Communication Strategies for Successful Virtual Team Projects in IT Sector

Dissertation submitted in part fulfilment of the requirement for the degree of masters in business administration (MBA) in project management at Dublin Business School in conjunction with Quality and Qualifications Ireland (QQI).

MBA in Project Management

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1 CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written. Further, texts cited are referenced from the original source. No material that has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

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SIGNED

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3 ABSTRACT:
The main objective of this research is to understand the impact of communication technologies on the success of IT virtual team projects. Communication technology has consequences for every virtual team project and its legacy will be measured by future generations. Much debate has ensured the perceived necessity of communication technologies in virtual team projects yet no study has ultimately proven the fact that whether advancement in communication technologies will create massive impact in virtual team's performance and ensure success.

The aims of this research are to establish understanding of virtual teams and its communication technologies in IT organizations, how communication technologies are used to improve virtual team performance, do current communication technologies fully satisfy the key needs of virtual team projects and whether future communication technologies can be used among the virtual teams to facilitate an increase in the productivity of the resources.

The research uses in-depth semi-structured interview, which is a qualitative method. Interviews involved project managers and software engineers from different IT organizations. The interviews were recorded, transcribed and analysed according to the thematic analysis. This research establishes that advancement in current communication technologies lead virtual teams in IT sector to ensure successful delivery of projects rather than to implement future communication technologies, which experiences unsustainable level of barriers both politically and technologically.

The researcher through secondary research, which is supported through primary research, acknowledges the need of two important theories that should be acknowledged by virtual team projects i.e. media richness theory and adaptive structuration theory. Advancement in the present communication technologies such as video conferencing and web-ex has a more profound positive effect in the success and development of virtual team projects.

In the conclusion, the researcher recognizes the advancement in current communication technologies. On that node video conferencing provides a strategic response to complex and unpredictable challenges faced by IT organizations. The research also founds that video-conferencing satisfies the key needs of the virtual team project and helps to reduce technological barriers such as miscommunication and information overload.
Keywords: Virtual teams, Communication technologies, Video-conferencing, Virtual team performance.

4 CHAPTER 1: INTRODUCTION
4.1 Rationale for topic

A Guide to the Project Management Body of Knowledge (PMBOK® Guide) defines Virtual team as group of people, who, with a common goal fulfil their roles with little or no time spent meeting face to face. The availability of successful communication technologies such as Video-conferencing, audio conferencing, social media, web-based meetings have made virtual team projects feasible and successful (PMI, 2013). The use of virtual teams by IT organizations can bring benefits such as more skilled resources, cost reduction, relocation expenses and the proximity of virtual team members.

The virtual team model makes it possible to:

- Form teams of people, who, from the same IT organization lives in widespread geographic areas.
- Add special expertise to a project team even though the expert is not in the same geographic area.
- Incorporate virtual team employees who work from home offices.
- Form virtual teams of people who work different shifts, hours, or days.
- Include people with mobility limitations or disabilities and move forward with virtual team projects that would have been ignored due to travel expenses (PMI, 2013).

In the 5th Edition of the PMBOK® Guide, released in 2013, the Project Management Institute (PMI) emphasis that virtual team projects vary based on the geographic location of its members. Communication technologies allow virtual team members in different locations or countries to work as virtual teams. Virtual teams rely on communication technologies such as video conferences, to coordinate their activities and exchange information about the project (PMI, 2013). The success of the virtual team project should be measured in terms of completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved between the project managers and virtual team members (PMI, 2013). The project manager is responsible and accountable for setting realistic and achievable boundaries for the project and to accomplish the project within the approved baselines.
There is a significant and substantial quantity of literature available on virtual teams and successful communication technologies for virtual teams. Moreover, several authors have highlighted the importance of communication technology for successful virtual team projects in the IT industry.

Nevertheless, a limited number of studies have been undertaken to evaluate the awareness and attitudes of virtual team projects in the IT industry to ensure project success by assessing the influence the communication technology approaches adopted in practice. The scope of these studies was limited to the IT industries in Ireland, India, USA and Canada.

The research expands on the previous studies by investigating the awareness and perception of communication technology amongst project managers and virtual team members of virtual team projects in the IT industry.

4.2 Research questions:

The research question is one of the most critical parts of any research. Saunders et al. (2009) argue that the clarity of the research question is determined by the extent to which a clear set of conclusions are drawn from the data collected. Additionally, it is very important to develop a research question that the researcher is concerned and interested in so that the researcher can completely focus on the research. (PMI, 2013)

What are the benefits and problems in virtual team projects due to communication technologies in IT Industry?

Sub Questions:

- Are there any significant relationships between performance of virtual teams and application of Communication technologies?
- What are the successful communication technologies used in virtual team projects?
- Do present communication technologies satisfy key needs of virtual team projects in IT sector?

The purpose of the research is to understand the role of communication technologies and the factors that influence how virtual team projects in the IT industry ensure project success from the perspectives of project managers and virtual team members.
The above question is accompanied by further research and figuring out importance of communication technologies and simultaneously examine the circumstances that influence the communication technologies and successful project delivery in the IT industry.

**What are the future communication technologies to enhance the productivity of the resources in virtual team projects?**

Sub Questions:

- What kind of impacts does future communication technologies create in virtual team projects?
- What are the most likely barriers that will forbid the implementation of the future Communication technologies?

The intent of the above research questions is to identify whether future communication technologies increase the productivity of resources and most likely barriers.

### 4.3 Research objectives

Saunders et al (2009) defines research objectives as clear, specific statements that identify what the researcher wishes to achieve as a result of doing the research. The following objectives are the focal point of the research dissertation:

A. To identify the theoretical basis and practical implementation of communication technology as recognized in Media richness theory and adaptive structuration theory and previous studies of the virtual teams in IT industry.

B. To determine the benefits and problems due to communication technologies and to identify which communication technology fully satisfy the key needs in virtual team projects.

C. To compare difference future communication technologies and present communication technologies

### 4.4 Researcher suitability

The researcher holds a degree in Business communications from Madras Christian College, India and has prior experience of working with IT organizations, India. The researcher is presently undertaking the Masters of Business Administration (MBA) program in Dublin Business School and will utilize the vast knowledge obtained in the course modules,
specifically the modules in Project Management, Strategic Management, International Management and Research Methods for the inquiry. Having worked in IT industry, the researcher has a proficient degree of interest in the subject. This is combined with the knowledge and research skills gained from the MBA program.

