage of more social media applications will definitely increase the odds of overcoming the socio-emotional challenges of virtual meetings such as lack of trust, lack of physical interaction, lack of social interaction and lack of face to face synergies. The misclassification error for every model was high. Hence, findings from the model cannot be generalizable.

6.2 Cross Tabulation

In this section, responses of one query is stacked against the responses of another to ascertain possible insightful relationships between them.

6.2.1 Data Modelling

The following additional variable was created from the existing variables in the dataset:

Frequency_SocialMedia: This variable was used for trend and cross tabulation analysis and represents the average frequency of social media use. Average of Frequency_GoogleApplications, Frequency_Facebook, Frequency_LinkedIn, Frequency_Twitter and Frequency_VideoConferencing yielded variable's value. It is referred to as just social media in the description.

6.2.2 *Internet frequency* versus *overcoming challenges*

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of physical interaction?

Internet	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Few times a Week				2		2
Rarely use Social Media				1		1
Several times in a day	1	8	1	22	9	41
Several Times in an hour	7	21	12	29	19	88
Grand Total	**8**	**29**	**13**	**54**	**28**	**132**

Table 12 Internet vs Social Media in overcoming lack of physical interaction

Table 12 shows the frequency counts for *how frequently do you use internet vs. how did social media help you overcoming the challenge: Lack of physical interaction.*

The statistical insights ascertained are as follows

- 62 % of the total respondents are positive on this subject. Of these:
  - 59% of the respondents use internet several times in an hour
  - 38% use internet several times in a day and
  - 3% use internet sparingly
- 22% of the total respondents are neutral on this subject. Of these
  - 72% of the respondents use internet several times in an hour
  - 28% of the respondents use internet several times in a day
- 16% of the total respondents are negative on this subject. Of these
  - 90% of the respondents use internet several times in an hour
  - 10% of the respondents use internet several times in a day

Inference

More than 60% of the respondents who frequently (several times in an hour and several times in a day) use the internet on a daily basis felt social media was helpful in overcoming lack of physical interaction. These formed 96% of the respondents who agreed to social media being helpful in overcoming lack of physical interaction.

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of social interaction?

Internet	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Few times a Week				2		2
Rarely use Social Media		1				1
Several times in a day		14	2	17	8	41
Several Times in an hour	3	17	6	39	23	88
Grand Total	**3**	**32**	**8**	**58**	**31**	**132**

Table 13 Internet vs Social Media helpful with lack of social interaction

Table 13 shows the frequency counts for *how frequently do you use internet vs. how did social media help you overcoming the challenge*: Lack of social interaction.

The Statistical insights ascertained are as follows:

- 67 % of the total respondents are positive on this subject. Of these:
  - 70% of the respondents use internet several times in an hour
  - 28% use internet several times in a day
  - 2% use internet sparingly
- 24% of the total respondents are neutral on this subject. Of these:
  - 53% of the respondents use internet several times in an hour
  - 44% of the respondents use internet several times in a day
  - 3% use internet sparingly
- 9% of the total respondents are negative on this subject. Of these:
  - 82% of the respondents use internet several times in an hour
  - 18% of the respondents use internet several times in a day

Inference

Nearly 68% percent of the respondents who frequently (several times in an hour and several times in a day) use the internet on a daily basis felt that social media was helpful in overcoming lack of social interaction. These formed 98% of the respondents who agreed to social media being helpful in overcoming lack of social interaction.

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of face to face synergies?

Internet	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Few times a Week		1		1		2
Rarely use Social Media			1			1
Several times in a day		21	4	12	4	41
Several Times in an hour	4	37	8	26	13	88
Grand Total	**4**	**59**	**13**	**39**	**17**	**132**

Table 14 Internet vs Social Media helpful with lack of face to face synergy

Table 14 shows the frequency counts for *how frequently do you use internet vs. how did social media help you overcoming the challenge: Lack of face to face synergies*. The statistical insights ascertained are as follows

- 42 % of the total respondents are positive on this subject. Of these:
  - 70% of the respondents use internet several times in an hour
  - 29% use internet several times in a day
  - 1% use internet sparingly
- 45% of the total respondents are neutral on this subject. Of these:
  - 63% of the respondents use internet several times in an hour
  - 36% of the respondents use internet several times in a day
  - 1% use internet sparingly
- 13% of the total respondents are negative on this subject. Of these:
  - 71% of the respondents use internet several times in an hour
  - 24% of the respondents use internet several times in a day
  - 5% use internet sparingly

Inference

Only about 43 % of the respondents who frequently (several times in an hour and several times in a day) use the internet on a daily basis felt social media helpful in overcoming face to face synergies. These formed 98% of the respondents who agreed to social media being helpful in overcoming lack of face to face synergy.

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of trust?

Internet	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Few times a Week				2		2
Rarely use Social Media			1			1
Several times in a day		21	4	14	2	41
Several Times in an hour	4	41	8	29	6	88
Grand Total	**4**	**62**	**13**	**45**	**8**	**132**

Table 15 Internet vs Social Media helpful with lack of trust

Table 15 shows the frequency counts for *how frequently do you use internet vs. how did social media help you overcoming the challenge: Lack of trust.*

The statistical insights ascertained are as follows

- 40 % of the total respondents are positive on this subject. Of these:
  - 66% of the respondents use internet several times in an hour
  - 30% use internet several times in a day
  - 4% use internet sparingly
- 47% of the total respondents are neutral on this subject. Of these:
  - 66% of the respondents use internet several times in an hour
  - 34% of the respondents use internet several times in a day
- 13% of the total respondents are negative on this subject. Of these:
  - 71% of the respondents use internet several times in an hour
  - 24% of the respondents use internet several times in a day
  - 4% use internet sparingly

Inference

Only about 40% of the respondents who frequently use the internet on a daily basis felt social media helpful in overcoming lack of trust. These 40% respondents form 96% of the respondents who agreed to social media being helpful in overcoming lack of trust.

6.2.3 *Social media frequency* versus *overcoming challenges*

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of physical interaction?

Social Media	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Do not use social media		1		1		2
Few times a Week	5	21	8	36	16	86
Rarely use Social Media	3	5	4	15	8	35
Several Times in a day		2	1	2	3	8
Several Times in an hour					1	1
Grand Total	**8**	**29**	**13**	**54**	**28**	**132**

Table 16 *Social media vs Social Media helpful with lack of physical interaction*

Table 16 shows the frequency counts for *how frequently do you use Social Media* vs. *how did social media help you overcoming the challenge: Lack of physical interaction*. The statistical insights ascertained are as follows

- 62 % of the total respondents are positive on this subject. Of these:
  - 1% use social media several times in an hour
  - 7% use social media times in a day
  - 63% use social media few times a week
  - 28% use social media rarely
  - 1% do not use social media
- 22% of the total respondents are neutral on this subject. Of these:
  - 7% use social media several times in a day
  - 73% use social media few times a week
  - 17% use social media rarely
  - 3% do no use social media
- 16% of the total respondents are negative on this subject. Of these:
  - 5% use social media several times in a day
  - 62% use social media few times a week
  - 33% use social media rarely

Inference

Nearly 62% of the respondents who use social media (excludes do not use social media, refer Table 16) felt social media was helpful in overcoming lack of physical interaction. These formed 99% of the respondents who agreed to social media being helpful in overcoming lack of physical interaction.

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of social interaction?

Social Media	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Do not use social media		1		1		2
Few times a Week	3	17	5	41	20	86
Rarely use Social Media		11	2	16	6	35
Several Times in a day		3	1		4	8
Several Times in an hour					1	1
Grand Total	**3**	**32**	**8**	**58**	**31**	**132**

Table 17 Social media vs Social Media helpful with lack of social interaction

Table 17 shows the frequency counts for how frequently *do you use Social Media vs. how did social media help you overcoming the challenge: Lack of social interaction*. The statistical insights ascertained are as follows

- 68 % of the total respondents are positive on this subject. Of these:
  - 1% use social media several times in an hour
  - 5% use social media times in a day
  - 68% use social media few times a week
  - 25% use social media rarely
  - 1% do not use social media
- 24% of the total respondents are neutral on this subject. Of these:
  - 9.5% use social media several times in a day
  - 53% use social media few times a week
  - 34% use social media rarely
  - 3.5% do no use social media
- 8% of the total respondents are negative on this subject. Of these:
  - 9% use social media several times in a day
  - 73% use social media few times a week
  - 18% use social media rarely

Inference

Nearly 68% of the respondents who use social media (excludes do not use social media, refer Table 17) felt social media was helpful in overcoming lack of social interaction. These 68% respondents form 99% of the respondents who agreed to social media being helpful in overcoming lack of social interaction.

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of face to face synergies?

Social Media	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Do not use social media		1	1			2
Few times a Week	4	40	5	26	11	86
Rarely use Social Media		16	6	11	2	35
Several Times in a day		2	1	2	3	8
Several Times in an hour					1	1
Grand Total	**4**	**59**	**13**	**39**	**17**	**132**

Table 18 Social media vs Social Media helpful with lack of face to face synergy

Table 18 shows the frequency counts for how frequently *do you use Social Media vs. how did social media help you overcoming the challenge: Lack of face to face synergies.* The statistical insights ascertained are as follows

- 42 % of the total respondents are positive on this subject. Of these:
  - 2% use social media several times in an hour
  - 9% use social media times in a day
  - 66% use social media few times a week
  - 23% use social media rarely
- 45% of the total respondents are neutral on this subject. Of these:
  - 3% use social media several times in a day
  - 68% use social media few times a week
  - 27% use social media rarely
  - 2% do no use social media
- 13% of the total respondents are negative on this subject. Of these:
  - 6% use social media several times in a day
  - 53% use social media few times a week
  - 35% use social media rarely
  - 6% do no use social media

Inference

Only 43% of the respondents who use social media (excludes do not use social media, refer Table 18) felt social media was helpful in overcoming lack of face to face synergy. These formed 100% of the respondents who agreed to social media being helpful in overcoming lack of face to face synergy.

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of trust?