4.5 Recipient for this research

The research thesis is submitted as part of the curriculum of the MBA Project Management program at Dublin Business School in association with Quality and Qualifications Ireland (QQI) and Liverpool John Moore’s University. The principal recipient of the proposed dissertation will be Dublin Business School and Liverpool John Moore’s University. As the research is mainly intended to perform an investigation to understand the impact of communication technology for virtual team projects in the IT industry, it is anticipated that many of the respondents interviewed will be interested in the outcome of the research. Hence, a copy of the research results will be made available to the respondents following assessment of the thesis by the examinations board.

5 CHAPTER 2: Literature review

5.1 Introduction:

The literature review is a critical discussion, showing the awareness of differing arguments, theories, frameworks and approaches. There are numerous journals, books, articles and associated documents available in the communication technologies in virtual teams, but narrowing down the selected literature to the key focus areas is a crucial element of the literature review.

The literature review has been divided under eight main headings, namely virtual teams, project management in global virtual team projects, communication technologies in virtual team projects in IT sector, conceptual framework for successful virtual teams, theories on selection of communication tools and techniques, video-conferencing technology, Future communication technologies in virtual team projects, advancement in present communication technologies in IT industry. The basis for the sequence and selection of these categories corresponds to the evolutionary stages of the research question.
Virtual team projects are very common in today’s business environment, especially in IT Sector. As stated by Kerzner (2009, p. 352), project management is a face-to-face environment where team meetings involved all players convening together in one room. Mihailova (2007) emphasizes that recent developments in the field of communication technology has enabled organizations to start using so-called virtual teams. Today, because of the complexity and size of projects, it’s unimaginable to get all team members located under the same ceiling. Virtual team members in IT sector is settled in different geographical positions, time zones and depend upon electronic communication. As defined by Martins (2004) virtual team projects in IT sector differ from other teams as virtual team members communicate with one another across geographical distances using computer-mediated technologies. Duarte and Snyder (2001) explains that development of the internet and communication technology in IT sector allowed for the emergence of virtual team projects in various types of projects such as product development, design and software development, IT programming, IT cloud services and customer support etc.

There are more controversies that exists in the literature about what exactly constitutes a virtual team. The last twenty years has not produced any agreed definition on virtual team. However, various definitions of virtual team shows considerable overlap in how they are defined by differences not seeming so important. A study by martin states that all organizational teams at the moment are virtual to some extent (Martin, 2004). Members of virtual teams moved away from working with people who are in our visual proximity to working with people around the globe (Johnson et al., 2001).

5.2 Virtual teams

PMBOK (2013) defines virtual teams are group of people with a shared goal who fulfil their roles with no time spent meeting face to face interaction. Dekker (2008) defines virtual team are technology-mediated groups of people from different geographical locations that work on common tasks. Young and Pauleen (2001) define virtual team as a management model that is being used worldwide. R. Lau (2004) defines virtual team as a group of people who use electronic means to communicate with each other rather than having face-to-face meetings. Communication is fundamental to any form of organizing, but it is pre-eminently in virtual team’s projects in IT sector. Without proper communication, the boundary spanning among virtual entities is not possible.
Communication technologies in virtual teams helps team members to connect across distance, time, culture, departments (Mihailova, 2007). Communication technologies unlocks the constraints, making it possible for virtual team projects that are geographically distant to exchange project information or messages with one another (Feldman, 1987).

The current technology is that virtual team can technically function well in large parts of the world. Employees who lives in different locations can have access to new communications technologies such as video-conferencing. The real strength of the virtual teams in IT sector is recognised when relationships exists among technologically linked firms or organisations produce innovative different communication technologies that yields product modernization (Ring, 1994). Concurrently, communication is likely to become more relationship based as they seek an interpersonal basis of transactions which creates relationship by means of trust and technology.

Pauleen and Young (2001) states that the utmost challenge in virtual team projects in IT sector is building proper communication within the virtual team projects. Problems that are associated with virtual team communication have been the subject of hundreds of case studies listing variations of the dilemmas. Members of virtual team’s projects in IT sector must have trust and efficiently use of communication technologies in order to increase virtual team performance.

According to Speechley (2005), "The historic legacy of a traditional bureaucracy have a habit of providing a wide range of assumptions about virtual team projects and leadership based concept that virtual teams largely operate at the same speed, with the same time, at the same people, with similar cultural backgrounds and place". Today, virtual team projects does not essentially operate on these historical principles. Efficient usage of communication technologies meets the demands of a communication gap within the virtual teams.
Figure 1: Various types of virtual teams.

Figure 1 illustrated various types of virtual teams in different organisations. Effective use of communication technologies in virtual team projects have proven benefits that includes customer focused, cost reductions, and upgraded ability to handle complexity and tough situations, more innovative and risk-taking (Speechley, 2005). Binder (2007) also states the challenges project managers experience managers experience many challenges working in global virtual team projects are distant geographical locations, Cultural differences and different languages.

Zofi (2011) states that project managers face the challenges working in virtual team projects such as the challenge of building virtual relationship, the challenge of evaluating, observing, measuring and assessing the work done together by skilful virtual team members development. The advent of communication technologies such as Internet, social media and video-conferencing technologies phenomena, have changed many virtual teams into modern workplaces. Virtual team projects in IT sector is one where group of people work interdependently with a mutual purpose across time, space, and organizational boundaries using communication technology (Lipnack & Stamps, 2000). In virtual team projects, the project managers are responsible for outcome since the members are dispersed geographically.

Successful virtual team works are spaced out more than in the same location, the team solves teething troubles and makes decisions jointly, and usually has lesser than 20 members.
Robert McGarvey says it is not surprising that successful virtual teams are so popular with the profits and benefits they provide to the organization.

Furthermore, the virtual team project succeeds being more creative and efficient usage of communication strategies, more proficient of dealing with complex difficulties. Virtual teams in IT sector help their organizations by cutting down on cost and time, allowing companies to use people who are reluctant to relocate, and allowing companies to easily add new team members.

Lewis (2009) states that proper usage of communication technologies is a key ingredient in successful virtual organizations. Henry and Hartzler (1997) states that IT organizations in virtual teams must truly consider the following in order to successfully deliver virtual team projects:

- To spend the money and time in developing communication technologies which is necessary for a virtual meeting.
- To invest in communication technologies addressing the virtual team's goals and needs.
- To train members in the virtual team projects in IT sector how to use communication software and hardware, methodologies for joint problem-solving, communication management, database management and project management.
- To stress the necessity to share critical information, Failure to consider these elements will surge a virtual team projects possibility of failure (Henry and Hartzler, 1997).