Social Media	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Do not use social media			1	1		2
Few times a Week	4	41	7	30	4	86
Rarely use Social Media		18	4	12	1	35
Several Times in a day		3	1	2	2	8
Several Times in an hour					1	1
Grand Total	**4**	**62**	**13**	**45**	**8**	**132**

Table 19 Social media vs Social Media helpful with lack of trust

Table 19 shows the frequency counts for how *frequently do you use Social Media vs. how did social media help you overcoming the challenge: Lack of trust*.

The statistical insights ascertained are as follows

- 40 % of the total respondents are positive on this subject. Of these:
  - 2% use social media several times in an hour
  - 8% use social media times in a day
  - 64% use social media few times a week
  - 24% use social media rarely
  - 2% do not use social media
- 47% of the total respondents are neutral on this subject. Of these:
  - 5% use social media several times in a day
  - 66% use social media few times a week
  - 29% use social media rarely
- 13% of the total respondents are negative on this subject. Of these:
  - 6% use social media several times in a day
  - 65% use social media few times a week
  - 25% use social media rarely
  - 6% do no use social media

Inference

Only 40% of the respondents who use social media (excludes do not use social media, refer Table 19) felt social media was helpful in overcoming lack of trust. These 40% respondents formed 98% of the respondents who agreed to social media being helpful in overcoming lack of trust.

6.2.4 Challenge category versus overcoming challenge

Categorize the challenges you face while working virtual teams: Lack of social interaction? Versus. How did social media help in overcoming the following challenges: Lack of social interaction?

Challenge: Lack of Social interaction	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Medium Challenge		20	3	34	18	75
Most Significant challenge	2	5	3	16	6	32
No Challenge at all	1	7	2	8	7	25
Grand Total	**3**	**32**	**8**	**58**	**31**	**132**

Table 20 Challenge category vs Social Media helpful with social interaction

Table 20 shows the frequency counts for *categorize the challenge- Lack of social interaction you face while working virtual teams* vs. *how social media helped in overcoming the challenge: Lack of social interaction*.

The statistical insights ascertained are as follows

- 68 % of the total respondents are positive on this subject. Of these:
  - 17% had categorized this as no challenge at all
  - 58% had categorized this as medium challenge
  - 25% had categorized this as most significant challenge
- 24% of the total respondents are neutral on this subject. Of these:
  - 22% had categorized this as no challenge at all
  - 63% had categorized this as medium challenge
  - 15% had categorized this as most significant challenge
- 8% of the total respondents are negative on this subject. Of these:
  - 27% had categorized this as no challenge at all
  - 27% had categorized this as medium challenge
  - 46% had categorized this as most significant challenge

Inference

More than 69% of the respondents that categorized lack of social interaction as an inconvenience felt that social media was helpful (somewhat helpful and very helpful, refer Table 20) in overcoming this challenge. These formed 85% of the respondents who agreed to social media being helpful in overcoming lack of social interaction.

Categorize the challenges you face while working virtual teams: Lack of physical interaction? Versus. How did social media help in overcoming the following challenges: Lack of physical interaction?

Challenge: Lack of Physical interaction	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Medium Challenge	1	17	2	32	17	69
Most Significant challenge	4	9	8	15	6	42
No Challenge at all	3	3	3	7	5	21
Grand Total	**8**	**29**	**13**	**54**	**28**	**132**

Table 21 Challenge category vs Social Media helpful with physical interaction

Table 21 shows the frequency counts for *categorize the challenge- Lack of physical interaction you face while working virtual teams vs. how social media helped in overcoming the challenge: Lack of physical interaction*.

The statistical insights ascertained are as follows:

- 62 % of the total respondents are positive on this subject. Of these:
  - 15% had categorized this as no challenge at all
  - 60% had categorized this as medium challenge
  - 25% had categorized this as most significant challenge
- 22% of the total respondents are neutral on this subject. Of these:
  - 10% had categorized this as no challenge at all
  - 59% had categorized this as medium challenge
  - 31% had categorized this as most significant challenge
- 16% of the total respondents are negative on this subject. Of these:
  - 29% had categorized this as no challenge at all
  - 14% had categorized this as medium challenge
  - 57% had categorized this as most significant challenge

Inference

More than 63% of the respondents that categorized lack of physical interaction as an inconvenience felt that social media was helpful (somewhat helpful and very helpful, refer Table 21) in overcoming this challenge. These formed 85% of the respondents who agreed to social media being helpful in overcoming lack of physical interaction.

Categorize the challenges you face while working virtual teams: Lack of face to face synergy? Versus. How did social media help in overcoming the following challenges: Lack of face to face synergy?

Challenge: Lack of Face to face synergy	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Medium Challenge		40	3	21	7	71
Most Significant challenge	3	15	7	11	7	43
No Challenge at all	1	4	3	7	3	18
Grand Total	**4**	**59**	**13**	**39**	**17**	**132**

Table 22 Challenge category vs Social Media helpful with face to face synergy

Table 22 shows the frequency counts for *categorize the challenge- lack of face to face synergies you face while working with virtual teams vs how social media helped you overcoming the challenge: Lack of face to face synergies*.

The statistical insights ascertained are as follows:

- 42 % of the total respondents are positive on this subject. Of these:
  - 17% had categorized this as no challenge at all
  - 50% had categorized this as medium challenge
  - 33% had categorized this as most significant challenge
- 45% of the total respondents are neutral on this subject. Of these:
  - 7% had categorized this as no challenge at all
  - 68% had categorized this as medium challenge
  - 25% had categorized this as most significant challenge
- 13% of the total respondents are negative on this subject. Of these:
  - 24% had categorized this as no challenge at all
  - 18% had categorized this as medium challenge
  - 58% had categorized this as most significant challenge

Inference

Only 40% of the respondents that categorized lack of face to face synergy as an inconvenience felt that social media was helpful (somewhat helpful and very helpful, refer Table 22) in overcoming this challenge. These formed 82% of the respondents who agreed to social media being helpful in overcoming lack of face to face synergy.

Categorize the challenges you face while working virtual teams: Lack of trust? Versus. How did social media help in overcoming the following challenges: Lack of trust?

Challenge: Lack of Trust	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
Medium Challenge	1	41	8	26	4	80
Most Significant challenge	2	8	4	10	2	26
No Challenge at all	1	13	1	9	2	26
Grand Total	**4**	**62**	**13**	**45**	**8**	**132**

Table 23 Challenge category vs Social Media helpful with trust

Table 23 shows the frequency counts for *categorize the challenge- Lack of trust you face while working virtual teams* vs. *how social media helped in overcoming the challenge: Lack of trust:*

The statistical insights ascertained are as follows

- 40 % of the total respondents are positive on this subject. Of these:
  - 21% had categorized this as no challenge at all
  - 56% had categorized this as medium challenge
  - 23% had categorized this as most significant challenge
- 47% of the total respondents are neutral on this subject. Of these:
  - 21% had categorized this as no challenge at all
  - 66% had categorized this as medium challenge
  - 13% had categorized this as most significant challenge
- 13% of the total respondents are negative on this subject. Of these:
  - 12% had categorized this as no challenge at all
  - 53% had categorized this as medium challenge

35% had categorized this as most significant challenge

Inference

Nearly 40% of the respondents that categorized lack of trust as an inconvenience felt social media helpful (somewhat helpful and very helpful, refer Table 23) in overcoming this challenge. These formed 79% of the respondents who agreed to social media being helpful in overcoming lack of trust.

6.2.5 Overcoming challenges versus social media way forward

How did social media help in overcoming the following challenges: Lack Of physical Interaction versus Do you think Social Media is the way forward for effective virtual team communication?

Social Media is the way forward	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
No	4	4	3	8	4	23
Yes	4	25	10	46	24	109
Grand Total	**8**	**29**	**13**	**54**	**28**	**132**

Table 24 Social media is the way forward versus overcoming physical interaction

Table 24 shows the frequency counts *for how social media helped in overcoming the challenge: Lack of physical interaction vs.do you think social media is the way forward for effective virtual communication*.

The statistical insights ascertained are as follows

- 62 % of the total respondents are positive on this subject. Of these:
  - 85% said yes to social media being the way forward
  - 15% said yes to social media being the way forward
- 22% of the total respondents are neutral on this subject. Of these:
  - 86% said yes to social media being the way forward
  - 14% said yes to social media being the way forward
- 16% of the total respondents are negative on this subject. Of these:
  - 67% said yes to social media being the way forward
  - 13% said yes to social media being the way forward

Inference

More than 62% of the respondents agreed to social media being helpful (somewhat helpful and very helpful, refer Table 24) in overcoming lack of physical interaction. Of these 62%, 85% also agreed that social media is the way forward for effective virtual communication.

How did social media help in overcoming the following challenges: Lack Of social Interaction versus Do you think Social Media is the way forward for effective virtual / team communication?

Social Media is the way forward	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
No	2	5	3	11	2	23
Yes	1	27	5	47	29	109
Grand Total	**3**	**32**	**8**	**58**	**31**	**132**

Table 25 Social media is the way forward versus overcoming social interaction

Table 25 shows the frequency counts for *how social media helped you overcoming the challenge: Lack of social interaction vs.do you think social media is the way forward for effective virtual communication*.

The statistical insights ascertained are as follows

- 68 % of the total respondents are positive on this subject. Of these:
  - 85% said yes to social media being the way forward
  - 15% said no to social media being the way forward
- 24% of the total respondents are neutral on this subject. Of these:
  - 84% said yes to social media being the way forward
  - 16% said no to social media being the way forward
- 8% of the total respondents are negative on this subject. Of these:
  - 54% said yes to social media being the way forward
  - 46% said no to social media being the way forward

Inference

More than 67% of the respondents agreed to social media being helpful (somewhat helpful and very helpful, refer Table 25) in overcoming lack of social interaction. Of these 67%, 85% also agreed that social media is the way forward for effective virtual communication.

How did social media help in overcoming the following challenges: Lack of face to face synergy versus Do you think Social Media is the way forward for effective virtual / team communication?

Social Media is the way forward	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
No	2	11	5	4	1	23
Yes	2	48	8	35	16	109
Grand Total	**4**	**59**	**13**	**39**	**17**	**132**

Table 26 Social media is the way forward versus overcoming face to face synergy

Table 26 shows the frequency counts for *how social media helped in overcoming the challenge: Lack of face to face synergy vs.do you think social media is the way forward for effective virtual communication*. The insights ascertained are as follows:

- 42 % of the total respondents are positive on this subject. Of these:
  - 91% said yes to social media being the way forward
  - 9% said no to social media being the way forward
- 45% of the total respondents are neutral on this subject. Of these:
  - 81% said yes to social media being the way forward
  - 19% said no to social media being the way forward
- 13% of the total respondents are negative on this subject. Of these:
  - 71% said yes to social media being the way forward
  - 29% said no to social media being the way forward

Inference

Only 42% of the respondents agreed to social media being helpful (somewhat helpful and very helpful, refer Table 26) in overcoming lack of face to face synergy. Of these 42%, 91% also agreed that social media is the way forward for effective virtual communication. It is important to note that 81% of the respondents who were neutral on the former, agreed to social media being the way forward for effective virtual communication.

How did social media help in overcoming the following challenges: Lack Of trust versus Do you think Social Media is the way forward for effective virtual team communication?

Social Media is the way forward	Social Media helpful with the challenge					
	Did not help at all	Neutral	Not Helpful	Somewhat Helpful	Very Helpful	Grand Total
No	2	9	5	7		23
Yes	2	53	8	38	8	109
Grand Total	**4**	**62**	**13**	**45**	**8**	**132**

Table 27 Social media is the way forward versus overcoming trust

Table 27 shows the frequency counts for *how social media helped in overcoming the challenge: Lack of trust* vs.*do you think social media is the way forward for effective virtual communication*. The insights ascertained are as follows:

- 40 % of the total respondents are positive on this subject. Of these:
  - 81% said yes to social media being the way forward
  - 19% said no to social media being the way forward
- 47% of the total respondents are neutral on this subject. Of these:
  - 85% said yes to social media being the way forward
  - 15% said no to social media being the way forward
- 13% of the total respondents are negative on this subject. Of these:
  - 59% said yes to social media being the way forward
  - 41% said no to social media being the way forward

Inference

Only 40% of the respondents agreed to social media being helpful (somewhat helpful and very helpful, refer Table 27) in overcoming lack of trust. Of these 40%, 94% also agreed that social media is the way forward for effective virtual communication. It is important to note that 85% of the respondents who were neutral on the former, agreed to social media being the way forward for effective virtual communication.

How frequently do you use Internet? Versus. Do you think Social Media is the way forward for effective virtual team communication?

Social Media is the way forward	Social Media helpful with the challenge				
	Few times a Week	Rarely use Social Media	Several times in a day	Several Times in an hour	Grand Total
No		1	6	16	23
Yes	2		35	72	109
Grand Total	**2**	**1**	**41**	**88**	**132**

Table 28 Internet usage versus social media is the way forward

Table 28 shows the frequency counts of the records for *how frequently do you use internet and do you think social media is the way forward for effective virtual communication.*

The statistical insights ascertained are as follows:

- 66% of the respondent use internet several times in an hour. Of these
  - 81% said yes to social media being the way forward
  - 19% said no to social media being the way forward
- 31% of the respondent use internet several times in a day hour. Of these
  - 85% said yes to social media being the way forward
  - 15% said no to social media being the way forward
- 2% of the respondent use internet few times a week. Of these
  - 100% said yes to social media being the way forward
- 1% of the respondent use internet rarely. Of these
  - 100% said no to social media being the way forward

Inference

Nearly 98% of the respondents use the internet on a daily (several times in an hour and several times in a day, refer Table 28) basis. Of the 98%, 83% agreed that social media is the way forward for effective virtual communication.

How frequently do you use Social Media? Versus. Do you think Social Media is the way forward for effective virtual team communication?

Social Media is the way forward	Social Media					
	Do not use social media	Few times a Week	Rarely use Social Media	Several Times in a day	Several Times in an hour	Grand Total
No	1	13	7	2		23
Yes	1	73	28	6	1	109
Grand Total	**2**	**86**	**35**	**8**	**1**	**132**

Table 29 Social media usage versus social media is the way forward

Table 29 shows the frequency counts of the records for *how frequently do you use social media* and *do you think social media is the way forward for effective virtual communication*.

The statistical insights ascertained are as follows:

- 0.7% of the respondent use social media several times in an hour. Of these
  - 100% said yes to social media being the way forward
- 6% of the respondent use social media several times in a day hour. Of these
  - 75% said yes to social media being the way forward
  - 25% said no to social media being the way forward
- 65% of the respondent use social media few times a week. Of these
  - 85% said yes to social media being the way forward
  - 15% said no to social media being the way forward
- 26.5% of the respondent use social media rarely. Of these
  - 80% said yes to social media being the way forward
  - 20% said no to social media being the way forward
- 0.75% of the respondent use social media rarely. Of these
  - 50% said yes to social media being the way forward
  - 50% said no to social media being the way forward

Inference

More than 98% of the respondents visit social media (excludes do not use social media, refer Table 29). Of this, 83% agreed that social media is the way forward for effective virtual communication.

6.2.6 Summary

The following are the interesting insights ascertained from cross tabulations:

- Of the people who agreed to social media being helpful to overcome lack of physical and social interaction, majority of them use social media and frequently use internet on a regular basis
- Only a minority agreed to social media being helpful to overcome lack of trust and face to face synergy. Majority of these users use social media and frequently use internet on a regular basis
- Majority of the respondents who categorized lack of trust, lack of physical interaction, lack of social interaction and lack of face to face synergies as a cause of inconvenience have found social media helpful in overcoming them
- Majority of respondents who agreed on social media being helpful in overcoming challenges of virtual team, also agree that social media is the way forward. However, respondents who were neutral on the former are just as likely to agree on the latter
- Respondents who use social media and frequently use internet on a regular basis form 98% of the people who agree to social media being the way forward

6.3 Trend Analysis

From previous section, qualitative analysis revealed a possibility that the frequency of social media and internet use could have a probable influence on whether Social media can help surmount the overbearing's of virtual teams. In this section, investigation on the existence of prospective trends between the two is explored.

6.3.1 *Internet frequency versus overcoming lack of physical interaction*

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of physical interaction?

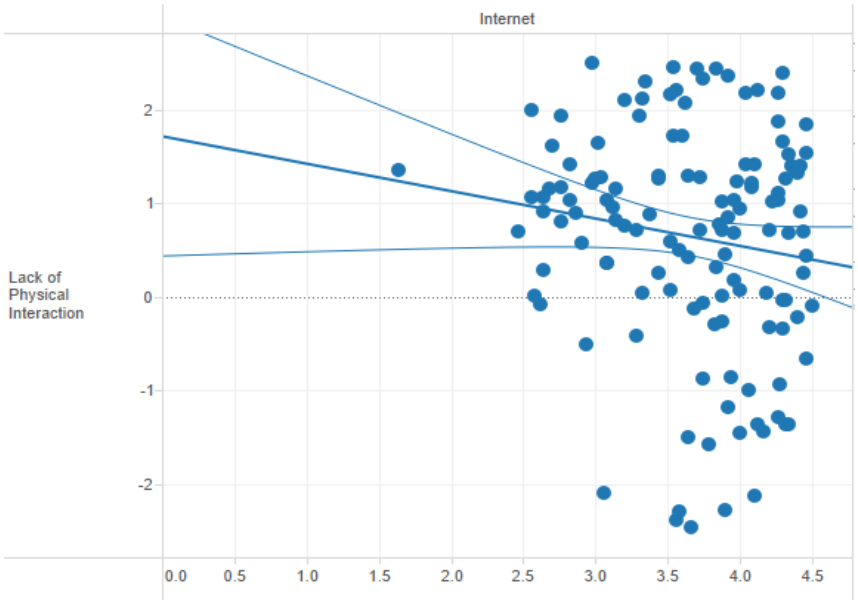

Figure 20 Trend model for frequency of internet usage and social as help for lack of physical interaction

Figure 20 shows a negative trend between the frequency of internet use and social media as a help in overcoming lack of physical interaction. The model parameters are described in Table 30.

Number of modelled observations:	132
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	129
SSE (sum squared error):	179.413
MSE (mean squared error):	1.3908
R-Squared:	0.0215488
Standard error:	1.17932
p-value (significance):	0.0943037

Table 30 Model parameters

The P value of the model is 0.0943037. This indicates that the above model is statistically insignificant and implies that the frequency of internet use has no noteworthy bearing on the final opinion.

6.3.2 *Social Media frequency versus overcoming lack of physical interaction*

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of physical interaction?

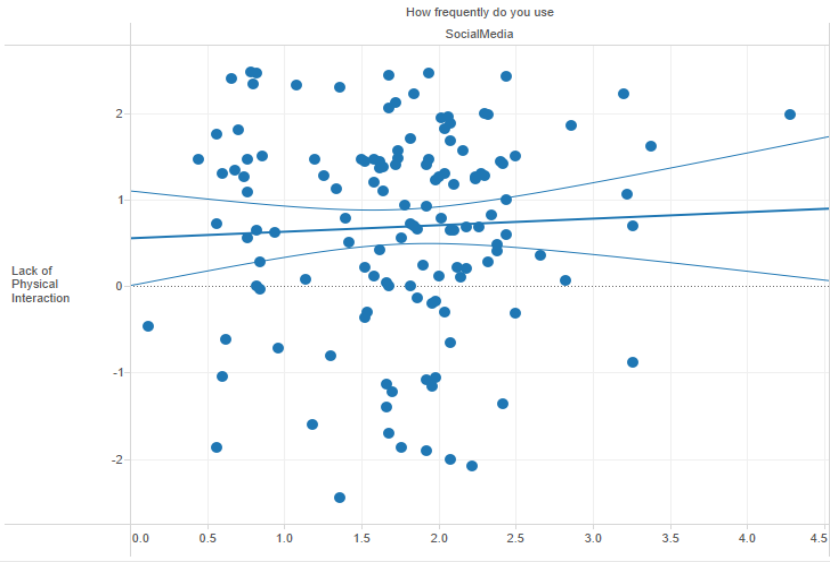

Figure 21 Trend model for frequency of social media usage and social as help for lack of physical interaction

Figure 21 shows a slightly positive trend between the frequency of social media use and social media as a help in overcoming lack of physical interaction. The model parameters are described in Table 31.