Global virtual teams is a group of individuals working across space, time and organizational boundaries with links bound by webs of communication technologies. They possess complementary skills, are committed to a common purpose, have specific goals, and share a work approach which holds them mutually accountable. Global virtual team allows IT organizations to hire and retain the people regardless of location. Southers (2002) Members of a virtual team communicate electronically through video-conferencing and therefore they never have face-to-face interactions. However, most virtual teams will meet at some point in time (Paris-Carew, 2002).
Cohen and Gibson (2003), states the concept of virtual teams has three major attributes. First, it is task oriented, have shared responsibilities for outcomes, and collectively manages relationships across organisational boundaries. Second, virtual team members who are geographically dispersed; and third, they rely on technology-mediated communication such as video-conferencing rather than face-to-face interaction to accomplish tasks.

5.3 Project Management in global virtual team projects:

PMBOK (2013) influences that IT Organizations are increasingly implementing globally distributed software communication technologies, considerably impacting the IT industry and the world economy as a whole. In doing this, many organisations are establishing virtual team projects. Difficulty is that project management must change from the traditional to the virtual for this strategy to be successfully implemented.

While distance in itself introduces barriers and complexity into the management of a globally distributed virtual team projects, other factors also come into play. Communication between virtual team members is normally electronic with inadequate opportunities for sharing the knowledge, depending on time-based difference (PMBOK et al., 2013) Communication, cooperation, visibility are all negatively impacted by distance. If these are not managed correctly, they can cause further barriers and complexity within a project (see Figure 2).

![Figure 2: Virtual team environment](image-url)
As with virtual team projects, coordination includes risk evaluation and project planning. Nevertheless, for the virtual team projects, work and communication must be partitioned between various sites. Furthermore, there is a requirement for the effective utilization of communication technology between locations for successful delivery of virtual team projects. Project planning and Procedures should be put in place to facilitate the level of cooperation between geographically dispersed virtual team members. To increase the performance and productivity within the virtual team, identification and addressing of problems must be ensured that roles and responsibilities are clearly voiced, with each team member knowing what is required for a project success. This requires effective communication technologies, reporting schedules and structures keeping virtual team members informed of progress.

There is a requirement for communication technologies into the virtual team’s operations and activities at all locations. Virtual project management must ensure that communication technologies difficulties do not become a barrier to virtual team projects. This requires proper usage of communication tools and technologies which are easily understood and utilised by all virtual team members.

Therefore, the role of a project manager in the virtual team projects in IT industry is no longer simply to coordinate and manage virtual team activities. To be successful in delivering their projects, they must fully satisfy the key needs of the globally distributed virtual team operations, monitoring and controlling the additional technical barriers such as miscommunication, information overload which occurs due to inadequate use of communication technologies in virtual team projects.

5.4 Communication technology in virtual team projects in IT sector:

Effective virtual team projects must be proficient of determining how to use communication technologies in order to provide essential environment for creative work. This characteristically involves estimating the degree of teamwork required for virtual team projects success and choosing appropriate communication technologies and media based on their requirements (Bell and Kozlowski, 2002). Eger (2006) explains that most of the IT organisations as well as several business companies must now "adapt their own mode of communications technologies and infrastructure to satisfy their key needs and also to ensure that performances is increased."
Ingason (2010) and Taylor (2008) states that communication technology creates a bridge between project managers and virtual team member who is involved in the project. Communication technology is the base for virtual team success as illustrated in figure 3.

With the advent of the internet and web-based video conferencing technologies, supported by the virtually omnipresent availability of high-standard bandwidth, reduces the need for face-to-face human interaction. Computer-mediated communication technologies such as video-conferencing plays a dominant role in virtual team projects and also transforms the virtual team from an innovative source of competitive advantage.

5.5 Conceptual framework in successful virtual team projects:

Communication Technology delivers a crucial channel of communication, exclusively in a virtual team projects in IT environment. There is no doubt that communication technologies in virtual team projects are a very effective way of bringing together the most appropriate set of skills and experience of virtual team members in order to meet business objectives without the costs and technical problems that exist in virtual team projects on a regular basis. However, advancement in present communication technologies resolves significant challenges that virtual teams in IT organizations faces in a pro-active way.
The experience in using these communication technologies by virtual team projects has been mixed at best, and the literature has gaps in offering satisfactory explanation about the role of communication technologies in virtual teams that require satisfactory performance to enhance successful delivery of virtual team projects. To address this gap, researcher has developed a conceptual framework to understand the critical role that communication technologies plays to increase virtual team performance.

**Figure 4: Conceptual framework in successful virtual team projects.**

The backdrop for this conceptual framework states the emergence and advancement in communications technologies that allow virtual team members to interact almost as if they were face-to-face (e.g., Video conferencing, web-ex). Explicitly, the advancement in present communication technologies such as The Cisco Telepresence MX Series, the new Crestron RL-video-conferencing has triggered effective technological developments in the virtual team.
projects to increase the performance and successful delivery of virtual team projects. The study is motivated by a need to develop a better understanding of communication technology in virtual team projects. Technical and Managerial issues faced by virtual team projects, such as conflicts management, miscommunication and information overload can be resolved through advancement of present communication technologies such as video-conferencing, web-ex in virtual team projects.

5.6 Theories on selection of communication tools and technologies:

In classifying and selecting communication technologies for the use in successful virtual team projects, two theories i.e. Media richness theory and Adaptive structuration theory are widely applied.

5.6.1 Media Richness theory:

Media Richness Theory is widely used to define the ability of communication media to transfer information within the virtual teams. Building on the media richness theory, Newberry (2001) ranked seven different media types from richest hierarchy to leanest media. His definition states that rich media carries the most information, whereas lean media is media carries the least information.

Newberry (2001) ranked them into a hierarchy from high to low that resulted in the following: face-to-face interaction, video conferencing, synchronous audio, text-based chat, e-mail/asynchronous audio. From a functional perspective, virtual team members typically uses rich media and new technologies, such as video conferencing which increases virtual team performances. It assumes that the information in organizations process reduces uncertainty. Media Richness Theory recommends that media differs in the levels of richness they provide.
The Media Richness Theory further recommends high media synchronicity which will be more effective. For most completion of tasks, the use of one medium alone is not sufficient to achieve ultimate communication performance and due to that reason many tasks require convergence.

5.6.2 Adaptive structuration theory:
Adaptive structuration theory explains the matching of communication technologies with the tasks and objectives of virtual team projects (Rice & Gattiker, 1999). Moreover, adaptive structuration theory refers to how virtual teams use the technologies in the social contexts and which communication technologies virtual teams’ use. Kahai and cooper (2003) states the factors that influence the decision of virtual teams on which communication technologies to choose and how to use them, including the availability, familiarity and appropriateness of the technology to the task, time constraints.

Beranek and Martz (2005) found that, communication technology play a fundamental role in virtual team’s projects in IT industry. In depth, two major factors that contribute success to most virtual team’s projects are, the development of information and communication technologies and the internet media. Kimball and Eunice (1999) explain that communication technologies that exist among virtual team members such as electronic mail or instant messaging system is not sufficient in today’s world. Successful virtual team projects require more than just access to cutting-edge technology (Kimaball and Eunice, 1999).

Maznevski & Chudoba, (2000) have reported the amount of communication technologies used by virtual team members as positively related to virtual team performance. Some of the communication technologies for virtual team projects are only appropriate for same-
time/different-location teams (e.g., videoconferencing, audio conferencing) while some are more appropriate for different-time/different-location teams (e.g., videoconferencing playback, electronic mail).

Ambrozek and Cothrel (2004) distinguishes between synchronous and asynchronous technologies. Synchronous communication is when information is sent and received almost simultaneously (e.g., videoconferencing). Meanwhile, asynchronous communication is when the receiver receives the information at a different time than when it was sent. This research focus on videoconferencing. Virtual team members can communicate by sending electronic mail, making a phone call, or having a videoconference. Since video conferencing technologies closely simulates face-to-face communication, media richness theories states that it certainly much richer media than the telephone or instant messaging.

Armstrong, (2000) emphasis that communication technologies that support the virtual team projects are only as good as their application, and unless virtual teams converse the expectations for using different communication technologies, the technologies will not bridge the distances between geographically dispersed virtual team members.

Aleander, (2000) communication technologies to be effective, virtual team projects in IT industry must select them based on the task, virtual team member’s skills and organizational capability but not based on the sake of using the technology itself. The research conducted by Tucker and Panteli (2003), results conveys that virtual teams regularly communicates with each other using the video conferencing, that provide a high degree of situation awareness and trust.

Consistent with both the media richness theory and Adaptive structuration theory assumptions, Purdue and uwex (2007) found that virtual team members typically involved in using communication technologies such as video-conferencing which imitates regular face-to-face interaction meets the specific requirements of the virtual team and processes of the organisation. Attaran (2003) states that most of the virtual teams in current generations uses video conferencing and web-based collaborations environments since it is easily accessible

Based on the discussion theories so far, the most suitable communication technology for successful virtual teams is videoconferencing because it so closely simulates face-to-face conversions, with certain bounds. Videoconferencing enables virtual teams projects in IT sector to overcome some of the identified problems mentioned earlier and improve virtual team performance.
5.7 Videoconferencing technology:

Videoconferencing is communication technology that uses video, computing, in order to enable virtual teams in different locations to meet virtually face-to-face and perform their tasks in the same way as they would perform them if all virtual team members were at the same site (Purdue, 2007). Videoconferencing transmits video and audio concurrently between two or more sites in both directions. Virtual team members of a videoconference can speak, hear and interact with people dispersed around the globe (Uwex, 2007). In the literature, the terms communication technology, videoconference system are used to address videoconferencing.

Videoconferencing technology are been widely used for communicating with numerous virtual teams purposes. In General, they are used to facilitate various types of virtual team projects meetings. Additional possibilities comprises emergency response applications, telecommuting, tele Education, judicial application and remote laboratories (Vide, 2007). Purdue (2007) states that Victual team projects includes usage of two types of videoconferencing that mainly exist.

(a) **Point-to-point videoconferencing**: a videoconference between two sites or localities. The virtual team member who initiate the conference dials the other video site or locality to start the conference. Each side has their own capabilities such as chatting and sharing the documents.

b) **Multi-point videoconferencing**: a videoconference concerning more than two locations. Three or more participants of virtual teams can sit in a "virtual conference room" and communicate effectively as if they have face-to-face interaction in the same room. Multi-point videoconferencing needs the use of a multi-point control unit.

5.7.1 Desktop videoconferencing system

This is the simplest form of videoconferencing and it creates the finest technique of interaction between virtual teams. Even though virtual teams are possible with simple e-mail systems and telephones, DVCS recreates the face to-face interactions with virtual teams, making possible the more complex levels of communication among virtual team members.

Though technologically sophisticated, the DVCS is comparatively simple system for virtual team members to operate. A small camera mounted on top of the computer monitor provides
the video feed to the system; voice transmissions function through microphone or speakerphone. Connection to other team members is managed through software such as skype on the user's computer in order to ensure proper understanding, the software uses an on-screen version of a traditional telephone to control the system. The final element of the system is a high-speed data connection, which may be accomplished through local area network connections. DVCS creates possible two primary types of group communication:

1. All team members are vigorously connected in a session. With current technology, groups of up to five teen virtual team members can simultaneously videoconference, means that each virtual team member can see and hear up to fourteen other team members on his/her computer monitor.

2. A face-to-face group interaction is possible with outside resource. DVCS can be used for individual interaction also permits a conference table of virtual team members to have a traditional teleconference with one or more outside resource. Since DVCS allows multiple conference connections, a local virtual group can connect with up to fifteen different groups or individuals.

5.7.2 **Room-based videoconferencing:**
Traditionally, room-based videoconferencing technology dominates the entire videoconferencing set-up. More over developments in technology-especially transmission over IP-have empowered videoconferencing from one personal desktop computer to another (desktop videoconferencing). This type of videoconferencing is now becoming more widely used in IT sectors virtual team projects. (Texas State Library, 2007).

There are several types of videoconferencing technologies based on the number of sites involved (point-to-point versus multi-point) and equipment involved (desktop videoconferencing versus room-based videoconferencing). The next theme is how two or more sites can be connected to each other. Based on this viewpoint, three major types of interactive videoconferencing are available (Uwex, 2007).

- **Compressed videoconferencing:** a CODEC is been used to compress the television video and audio signals from an analog to a digital signal for transmission via ISDN phone lines or the internet. The CODEC decompress the digital signal to an analog signal.
- **IP videoconferencing:** a H.323 standard technology is been widely used to connect locations to videoconferencing via the internet.
- **DS 3 videoconferencing**: full motion, two-way video, voice, and data communications transmitted over a fibre optic network.

Currently, the first two options (ISDN lines and IP-based lines) are the most extensively used in virtual team projects despite their considerable differences (LeMair and Shae, 1997). These two options will be explored more deeply.

The H.320 protocol outlines how real-time multimedia communication and video conferencing are handled over ISDN telecommunication links. It’s an international standard network of the International Telecommunications Union. The digital stream is transmitted via the ISDN telecommunication lines to the remote site, where it is decoded, uncompressed and displayed on the remote user's display (North-western University, 2007). But, H.320 terminals are expensive and it possess significant cost associated with their usage (Purdue, 2007). This protocol uses the internet as the medium to transmit video and audio.