Number of modelled observations:	132
Number of filtered observations:	0
Mode degrees of freedom:	2
Residual degrees of freedom (DF):	130
SSE (sum squared error):	175.71
MSE (mean squared error):	1.35161
R-Squared:	0.0020306
Standard error:	1.16259
p-value (significance):	0.607911

Table 31 Model parameters

The P value of the model which is 0.607911 indicates that the trend model is not statistically significant and implies that the frequency of social media use has no noteworthy bearing on the final opinion in this particular instance.

6.3.3 *Internet frequency versus overcoming lack of social interaction*

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of social interaction?

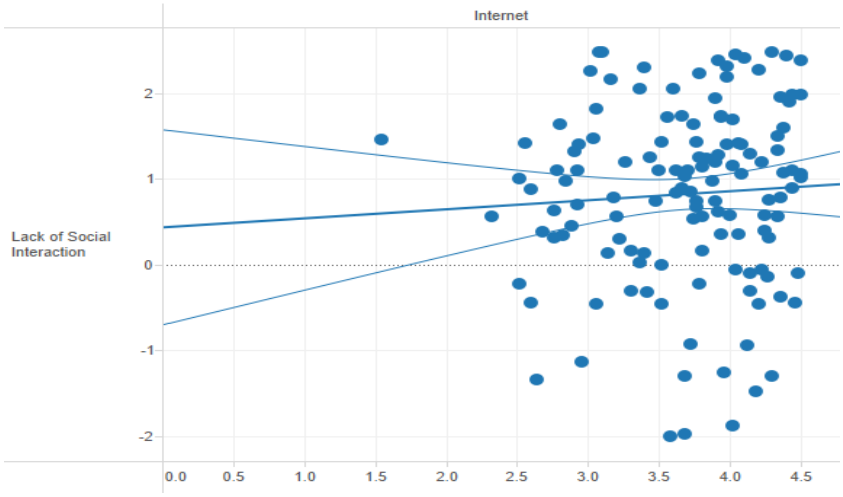

Figure 22 Trend model for frequency of internet usage and social as help for lack of social interaction

Figure 22 shows a positive trend between frequency of internet use and social media as a help in overcoming lack of social interaction. The model parameters are described in Table 32.

Number of modelled observations:	132
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	129
SSE (sum squared error):	139.83
MSE (mean squared error):	1.08395
R-Squared:	0.0036002
Standard error:	1.04113
p-value (significance):	0.496011

Table 32 Model Parameters

The P value of the model which is 0.496011 indicates that the trend model is not statistically significant and implies that frequency of internet use has no noteworthy bearing on final opinion in this particular instance.

6.3.4 *Social Media frequency versus overcoming lack of physical interaction*

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of social interaction?

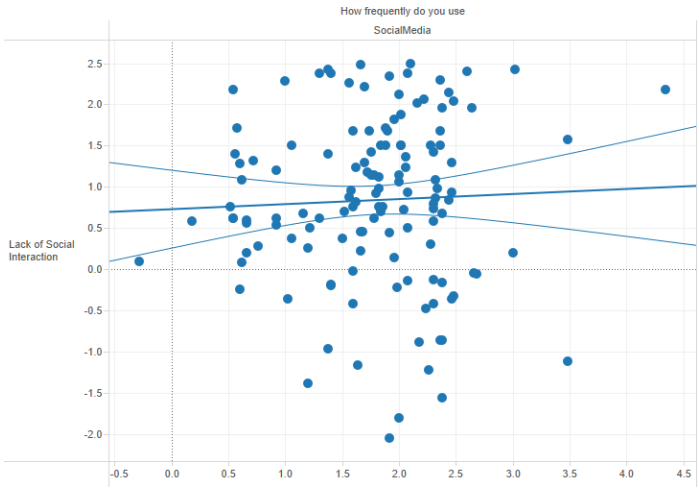

Figure 23 Trend model for frequency of social media usage and social as help for lack of social interaction

Figure 23 shows a slightly positive trend between frequency of social media use and social media as a help in overcoming lack of social interaction. The model parameters are described in Table 33.

Number of modelled observations:	132
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	130
SSE (sum squared error):	131.84
MSE (mean squared error):	1.01416
R-Squared:	0.0018485
Standard error:	1.00705
p-value (significance):	0.624496

Table 33 Model parameters

The P value of the model which is 0.624496 indicates that the trend model is not statistically significant and implies that the frequency of social media use has no noteworthy bearing on final opinion in this particular instance.

6.3.5 *Internet frequency versus overcoming lack of social interaction*

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of face to face synergies?

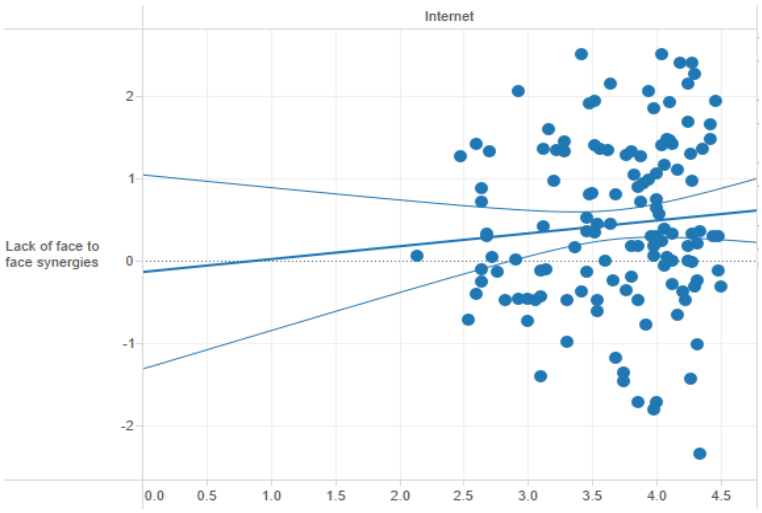

Figure 24 Trend model for frequency of internet usage and social as help for lack of face to face synergies

Figure 24 shows a slightly positive trend between frequency of internet use and social media as a help in overcoming lack of face to face synergies. The model parameters are described in Table 34.

Number of modelled observations:	132
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	129
SSE (sum squared error):	133.021
MSE (mean squared error):	1.03117
R-Squared:	0.0073578
Standard error:	1.01546
p-value (significance):	0.329977

Table 34 Model parameters

The P value of the model which is 0.329977 indicates that the trend model is not statistically significant and implies that frequency of internet use has no noteworthy bearing on final opinion in this particular instance.

6.3.6 *Social Media frequency versus overcoming lack of physical interaction*

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of face to face synergies?

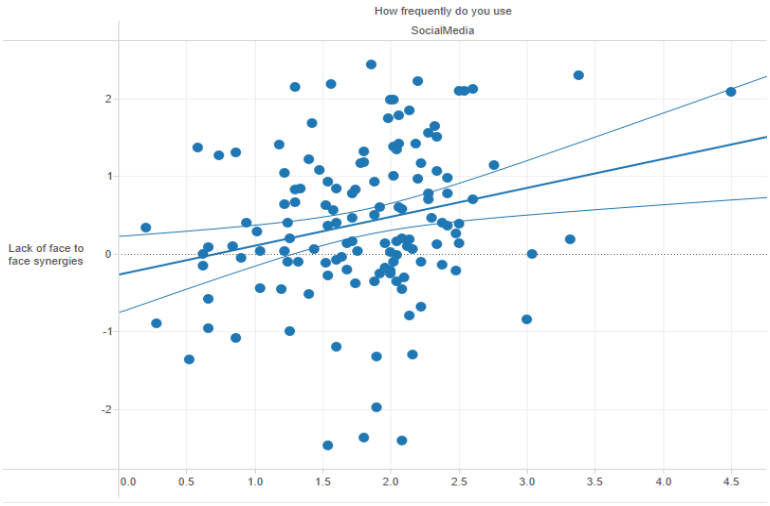

Figure 25 Trend model for frequency of social media usage and social as help for lack of face to face synergies

Figure 25 shows a positive trend between frequency of social media use and social media as a help in overcoming lack of face to face synergies. The model parameters are described in Table 35.

Number of modelled observations:	132
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	130
SSE (sum squared error):	119.901
MSE (mean squared error):	0.922314
R-Squared:	0.0593035
Standard error:	0.960372
p-value (significance):	0.0048968

Table 35 Model parameters

The P value of the model which is 0. 0048968 indicates that the trend model is statistically significant and implies that frequency of social media use has noteworthy bearing on final opinion in this particular instance.

6.3.7 *Internet frequency versus overcoming lack of social interaction*

How frequently do you use Internet? Versus. How did social media help in overcoming the following challenges: Lack of trust?

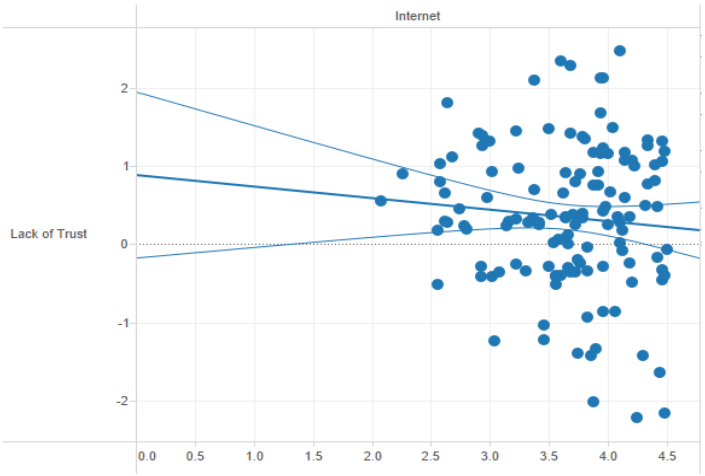

Figure 26 Trend model for frequency of internet usage and social as help for lack of Trust

Figure 26 shows a negative trend between frequency of internet use and social media as a help in overcoming lack of trust. The model parameters are described in Table 36:

Number of modelled observations:	132
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	129
SSE (sum squared error):	110.166
MSE (mean squared error):	0.854001
R-Squared:	0.007938
Standard error:	0.924121
p-value (significance):	0.311545

Table 36 Model parameters

The P value of the model which is 0. 311545 indicates that the trend model is not statistically significant and implies that frequency of internet use has no noteworthy bearing on final opinion in this particular instance.

6.3.8 *Social Media frequency versus overcoming lack of physical interaction*

How frequently do you use Social Media? Versus. How did social media help in overcoming the following challenges: Lack of trust?

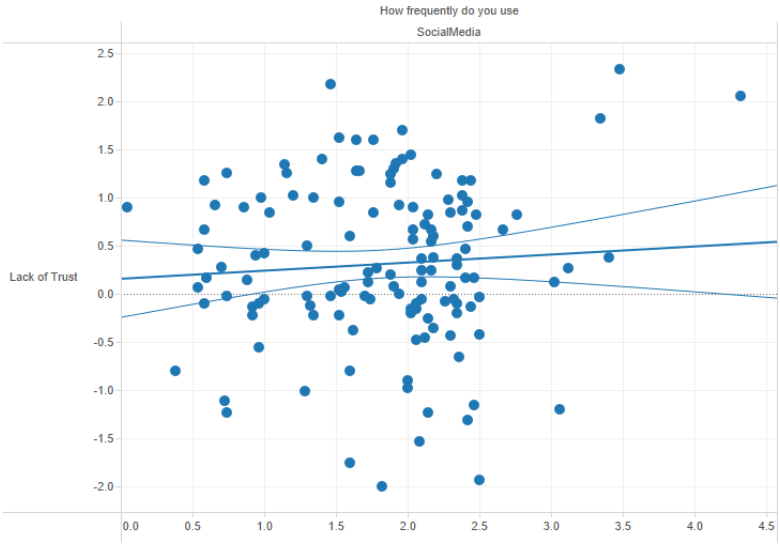

Figure 27 Trend model for frequency of internet usage and social as help for lack of trust

Figure 27 shows a positive trend between frequency of social media use and social media as a help in overcoming lack of trust. The model parameters are described in Table 37.

Number of modelled observations:	132
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	130
SSE (sum squared error):	92.5815
MSE (mean squared error):	0.712166
R-Squared:	0.004976
Standard error:	0.843899
p-value (significance):	0.421542

Table 37 Model parameters

The P value of the model which is 0. 311545 indicates that the trend model is not statistically significant and implies that frequency of social media use has no noteworthy bearing on final opinion in this particular instance.

6.3.9 Summary

Trend Line investigation provides an early sign of existence of trends between the frequency of social media and internet use against challenges. Table 38 illustrates the relevance of these trends.

Frequency of Internet use	**Challenges**	**Statistical Significance**
	Lack of physical interaction	Insignificant
	Lack of social interaction	Insignificant
	Lack of face to face synergy	Insignificant
	Lack of trust	Insignificant
Frequency of Social Media use	**Challenges**	**Statistical Significance**
	Lack of physical interaction	Insignificant
	Lack of social interaction	Insignificant
	Lack of face to face synergy	Significant
	Lack of trust	Insignificant

Table 38 Summary

From the above table, only frequency of social media use has a noteworthy positive impact on overcoming lack of face to face synergy.

6.4 Clustering

Previous section hinted on existence of trends that could lead us to identification of patterns that could be exploited. Although 90% of those trends turned insignificant, they provided impetus for further investigation. In this investigation, possibility of a combinatorial parameter having a substantial bearing on the stance for us to exploit is explored.

Clusters were formed based on a cumulative value derived from parameters such as Frequency_ Internet, Frequency_ GoogleApplications, Frequency_ Facebook, Frequency_ LinkedIn, Frequency_ Twitter, Frequency_VideoConferencing (as described in 4.3.1), SocialMediaActive and SocialMediaUsed (as described in 6.1.1). A total of three clusters were formed, namely cluster 1, cluster 2 and cluster 3. Each of these clusters have records which were similar to records within their cluster than records in other clusters. Figure 28 shows the clusters. Cluster 3 contained records that had maximum score, Cluster 1 contained records with an intermediate score and cluster 2 contained records with least score.

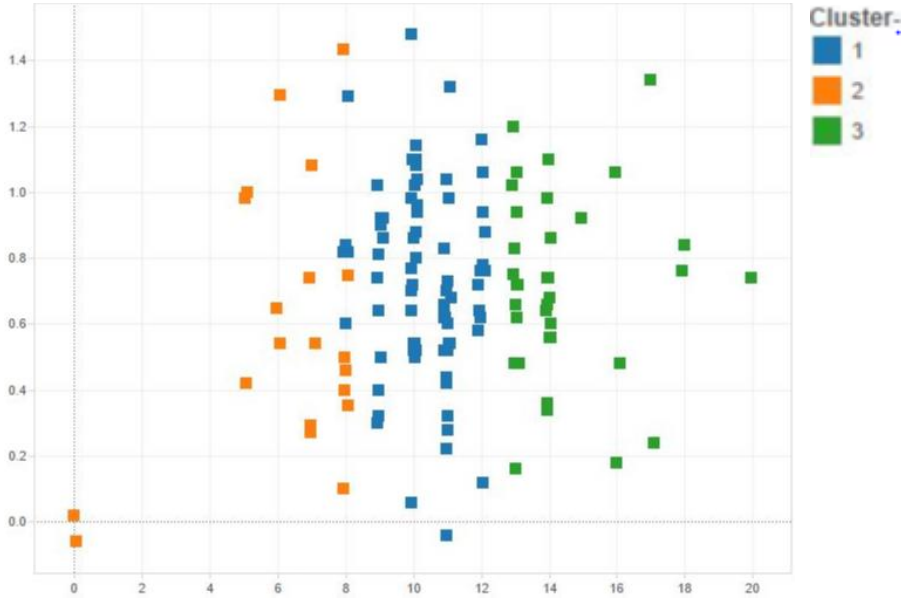

Figure 28 Clusters of records based on social media presence

6.4.1 Lack of physical Interaction

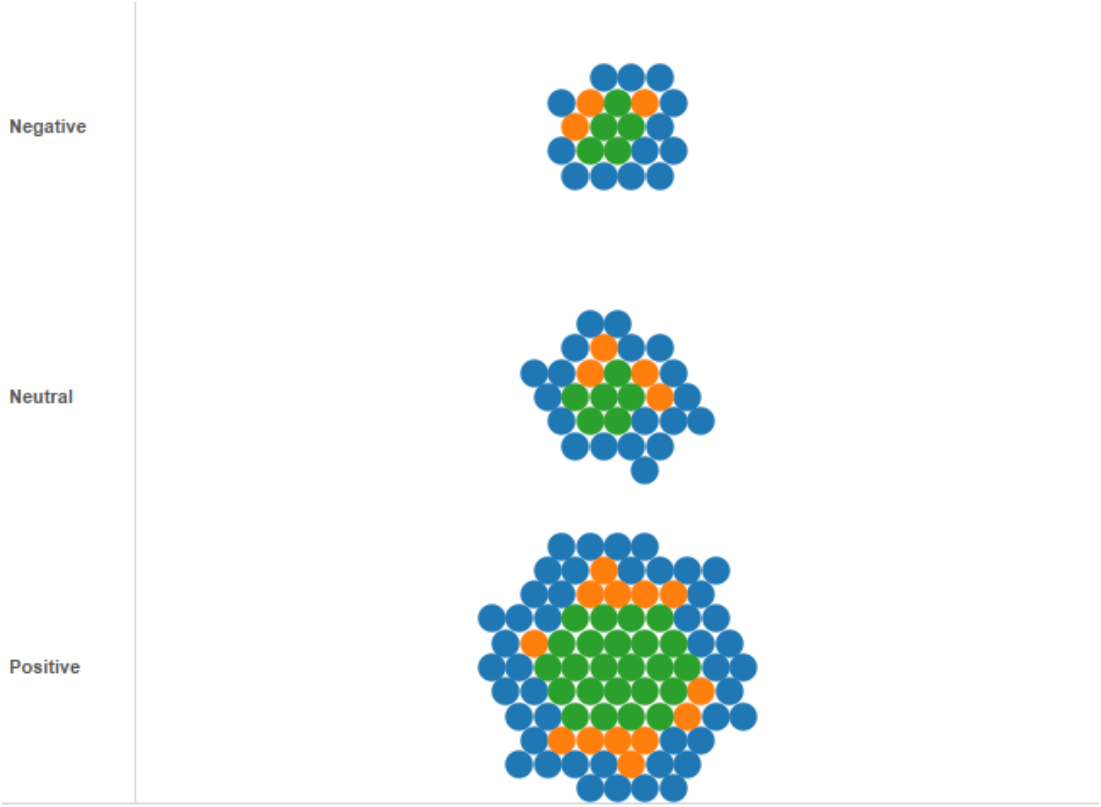

Figure 29 clusters versus Social media helping overcome lack of physical interaction

Figure 29 indicates how records within each cluster stack up against how social media helped in overcoming challenge: lack of physical interaction. Insights ascertained are as follows:

- Cluster 1: 17% sided with negative, 25% sided with neutral and 58% sided with positive on social media being helpful in overcoming the challenge
- Cluster 2: 15% sided with negative, 20% sided with neutral and 65% sided with positive on social media being helpful in overcoming the challenge
- Cluster 3: 14% sided with negative, 17% sided with neutral and 69% sided with positive on social media being helpful in overcoming the challenge

Most positive responses received are from cluster 3. This hints to existence of a pattern which is investigated further in the section below.

6.4.1.1 Cluster Evaluation

The responses of the above challenge were analysed on scale and frequency basis Details are illustrated in Table 39 below.