Videoconferencing concurrently transmits video and audio between two sides in both directions (Uvex, 2007). Using videoconferencing results several key benefits for virtual team projects in IT sector. One noticeable benefit is reduced travel costs (Bland, 2007) since virtual team members do not have to travel to one site. In addition, using videoconferencing technology saves a lot of time since virtual team members do not need to be off site during a virtual team meeting (Bland, 2007), leads to increase productivity. Likewise, with the advances in the internet and communication technology videoconferencing has become more developed and affordable (Ohlhorst, 2002). Videoconferencing closely simulates face-to-face meetings as virtual team members can see body language and facial expressions of other virtual team members (Picture phone, 2007), gaining the benefits often acquired from non-verbal communication.

Videoconferencing technology still has numerous disadvantages that must be addressed. Virtual Team members in different time zones who want to communicate through real-time videoconferencing run into problems in identifying a time that works for all virtual team members in IT sector (Gould, 2002). Moreover, virtual team members might feel uncomfortable in videoconferencing situations because some of them hesitates to talk in front of a camera. Technological issues of videoconferencing leads to complex problems as it requires all sites to have basic equipment (Picture phone, 2007) and systems that are compatible with one another and work on the same protocol (Purdue, 2007). This technological issue becomes effective when virtual team members trying to connect different
sites to videoconferences. Likewise, low-quality images can be a serious hurdle for videoconferencing (Duarte and Snyder, 1999, p. 39).

Virtual team’s projects in IT sector uses entire range of different technologies to ensure success. Videoconferencing makes collaboration between virtual team members similar to a face-to-face meeting. The task the virtual team needs to perform can determine which of the four identified types of videoconferences is most suitable for the virtual team. Desktop videoconferencing is more appropriate for simpler tasks and teams in which participants collaborate on a regular basis. Meanwhile, room-based videoconferencing is more suitable for performing complex tasks on a virtual team. Selecting the appropriate type of videoconferencing will enable virtual teams to improve their performance.

<table>
<thead>
<tr>
<th>Main Purpose</th>
<th>VC (%)</th>
<th>FTF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference/seminar</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Education/course</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Project work</td>
<td>53</td>
<td>30</td>
</tr>
<tr>
<td>Information exchange</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>Negotiation/discussion</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Marketing/sale/product demonstration</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Service</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Consultancy</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Board meeting and management meeting</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

**Figure 6: Usage of Video-conferencing technology in global virtual teams.**
Source: Gary Hamilton, Gareth Byatt and Jeff Hodgkinson (2010)

Videoconferencing is a communication technology frequently used in virtual teams projects in IT sector. Figure One possible explanation for its popularity lies in fact that is closely simulates face-to-face collaboration and brings participants the benefits of non-verbal communication. From this point of view, researcher considers videoconferencing to be the most appropriate tool for performing work in virtual teams.

5.8 **Future communication technologies for successful virtual team projects:**

The following section summarizes key emerging future technologies that the literature identifies as potential opportunities for enhancing creativity within virtual teams and increase in the productivity of resources in the future. These technologies are The Cisco Telepresence MX series, the new Crestron RL, Quantum Computing, Collaboration in 3D Web, cloud applications, advancement in present communication technologies, Nanotechnology. These discussions are purely a summary of each technology which enables virtual teams to resolve
the technical issues such as miscommunication and information overload and to ensure success in virtual team projects.

5.8.1 The Cisco Telepresence MX Series

Christopher Maione (2014) describes Cisco Telepresence MX series consists of four fully integrated videoconferencing systems capable enough of turning a room into a video collaboration hub. The MX200G2 and MX300G2 offer easy installation/deployment and this communication technology is designed for virtual team projects in IT sector, communication can be quickly and easily set up and its cost effective. The Tele-Presence SX10 Quick Set is a video collaboration set-top solution offering quality video communications for Virtual teams or virtual meetings.

Tele-Presence SX80 Codec is a video and audio engine that enables high-definition video applications in advanced virtual environment, delivers up to 1080p60 end-to-end high-definition (HD) video.

5.8.2 The New Crestron RL

The New Crestron RL is yet another all-in one videoconferencing and telepresence solution that combines the features of Microsoft Lync which enables virtual team to connect, share, and collaborate communication regardless of their geographic location. Crestron is Developed in alliance with Microsoft, includes high-definition, multi-party video which shares desktop or applications as well as collaborative white boarding in a complete solution tailored for the virtual meeting room. (Christopher Maione, 2014)

Video Conferencing technology is advancing rapidly, with functionality available on different platforms such as mobile phones, personal digital assistants, laptops, PCs and networks such as wireless fidelity and internet protocol which helps virtual teams to communicate anytime, anywhere.

5.8.3 Quantum Computing:

Bloom and Miller (2002) theoretically states that quantum computers will have such unexpected processing speed capability which resolves virtual team’s complex problems and miscommunications that take years to present technologies. Smolin (2002) emphasis that with quantum computing technology has the ability to replicate emotions, humour and creative ideas of brain for virtual teams use.
5.8.4 Collaboration in 3D Web:
Forrester research (2008) predicts that the 3D web will create greater impact for virtual teams to communicate with each other in graphically enhanced virtual worlds or web spaces. Currently, virtual worlds such as Second Life, or Sun’s MPK20, and 3D web programs such as 3B, gives the feel for what the 3D Web influence like.

3D web provides a better understanding for virtual teams on adding the visual representation of a person with an avatar, allowing for some body language through the avatar, and giving the virtual meeting a “physical” space would do to group perceptions of the meeting and how satisfied they would be with the collaboration process and outcome. Furthermore, visual dimensions of virtual worlds affected the way that group members talked with each other and conducted their group task.

It is a 3D virtual environment where individuals can interact with each other using “avatars and software agents”. Individuals can communicate and collaborate in this virtual world on a professional or personal level. Some companies are exploring virtual worlds as environments for virtual teams and other contexts.

5.8.5 Cloud applications
This new communication technology permits virtual team members to operate software and applications from an online environment. Virtual team members can store data related to virtual team projects on remote location and is accessible from any Internet-connected device. Virtual teams can store all project data in one shared location. Chance of document redundancy on different computers is reduced. Single location ensures the document's most current version is utilized.

5.8.6 Advancement in present technologies:
Penland (2002) states that videoconferencing one of the most advanced and useful technologies for today's creative virtual teams. This visual data emulates the presence of the other person more so than voice increasing the likelihood of establishing trust amongst the members, more accurate interpretation of message content, and provides additional visual cues that result in an increase of free flow information (Penland, 2002). The current trend is to add the capability of web-conferencing, providing video, voice, graphics, and other data to all parties simultaneously (Ambrozek and Cothrel, 2004)

Video conferencing allows two or more people to see and hear one another in full motion video while being in different locations” East Carolina University (2006). This synchronous
communication can be accessed using several different communication mediums. The earliest video conferencing capabilities evolved after the invention of televisions using two closed circuit television systems connected by landline cable (Razmerita et al., 2009).

The basics of videoconferencing include the capture of video through a camera system, compressing the data using CODEC equipment, transmitting the data through a digital network, decoding it on the other side of the transmission, and displaying the images on a display device. The initial systems were very expensive for teams to acquire because they not only had to purchase the hardware needed but they also had to incur recurring costs for the communication service. As the industry has moved away from highly proprietary equipment and towards a standards-based technology, video conferencing has become more accessible and affordable for virtual teams. There are currently two types of systems to exchange real-time video: dedicated systems and desktop systems. For virtual teams working out of various offices, the dedicated systems provide higher quality and better security. However, as it becomes more common for creative teams to include individuals working in remote areas, the desktop capability offers visual cues through low-cost technology.

Advancement in Web 2.0 technologies enhances virtual team’s ability to interact and create a strategic advantage (Razmerita et al., 2009). With older technologies virtual teams could not operate to their fullest potential due to delays in technology delivery speeds and costs; however, with Web 2.0 technologies virtual teams can interact in real-time where members are able to provide input, receive immediate feedback, and respond without delays.

Web 2.0 technologies improve the project manager’s ability to manage knowledge. As mentioned earlier virtual teams can use Wikis, blogs and forums. Companies such as IBM are encouraging virtual teams to create, change, and delete data from Wikis. The information shared in these blogs is technical expertise that is difficult to replace. IBM retains this knowledge so future project managers or teams can access to assist in risk mitigation, cost analysis, project estimations at any other point in the project life cycle. Some individuals are reluctant to provide the knowledge because it is a form of power and release of this power could result in job loss (Razmerita, 2009).

5.9 Literature Conclusion:

Study indicates that Video conferencing is a central choice for virtual team meetings with members and project managers located at various remote sites. Researcher stresses the fact
that, the use of communication technology in virtual team project is significant, particularly in IT organizations with multiple locations. Even though communication technologies such as instant messaging, emails are still predominant, video conferencing technology for Virtual team based on Internet protocol networks are often preferred by IT organizations.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Audio</th>
<th>Video</th>
<th>Data</th>
<th>Real-time</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>best possible</td>
<td>best possible</td>
<td>-</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>H-Res video conferencing</td>
<td>very good</td>
<td>excellent</td>
<td>-</td>
<td>Y</td>
<td>Halo</td>
</tr>
<tr>
<td>Desktop video conferencing</td>
<td>good</td>
<td>fair</td>
<td>-</td>
<td>Y</td>
<td>WebEx</td>
</tr>
<tr>
<td>Phone - POTS</td>
<td>good</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Cell phone</td>
<td>fair</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>VOIP (PC-to-PC)</td>
<td>good</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>Skype, GoogleTalk</td>
</tr>
<tr>
<td>Voicemail</td>
<td>depends on source</td>
<td>-</td>
<td>-</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td>-</td>
<td>-</td>
<td>rich</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Instant messaging</td>
<td>-</td>
<td>-</td>
<td>limited</td>
<td>N</td>
<td>Yahoo IM</td>
</tr>
<tr>
<td>Text messaging</td>
<td>-</td>
<td>-</td>
<td>very limited</td>
<td>N</td>
<td>Twitter, cell phone</td>
</tr>
</tbody>
</table>

**Figure 7: Richness of Communications**

Andreev (2010) states that previous studies on the use of Video conferencing in IT organizations have looked at opportunities on a larger scale and thereby reduce the cost of travel. Figure 8 illustrates the richness of communication where video-conferencing technologies such as skype, google talk and web-ex which influences successful delivery of projects. Even though a number of previous researchers have been concerned with the impact of new electronic media, few studies have explicitly compared the way how Video conferencing are used in modern organizations. By conducting a systematic comparison of Future communication technologies and current communication technologies, we have found that current communication is more effective especially Video conferencing technology seems to operate complementarily in virtual teams projects over distance and mainly used as a communication tool for distributed virtual team projects and virtual team meetings. Thus, the benefits of Video conferencing in relation to saving time and reducing travel-related stress seem to be most successful communication technology for successful delivery of projects.

6 CHAPTER 4: METHODOLOGY

6.1 Introduction

The purpose of this study was to better understand the characteristics and examine the role of communication technologies such as video conferencing in globally distributed IT virtual team projects that promote and sustain successful virtual team’s projects in IT sector. With
the numbers of virtual teams increasing, industrial/organizational psychologists and team sponsors need to know more about how these teams function. This increased knowledge about virtual teams will help both better support virtual teams, thereby improving team performance. Defining the research methods provides the planning structure for conducting research. Arbnor and Bjerke (1997) described research methods as “guiding principles for the creation of knowledge”.

The guide to the project management body of knowledge (PMBOK, 2013) published by Project management institute (PMI), USA is a collection of processes and knowledge areas generally accepted as the best practice within the project management discipline. PMBOK recognizes 9 project areas (scope, cost, time, quality, risk, procurement, integration, resources and communication) that can be treated as a critical success factors (CSF) in evaluating the performance of a project. However this research concentrates mainly on the triple constraints namely the time, cost and scope in evaluating the agile testing projects with key focus mainly in the time and scope alone. This report symbolizes the philosophy, approach, strategy, selecting respondents, and research ethics and data collection procedures chosen by the researcher and justifies them in the context of the research questions and objective of this dissertation.

The forthcoming section explains in detail about the research design used. Firstly the type of research philosophy selected is explained with a rational. Later, the research approach and the different strategies of the research that are to be adopted are clearly explained to detail. The sampling methods and the samples selected for this research and the rational for doing the same are described. Finally, the instruments that used for collecting the primary data and the reason for selecting the particular samples are also explained in a separate section. Along with this the data analysis procedure and the limitations of this research are described in brief as a final conclusion.

6.2 Research Methodology:

Methodology is defined as the way the knowledge is gained and how theories are generated and tested, and also the relationship between theoretical perspectives and research problem (Blaikie, 2000). It also refers to the procedural framework within which the research is conducted. The main purpose of the research methodology is to help the researcher in answering the research question by collecting specific relevant information related to the
researcher topic. There are various ways through which the researcher can carry out their research. However, the quality of the research largely depends on the type of the method selected that suits the research. In order to better facilitate this research the researcher has followed the Saunder et al ‘onion’ approach to the methodology followed. The researcher believes that Saunders et el ‘onion’ model would help this research in getting the key questions answered.