Analysis - Parameter : Lack of physical interaction			
	Scale	**Difference Increase**	**Statistical significance**
Population	0.613636364		
Cluster 3	0.623931624	1.67%	Insignificant: p-value = 0.347
	Frequency	**Difference Increase**	**Statistical Significance**
Population	62%		
Cluster 3	73%	11%	Insignificant: p-value = 0.265

Table 39 Cluster vs population evaluation

Insights

- The scale score of cluster 3 increased by 1.67% from the populations score. The frequency of positive responses also increased by 11% from the populations. These increment yielded to be insignificant.
- Digging further in cluster 3 vs population evaluation revealed increase in scale score across all age groups except for age group less than 21 years. Details are as follows
    - 10% decrease for age group less than 21 years
    - 3% increase for age group between 21 and 34 years
    - 8.57% increase for age group between 35 and 49 years
    - 41% increase for age group between 50 and 64 years

Inference

Reponses from cluster 3, the ones with increased presence on social media applications and internet, are appreciably more positive than the entire population. Implication being respondents across all age groups, except for age group less than 21 years, with the characteristics of cluster 3 are more likely to experience social media helping them overcome lack of physical interaction in virtual teams.

6.4.2 Lack of social Interaction

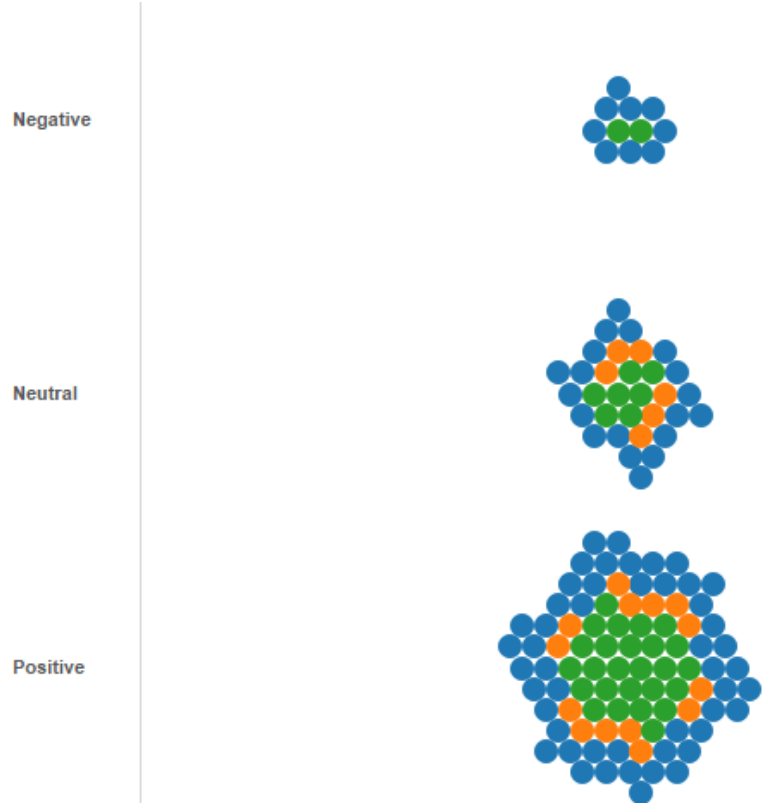

Figure 30 clusters versus Social media helping overcome lack of social interaction

Figure 30 indicates how records within each cluster stack up against how social media helped in overcoming challenge: lack of social interaction. Insights ascertained as follows

- Cluster 1: 12% sided with negative, 25% sided with neutral and 63% sided with positive on social media being helpful in overcoming the challenge
- Cluster 2: 0% sided with negative, 30% sided with neutral and 70% sided with positive on social media being helpful in overcoming the challenge
- Cluster 3: 6% sided with negative, 20% sided with neutral and 74% sided with positive on social media being helpful in overcoming the challenge

Most positive responses received are from cluster 3. This hints to existence of a pattern which is investigated further in the section below.

6.4.2.1 Cluster Evaluation

The responses of the above challenge were analysed on scale and frequency basis, details are illustrated in the Table 40.

Analysis - Parameter : Lack of social interaction			
	Scale	**Difference Increase**	**Statistical significance**
Population	0.803030303		
Cluster 3	0.811965812	1.11%	Insignificant: p-value = 0.18
	Frequency	**Difference Increase**	**Statistical Significance**
Population	67%		
Cluster 3	71%	4%	Insignificant: p-value = 0.2202

Table 40 Population versus Cluster 3

Insights

- The scale score of cluster 3 increased by 1.11% from the populations score. The frequency of positive responses also increased by 4% from the populations. These increment yielded to be insignificant
- Digging further in cluster 3 vs population evaluation revealed increase in scale score across all age groups except for age group between 21 and 34 years. Details are as follows
    - 42% increase for age group less than 21 years
    - 3.45% decrease for age group between 21 and 34 years
    - 47% increase for age group between 35 and 49 years
    - 31.24% increase for age group between 50 and 64 years

Inference

Reponses from cluster 3, the ones with increased presence on social media applications and internet, are appreciably more positive than populations. Implication being respondents across all age groups, except for age group between 21 and 34 years, with the characteristics of cluster 3 are more likely to experience social media helping them overcome lack of social interaction in virtual teams.

6.4.3 Lack of face to face synergy

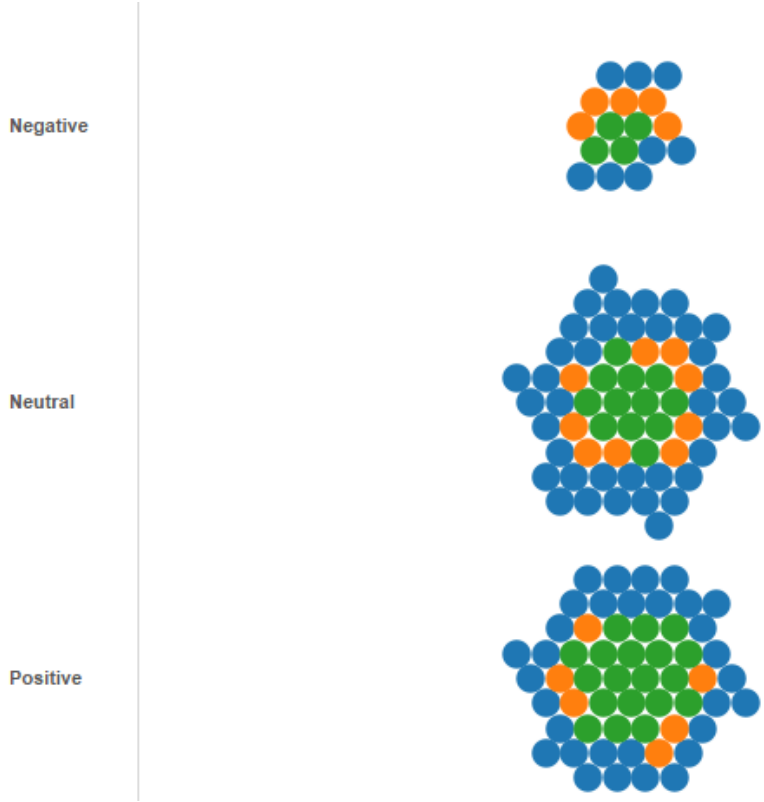

Figure 31 clusters versus Social media helping overcome lack of face to face synergy

Figure 31 indicates how records within each cluster stack up against how social media helped in overcoming challenge: lack of face to face synergies. Insights ascertained as follows

- Cluster 1: 10% sided with negative, 50% sided with neutral and 40% sided with positive on social media being helpful in overcoming the challenge.
- Cluster 2: 25% sided with negative, 45% sided with neutral and 30% sided with positive on social media being helpful in overcoming the challenge.
- Cluster 3: 12% sided with negative, 34% sided with neutral and 54% sided with positive on social media being helpful in overcoming the challenge.

Most positive responses received are from cluster 3. This hints to existence of a pattern which is investigated further in the section below.

6.4.3.1 Cluster Evaluation

The responses of the above challenge were analysed on scale and frequency basis, details are illustrated in the Table 41.

Analysis - Parameter : Lack of face to face synergy			
	Scale	**Difference Increase**	**Statistical significance**
Population	0.393939394		
Cluster 3	0.461538462	17%	Insignificant: p-value = 0.3069
	Frequency	**Difference Increase**	**Statistical Significance**
Population	42%		
Cluster 3	55%	13%	Insignificant: p-value = 0.2414

Table 41 Population versus Cluster 3

Insights

- The scale score of cluster 3 increased by 17% from the populations score. The frequency of positive responses also increased by 13% from the populations. These increment yielded to be insignificant
- Digging further in cluster 3 vs population evaluation revealed increase in scale score across all age groups except for age group less than 21 years. Details are as follows
    - 0% increase for age group less than 21 years
    - 4.94% increase for age group between 21 and 34 years
    - 16.67% increase for age group between 35 and 49 years
    - 14.28% increase for age group between 50 and 64 years

Inference

Reponses from cluster 3, the ones with increased presence on social media applications and internet, are appreciably more positive than populations. Implication being respondents across all age groups, except age group less than 21 years, with the characteristics of cluster 3 are more likely to experience social media helping them overcome lack of face to face synergy in virtual teams.