6.3 Research Design

According to Saunders (2009), in multi-method quantitative designs the researcher can use more than one quantitative data collection technique with associated statistical analysis procedures. For multi-method qualitative designs he or she uses more than one qualitative data collection technique. For example, semi-structured interviews and observations are used with associated analysis procedures.

A mixed methods, design combine both qualitative and quantitative data collection techniques and analysis procedures (Saunders et al., 2009, p.152). As stated by Burns and Burns (2008, p. 18), qualitative research enables researchers to obtain and analyse information conveyed through language and behaviours exhibited in natural settings. It captures expressive information not conveyed in quantitative data about perceptions, values, needs, feelings, and motivations that underlie behaviour at an individual level.
6.4 Research Philosophy

According to Johns & Clarks (2006) philosophical commitment should be shown by a researcher in the research, it means how a researcher going through are search strategy and obviously it has some great impact on the way of research has been done or investigate and understands.

Saunders et al (2009) argue two types of research philosophy. They are: ontology and epistemology. Ontology works with the reality. Subjectivism under ontology means situation that created from any perception or action. On the other hand, objectivism philosophy means that exist in the society. In addition, epistemology deals with acceptable knowledge in the specific research field. Positivist approach demands that the role of the researcher is to test theories and to provide materials for the development of laws (Bryman and Bell, 2008, p. 16). Saunders et al., (2009, p. 114) claim that realism can take the form of direct realism or critical realism. Direct realism supports the idea that what we experience through our senses depicts the world as it actually is. On the other hand, critical realism supports the notion that what we
see and live are only sensations. They are representations of the real world. The basic assumption of the interpretive approach is that the world is socially constructed and subjective (Burns, 2008, p. 18).

Knowledge is developed and theories are built through developing ideas inducted from the observed and interpreted social constructions. For the purposes of this study it has been identified that the research goal is best suited within the framework of the interpretive approach. According to the this research, the research philosophy is interpretive under epistemology since the aim of the research is to investigate how communication technologies in virtual team projects in IT sector more efficient and how future communication technologies involve in the role of creating successful virtual teams.

As this research has collected data from a survey using questionnaire, the research has also selected positivist approach. Also a positivist uses the deductive approach and the questionnaire data collection needs a deductive approach to best analyse the data, the researcher has selected positivism based on these grounds as well. Research based on this approach will result in findings that are law such as generalizations defined as “a pattern or regularity that repeats over different circumstances and that can be described simply by mathematical, graphic or symbolic methods. A pattern that repeats but need not be universal over all circumstances” (Hair, 2003).

6.5 Research Approach

As described by Saunders, Inductive approach are the data collected and the theory is developed as a result of the data analysis’(Saunders et al., 2009, p. 129). As advocated by Saunders et al. (2009, p. 126), research using an inductive approach is likely to be particularly concerned with the context in which such events took place. The inductive approach is a bottom-top approach where data are analysed, collected and used as a source for developing a theory. The researcher has followed inductive approaches for this research. Saunders (2012) has defined inductive approach as “a research approach which involves the development of theory as a result of analysing data already collected”.

A researcher who uses the inductive approach will most likely choose a conduct qualitative research with a small sample of subjects. In this research ,the researcher is clear that ,the approach of this research is inductive as the research will analyse the communication technologies used in successful virtual team projects in IT sector .Inductive approach will be
followed to the data collected from the experienced project managers and software engineers to suggest the best way to improvise virtual team performance.

6.6 Research Strategy

Saunders et al (2009) found that, identifying research strategy is very important for a research. Saunders showed some research strategies as below:

- Experiment
- Survey
- Case study
- Ethnography
- Archival research
- Action research
- Grounded theory

According to Saunders (2012) explains that research is basically classified by the type of research strategy it has used. A research strategy will help the researcher in answering the research question which in turn would help in meeting the research objectives. These research strategies can be used for any kind of research purpose, such as: explanatory, exploratory and descriptive studies (Yin, 2003). According to Saunders et al (2009, p.146) Case study strategy is most used research strategy in business and management studies. The case study strategy of research answers the question starting with ‘How’ and ‘What’ more effectively and it is very suitable for explanatory and exploratory studies.

Morris & Wood (1991) states that case study can help are researcher to understand the circumstance of the research effectively. In addition, this research strategy helps a researcher to do experimental investigation in the real life situation (Robson, 2002). Yin (2003).

The main research strategy followed here is “Case Study” through interviews. Since qualitative methods are followed, strategies such as Case study through interviews are used. According to this research it is clearer from the research topic and objectives, the researcher has adopted embedded case study as this research is on virtual teams projects on IT. So to collect data and get best outcomes the researcher needed to approach project managers and software engineers from different virtual teams in IT sector.
In order to have rich and diverse data, interviews with project managers and software engineers who have immense experience about virtual team projects and have worked in virtual team projects in IT sector have been used for this research as stated earlier. The data collected from the interviews will be compared and after analysing the conclusions will be drawn. By taking the interviews the problem of having less reliable and direct data might be reduced.

6.7 Research choice:

Saunders et al (2009) states various kinds of research methods; they are essentially divided into two main categories with some sub categories. The research methods are divided to mono and multi method. According to Tashakkori & Teddlie (2003) mono method means research done with only one method either qualitative or quantitative. Saunders et al (2009) multi method is divided into two categories; multi-method and mixed-method. Multi-method divided into multi method (Qualitative data) and Multi method (Quantitative data). On the other hand, mixed-method divided into mixed method research mixed model research. The researcher has followed the mono method research (qualitative method) in this research.

![Research choices](image)

As interview will be taken from IT project managers and software engineers, who work in virtual team projects to know how they use communication technologies and successful communication strategies with their employees. Qualitative data will be collected through qualitative data collection techniques such as interviews and the data will be analysed through qualitative data analysis procedures.
After collecting the qualitative data, the researcher will analyse them by their data types to recommend various virtual team projects in IT sector on how to improve the virtual team performance by using essential communication strategies and technologies.

### 6.8 Time Horizon:

According to Saunders et al (2009), There are two kinds of time horizon that can considered while undertaking a research; cross-sectional and longitudinal. Predominantly the time horizon for a research mostly depends on the research questions. The restricted timeframe for a research and taking a snapshot of a specific time and conducting the research is called cross-sectional (Robins, 2002). If a researcher takes over a long term to do the research by logging in a diary of events and recording them is called as longitudinal and it’s not time bound. In Business and management research longitudinal research is very rarely used due to its cost and time. The researcher has used Cross Sectional time horizon in this research since the research is time bound and the research had a strict deadline and timeframe to complete the research.