6.4.4 *Lack of Trust*

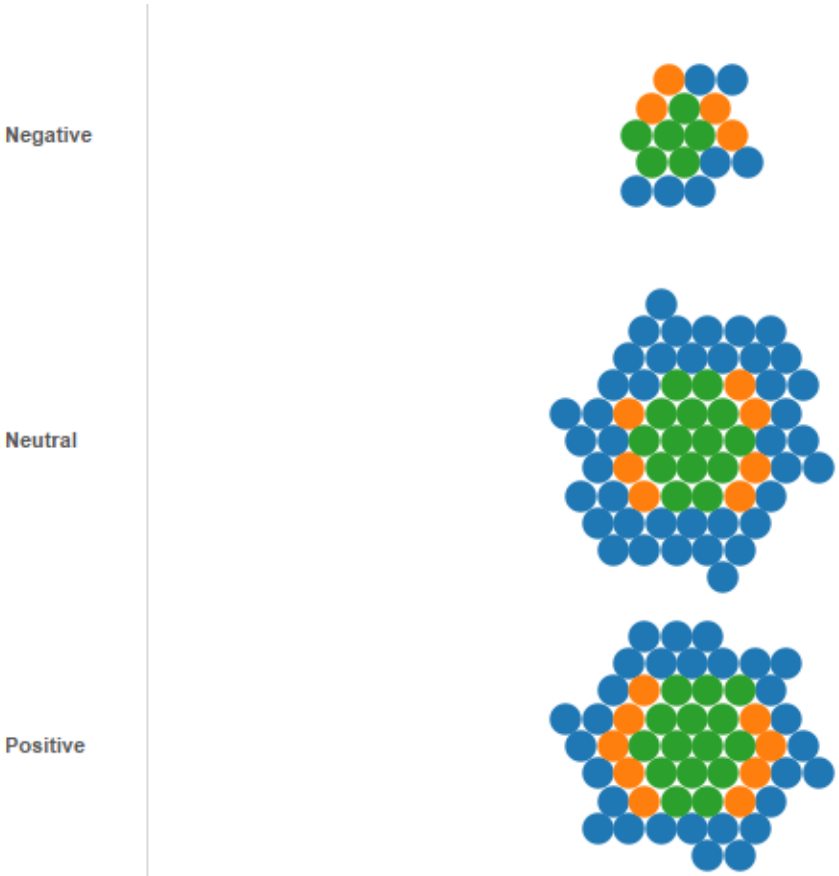

Figure 32 Clusters versus Social media helping overcome lack of trust

Figure 32 indicates how records within each cluster stack up against how social media helped in overcoming challenge: lack of trust. Insights ascertained as follows

- Cluster 1: 9% sided with negative, 53% sided with neutral and 38% sided with positive on social media being helpful in overcoming the challenge.
- Cluster 2: 20% sided with negative, 35% sided with neutral and 45% sided with positive on social media being helpful in overcoming the challenge.
- Cluster 3: 20% sided with negative, 46% sided with neutral and 50% sided with positive on social media being helpful in overcoming the challenge.

Most positive responses received are from cluster 3. This hints to existence of a pattern which is investigated further in the section below.

6.4.4.1 Cluster Evaluation

The responses of the above challenge were analysed on scale and frequency basis, details are illustrated in the Table 42.

Analysis - Parameter : Lack of trust			
	Scale	**Difference**	**Statistical significance**
Population	0.303030303		
Cluster 3	0.35042735	14%	Insignificant: p-value = 0.1489
	Frequency	**Difference**	**Statistical Significance**
Population	40%		
Cluster 3	45%	5%	Insignificant: p-value = 0.265

Table 42 Population vs Cluster 3

Insights

- The scale score of cluster 3 increased by 14% from the populations score. The frequency of positive responses also increased by 5% from the populations. These increment yielded to be insignificant.
- Digging further in cluster 3 vs population evaluation revealed increase in scale score across all age groups except for age group's less than 21 years and between 21 and 34 years. Details are as follows
    - 0.0% increase for age group less than 21 years
    - 0.05% decrease for age group between 21 and 34 years
    - 31.45% increase for age group between 35 and 49 years
    - 33.33% increase for age group between 50 and 64 years

Inference

Reponses from cluster 3, the ones with increased presence on social media applications and internet, are appreciably more positive than populations. Implication being respondents across all age groups, except age group's less than 21 years and between 21 and 34 years, with the characteristics of cluster 3 are more likely to experience social media helping them overcome lack of face to face synergy in virtual teams.

6.4.5 Summary

Cluster analysis ascertained that, increased presence and usage of social media leads to increase successful surmounting of challenges that ail virtual teams through social media.

Some of the interesting insights from comparison of the cluster, with increased social media usage, presence, and population analysis are as follows:

- Cluster reports higher positive impact of social media in overcoming the issues ailing virtual teams as opposed to population
- In the cluster, increase in positive impact (30 %) of social media is mostly for age groups between 35 and 49 years and between 50 and 64 years
- In terms of frequency of positive sentiment, cluster has a higher fraction than the population

The increase in the impact of social media however, for cluster is not statistically significant from that of the populations.

6.5 Discussions

In this section an elaborate discussion on patterns that emerged in the initial exploration phase and in thorough analysis phase is done.

Some of the insights obtained are as follows:

- Majority of the respondents use internet and social media
- Social media tools have been used for the purpose of virtual communication, with 16% of the respondents having used atleast 7 social media tools for the above purpose
- Among all the challenges faced during virtual communication, lack of social interaction, lack of physical interaction, lack of face to face synergy and lack of trust were identified as the ones that cause the most inconvenience

6.5.1 Social Media and Lack of physical Interaction

Only 32% of the respondents categorized this challenge as most significant. Of these 32%:

- 24% of them used most social media applications for virtual communication, frequented social media and internet on a daily basis
    - 67% of the 24% found social media helpful for this challenge
- 67% used the above in moderate amount and
    - 43% of the 67% found social media helpful for this challenge
- 9% used the above in least amount
    - 50% of the 9% found social media helpful for this challenge

Overall, 50% of the respondents who found this challenge critical found social media helpful.

Age group 50 to 64 years found this challenge most critical. Only 16.67% of them belonged to the group which use internet and social media more frequently. And, all of the 16.67% found social media helpful in overcoming the above challenges.

The overall response to this query was positive as seen in section 5.1.5. 62% percent of the respondents found social media helpful. 99% of the above respondents use internet regularly and have presence on social media but, analysis revealed that there is no significant trend between the frequency of usage of internet and social media and the response of social media helping overcome this challenge.

In conclusion, it is observed that although 62% of the respondents found social media helpful in this regard. Only 50% of the respondents, who found this challenge critical felt social media helpful. This number increases to 67% if respondents, who use more social media applications and frequent social media regularly are considered. Age group 50 to 64 years seems to be the biggest benefactor of use of more social media applications and greater social media presence.

6.5.2 Social Media and Lack of social Interaction

24% of the respondents categorized this challenge as most significant. Of these 24%,

- 31% of them used most social media applications for virtual communication, frequented social media and internet on a daily basis
    - 70% of the 31% found social media helpful for this challenge
- 53% used the above in moderate amount and
    - 63% of the 53% found social media helpful for this challenge
- 16% used the above in least amount
    - 90% of the 16% found social media helpful for this challenge

Overall, 69% of the respondents who found this challenge critical found social media helpful.

Age group 50 to 64 years found this challenge most critical, only 33.33% of them belonged to the group which use internet and social media more frequently. And, all of the 33.33% found social media neutral in overcoming the above challenges.

The overall response to this query was positive as seen in section 5.1.5. 67% percent of the respondents found social media helpful. 99% of the above respondents use internet regularly and have presence on social media but, analysis revealed that there is no significant trend between the frequency of usage of internet and social media and the response of social media helping overcome this challenge.

In conclusion, it is observed that although 67% of the respondents found social media helpful in this regard. 69% of the respondents, who found this challenge critical felt social media helpful. This number increases to 70% if respondents, who use more social media applications and frequent social media regularly are considered. Age group 50 to 64 years seems to be the biggest benefactor of use of more social media applications and greater social media presence.

6.5.3 Social Media and Lack of face to face synergy

Only 33% of the respondents categorized this challenge as most significant. Of these 33%,

- 21% of them used most social media applications for virtual communication, frequented social media and internet on a daily basis
    - 70% of the 21% found social media helpful for this challenge
- 67% used the above in moderate amount and
    - 34% of the 67% found social media helpful for this challenge
- 12% used the above in least amount
    - 40% of the 12% found social media helpful for this challenge

Overall, 50% of the respondents who found this challenge critical found social media helpful.

Age group 50 to 64 years found this challenge most critical, only 16.67% of them belonged to the group which use internet and social media more frequently. And, all of the 16.67% found social media helpful in overcoming the above challenges.

The overall response to this query was positive as seen in section 5.1.5. 42% percent of the respondents found social media helpful. 82% of the above respondents use internet regularly and have presence on social media but, analysis revealed that there is a significant trend between the frequency of usage of social media and the response of social media helping overcome this challenge across all age groups.

In conclusion, it is observed that 42% of the respondents found social media helpful in this regard. Only 33% of the respondents found this challenge critical and 50% of them found social media helpful. This number increases to 70% if respondents, who use more social media applications and frequent social media regularly are considered. Age group 50 to 64 years seems to be the biggest benefactor of use of more social media applications and greater social media presence.

6.5.4 Social Media and Lack of trust

Only 20% of the respondents categorized this challenge as most significant. Of these 20%,

- 27% of them used most social media applications for virtual communication, frequented social media and internet on a daily basis
    - 29% of the 27% found social media helpful for this challenge
- 69% used the above in moderate amount and
    - 56% of the 69% found social media helpful for this challenge
- 4% used the above in least amount
    - 0% of the 4% found social media helpful for this challenge

Overall, 50% of the respondents who found this challenge critical found social media helpful.

Age group 50 to 64 years found this challenge most critical, only 40% of them belonged to the group which use internet and social media more frequently. And, 50% found social media helpful in overcoming the above challenges.

The overall response to this query was positive as seen in section 5.1.5. 40% percent of the respondents found social media helpful. 82% of the above respondents use internet regularly and have presence on social media but, analysis revealed that there is a significant trend between the frequency of usage of social media and the response of social media helping overcome this challenge across all age groups.

In conclusion, it is observed that 40% of the respondents found social media helpful in this regard. Only 20% of the respondents found this challenge critical and 50% of them found social media helpful. This number decreases to 27% if respondents, who use more social media applications and frequent social media regularly are considered. This number increases to 40% if we just consider social media presence. Clearly lack of trust is the least resolved issue. Age group 50 to 64 years is the case in point.

6.5.5 Is social media the way forward for effective virtual team communication

Everybody in the age group less than 21 years agreed to the above statement. 85% of the age group between 21 and 34 years agreed to the above statement. 68% of the age group between 35 and 49 years agreed to the above statement. However, if those who use more social media applications and frequent social media regularly are considered then the number increases to 100%. 83% of the age group between 50 and 64 years agreed to the above statement. However, only 50% of this age group, who use more social media applications and frequent social media regularly agree to this.

Only 33% of the respondents who did not find social media helpful in overcoming any challenge agree to this statement. 85% of those who found social media helpful in overcoming lack of physical interaction and social interaction agreed to this. In the case of lack of face to face synergy and trust, 91% and 94% agreed to this respectively.

In conclusion, it is observed that 83% of the respondents agree to the above statement. Only a minority of respondents who did not find social media helpful agree to this. Age group 35 to 49 years agree to the above statement to a lesser extent however a higher social media presence could increase the odds. Also interesting to note is that a minority of those who found social media helpful in overcoming the challenge do not agree with social media being the way forward. This implies that there is an underlying wave of scepticism about this.

Chapter 7 - Conclusions and Recommendations

7.1 Summary

The purpose of the study was to establish a precedent for integrating social media with virtual teams to surmount issues such as lack of trust, lack of physical interaction, lack of face to face synergy and lack of social interaction that currently ails it and hindering it from replacing conventional teams. Initial exploration of the data revealed that social media does indeed help in overcoming the above issues. This confirmation is based on the mean scale value which were positive for the above issues. Majority of the respondents also agree that social media could be the way forward for virtual communication.

Other interesting insights identified are as follows:

- There exists some disparity in the amount of time spent by people on the internet and the proportion of internet time spent on social media.
- Video conferencing applications is the most popular social media for virtual communication
- Younger generation think social media is the way forward for virtual communication.
- Among the older generation (age group 35 to 49 and 50 to 64), those who have adapted to social media also share the above positive sentiment

Further analytical investigation such as trend analysis, cross tabulation, classification and clustering were done to identify existence of any patterns and if these patterns have any bearing on the responses to queries pertaining to possible integration of social media and virtual teams, and social media surmounting issues ailing virtual teams. The findings from each analysis are as follows:

- *Cross tabulation:* Of the respondents who agree to social media being helpful, majority use internet on a regular basis and have social media presence
- *Trend:* There is a significant trend between the challenge and social media usage, only in the case of social media overcoming lack of face to face synergy

- *Classification:* All the predictive models that were built in the hope of generalizing the positive sentiment using social media had high misclassification errors. This signifies that the positive sentiment could not be replicated by generalizing the models
- *Clustering:* Group of respondents with higher score calculated based on frequency of social media and internet usage, number of social media active in and number of social media used for virtual communication had better positive mean value scores and a higher positive sentiment as opposed to general populations with regards social media helping virtual teams with its issues. In this Group, Age category 50 to 64 and 35 to 49 exhibited the most increase in positive mean value score and positive sentiment. This increase however, was found to be statistically insignificant to the original score and sentiment exhibited by the general population.

From all the above findings it is clear that social media does help in overcoming the current ailing's of virtual teams and the general consensus is that integrating social media with virtual teams is a good notion going forward. This aligns perfectly with the objective of the research. Increased presence on social media is the cause for this stance. At the same time, there is also an inkling of sceptism present among those who found social helpful in overcoming issues pertaining to virtual teams with regards to integration of social media and virtual teams. Signalling a need for further investigation to be completely assured.

7.2 Contributions to Academic literature and Practice

The speculations put forward in the Literature Review depict that the conclusions from this study add valuable input to the academic world, as very little research has been carried out in this area. The conclusions have established, that the popular sentiment with regards to integration of social media with virtual media is that it is a good notion. This is on the basis that people have found social media helpful in overcoming the socio-emotional processes of virtual teams. This evidence is enough to mount a full investigation that could drastically advance the overall effectiveness of Virtual Teams and finally have virtual teams break ground which it has been threatening to do all along. If policy makers or Executive heads were to take these findings seriously, they

could restructure the entire concept of Virtual Teams by tapping into the vast potential that the Social Media has to offer.

7.3 Limitations and Future Work

The findings of this study suggest that social media could be the saviour for virtual teams. These findings however, cannot be generalized due to severe inequality in representation of different age categories that existed in respondent data. One of the ways to overcome this issue would be to speak to these individuals and use their views and kinesics as additional parameters for establishing precedent for the questions at hand. This however, was not feasible due to anonymous nature of survey. Also lack of literature on this subject played a significant role in the quality of the questionnaire designed. Social media as a concept is relatively new and is drastically different from traditional form of communication. It has just begun to penetrate the older generation and most of them are not social media savvy owing to their habituations to traditional forms of communication. Hence, their views could be less definitive than the younger generations, who are completely attuned to social media. This had an impact on the final results.

It would be interesting to re-visit this project five years from now, when more people are bound to have access to social media with all the talks of Wi-Fi air balloons etc., bringing in a whole new set of opinions presently not considered. This time gap will also mean that the older generation will have better sense of social media and a more definitive opinion on this subject. Additionally, having a verbal dialogue on this subject with the respondents to get a better sense of their standing could be incorporated. This is to be pursued as future work in the hopes that the findings of this would further add novelty to the academic literature on this subject.

Appendices

Appendix 1: Survey Questionnaire

Q1 Introduction: This research project is being conducted by Mohammed Azar and Swathy Rengarajan (MSc Business Analytics students, UCD Michael Smurfit Graduate Business School). This research initiative is supervised by Matt Glowatz (MIS, UCD School of Business, matt.glowatz@ucd.ie).

What is this research about?

The primary aim of this study is to measure the impact of Social Web Applications on global virtual team effectiveness.

Why are we conducting this research?

Social Media as we know has taken over every facet of our lives. Schools, Universities and several organizations including corporate and otherwise are connected virtually. In the competitive market, virtual teams represent a growing response to the need for fasting time-to-market, low cost and rapid solutions to complex organizational problems. So virtual teams enable organizations to pool the talents and expertise of employees and non-employees by eliminating time and space barriers. Some of the challenges faced by these virtual systems are:1. Lack of physical interaction2. Lack of Social interaction3. Loss of face to face synergies4. Lack of trust among others We would like to measure the impact of Social Media in eradicating the above barriers.

How will your privacy be protected?

If you take part in the study the research team will treat your contributions with the utmost confidentiality and in reporting the findings of this study we will exclude any identifying information.

What are the benefits of taking part in this research project?

The findings of this project will make a valuable contribution to our understanding of academics. The findings from this study will be presented at school level and at national and international conferences. The findings will also be submitted for publication in peer-reviewed journals. However, no individual participant will be identified in any publication or presentation.

What are the risks of taking part in this research project?

There are no known risks associated with participation. Contact details for further information If you have any further questions about the research or would like information on the findings, you can contact:

Mohammed Azar : mohammed.azar@ucdconnect.ie

Swathy Rengarajan : swathy.rengarajan@ucdconnect.ie

Matt Glowatz : matt.glowatz@ucd.ie

Thank you for taking part in this project.

Q2 Which age group do you belong to?

- Less than 21 (1)
- Between 21 and 34 years (2)
- Between 35 and 49 years (3)
- Between 50 and 64 (4)
- 65 and above (5)

Q3 Kindly specify your gender

- Male (1)
- Female (2)
- Do not wish to specify (3)

Q4 Which of the following describes your current position?

- ❍ Lecturer (3)
- ❍ Student (Full Time) (4)
- ❍ Student (Part Time) (5)
- ❍ Employee (6)
- ❍ Other (please specify) (7) _____

Q5 If you chose Employee or Student (Part Time) in the previous question, specify your role in the organization (e.g.: Manager, Software Engineer, Analyst etc.)

Q6 What Social media application have you used for effective virtual communication? (This can include Facebook or any other internal social media that you may use within your school/organization to overcome lack of physical interaction)

	Select whichever applicable (8)
Email (1)	❑
Internet (2)	❑
Google (3)	❑
Facebook (4)	❑
Twitter (5)	❑
LinkedIn (6)	❑
Google+ (7)	❑
YouTube (8)	❑
Video Conferencing (Skype etc.) (9)	❑
Other (please specify) (10)	❑
Other (please specify) (11)	❑

Table 42

Q7 How frequently do you use Social Media?

	Several Times in an hour (1)	Several times in a day (2)	Few times a Week (3)	Rarely use Social Media (4)	Do not use Social Media (6)
Email (1)	❍	❍	❍	❍	❍
Internet (2)	❍	❍	❍	❍	❍
Google (3)	❍	❍	❍	❍	❍
Facebook (4)	❍	❍	❍	❍	❍
Twitter (5)	❍	❍	❍	❍	❍
LinkedIn (6)	❍	❍	❍	❍	❍
Google+ (7)	❍	❍	❍	❍	❍
YouTube (8)	❍	❍	❍	❍	❍
Video Conferencing (Skype etc) (9)	❍	❍	❍	❍	❍

Table 43

Q8 Categorize the challenges you face while working with virtual teams. Select whichever appropriate.

	Most Significant challenge (1)	Medium Challenge (2)	No Challenge at all (3)
Collaborating solutions/interacting with your colleagues from around the globe (1)	❍	❍	❍
Help in getting in touch with each other especially when there is a geographical barrier (2)	❍	❍	❍
Overcoming cultural/Language barriers (3)	❍	❍	❍
Lack of physical interaction (4)	❍	❍	❍
Lack of social interaction (5)	❍	❍	❍
Lack of trust (6)	❍	❍	❍
Lack of face to face synergy (7)	❍	❍	❍
Any other challenges you can think of? (8)	❍	❍	❍

Table 44

Q9 How did Social Media help in overcoming the following challenges. Select the appropriate choice.

	Very helpful (1)	Somewhat helpful (2)	Neutral (3)	Not Helpful (4)	Did not help at all (5)
Lack of Physical Interaction (1)	❍	❍	❍	❍	❍
Lack of Social Interaction (2)	❍	❍	❍	❍	❍
Lack of Trust (3)	❍	❍	❍	❍	❍
Lack of face to face synergies (4)	❍	❍	❍	❍	❍

Table 45

Q10 Do you think Social Media is the way forward for effective virtual team communication given how it has managed to conquer every dimension?

❍ Yes (1)
❍ No (2)

Q11 Please outline any other comments you would like to make in relation to your perceptions of Social media applications for virtual meetings. (Optional)

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