### 6.9 Data Collection:

“A strategy for doing research involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence”. Both primary and secondary data was used. The primary data in a form of structured and semi-structured phone interviews was collected over a period of a month through skype, telephone based and face-to-face.

The respective project managers and software engineers who works in virtual team projects in IT sector from different locations were selected by the researcher, who identified them as the best sample of opposing work and national cultures in terms of the project aimed at exploring the virtuality in a virtual team projects.

By interviewing employees from several locations, it was possible to grab more aspects and differences between the locations. The researcher found out that interviews helps in getting a deeper knowledge about the topic and semi structured informal interviews would in turn further help in answering the research question.
An interview, as a technique of data collection, provides an opportunity to express the respondents’ reality rather than my perceptions and views, and is therefore more efficient than observation, for example. Semi-structured interviews were chosen because it allowed an in-depth view into the subject in a structured way. Semi-structured interview gives a researcher more freedom to explore interesting points or issues that were probably missed out rather than a structured interview with somewhat predetermined answers and no possibility to go into a more interesting relevant topic. The semi-structured nature of the interview still calls for an interview guide that helps to make the interviews consistent, valid, replicable and comparable, enough to draw conclusion, compare and make a sample.

In total of five interviews are conducted with project managers and software engineers who have experience in virtual team projects in IT sector. Interviews will be recorded through the Skype recorder software in PC and recording software in the mobile. According to Saunders (2009) recording the interviews through tapes have immense advantages as they could be re-listened and if any query arise in the later stage the tapes can be re-played.

The researcher was also aware of the drawback of taking the semi-interview as additional time would be needed to transcribe the audio and video recordings into actual written data. The secondary data included existing literature on the global virtual team projects in IT.
sector, media richness theory and other related topics, everything that could be related or helped to further understand which difficulties and challenges of communication strategies and technologies the virtual teams projects in IT sector are facing and how can the existing body of literature explain it. Secondary data helps to reach an overview of the research area and get an in-depth understanding and knowledge of potential challenges of virtual teams. When the secondary data cannot wholly give the overview to answer the research question, the primary data comes into existence – the information particularly and specifically interesting for the chosen topic and the research question addressed (Ghauri&Grønhaug).

6.10 Data Analysis Technique

According to Craig&Douglas, (2005). The two data collection techniques are qualitative and quantitative. The selection of the appropriate research techniques may lead to a series of questions. The researcher has chosen qualitative research technique to enhance the information needed to various dimension of the problem, and the accessibility to information. Qualitative research will be used as the principal methodology because it enables to provide the details and information the quantitative research lacks. Qualitative research has the ability to provide the problems in a real-life context which helps in creating real solutions for the workplace. Researcher examines and try to offer the real managerial implications and guidelines for working virtually, how do communication lacks in virtual team projects and how virtual team performance is not improvised and the different cultural background. The qualitative data will be analysed from the interviews and the interviews would be completely be transformed into transcripts into text form.

The data from each of the interviews would then be analysed and summarised and made into abridged or condensed form removing all the needless information. Categorization and unitization from each of the data will be analysed and interviews taken from the project managers and software engineers will be compared consequently and conclusions will be drawn based on all of the interviews. The researcher prefers analysing the qualitative data manually rather than of seeking help from different software packages available. The reason behind is that the manual way makes the researcher feels that the software would take off the creative aspect of analysing the interview. The final footstep is to compare the findings of qualitative data and compare it with the secondary data.
6.11 Population and sample

According to Bryman and Bell (2007) sampling methods are relevant in any research work, where it is not possible to cover the entire population due to limiting resources or time constraints. In most of the cases the researcher would be able to draw conclusion based on a particular sample. However in order to do that the sampled population must be relevant and be representative of the entire population.

For this research it is highly difficult to survey the entire population hence sampling is considered necessary. (Bryman, Bell and Teevan, 2009). Considering the research strategy which is qualitative, the sampling techniques selected for this study are snowball sampling and non-profitability sample for qualitative. Snowball sampling is type of sampling where the initial respondents are typically chosen using Probability methods. In snowball sampling, the initial respondents are used by the researcher to establish relevant additional contacts. (Hair, 2003). The research is also focused on a nonprobability sample, which provides fruitful information to gain theoretical insights into the research phenomena.

The selection of interview candidates were purely based on the experienced experts who have managed communication within virtual teams in global projects in the IT industry. For the interview, the researcher targeted project managers and software engineers from Cisco, Bank of Ireland, Tata Consultancy Services, Amazon, Hertz, Accenture and Bwin party. The researcher made sure that project managers and software engineers selected have immense experience working in virtual team projects in IT sector. Group of virtual team members identified in LinkedIn and relevant resources related to virtual teams will be targeted predominantly.

6.12 Research ethics

The ethical issues that the researcher might come across are during the interview are that the interviewee might answer to the questions in a biased manner. For example the Project manager might have worked predominantly on the managerial side of virtual team projects and may not be in favour of communication technologies and acquires less knowledge how deeply communication technology is utilised in virtual team projects in IT sector. Also the particular project manager might be in a hurry to complete the interview due to some personal reasons. In order to make sure these problems are not faced the project manager would be selected in such a way he has enough experience in handling virtual team projects
in IT sector and he/she would be intimated well in advance about the nature of the interview. The particular sample would be given a specific timing according to their convenience. The participants in the interview would be given full confidentiality and anonymity and this will also be told to the researches well in advance. Apart from these the participants will be given the full freedom to withdraw from the interview at any point in time, as putting constant pressure on the participant might result in getting unclear data or biased data or unreliable data.

As stated by Bryman, (2007, p. 177) all potential precautions will be undertaken in order to ensure that respondents are not affected by the research. The Ethical issues will be seen in this research according to Dublin Business School Ethical Approval. In order to promote honest and truthful and open responses and to maintain respondent confidentiality, the researcher has decided to give the interviewees the option to keep their answers anonymous and send the abstract of the final report. Participants of this research will assured of the confidentiality of the information given prior to and after the interview process. Assurance of confidentiality allows for sincere responses from the participants. To comply with all the required ethical rules, the researcher codified the records of each respondent’s interviews to make them completely anonymous. Each participant will be assigned a number and no personal information was collected other than age, gender, education level, the amount of years the individual has been employed by the organization, and the amount of years the respondent has led virtual team projects in IT sector.

6.13 Limitations of research methodology:

The primary limitations of the methodology relate to difficulties in obtaining a sufficient information about the usage of communication technology in IT industry. Furthermore, project managers and virtual team members of the IT Industry Federation take annual holidays from December 25, 2014 to 3 January 2015. This presents a significant challenge to ensure an adequate response rate from the interviews to analyse, transcript the recorded interviews and to draw generalizable conclusions from the data obtained. However, the researcher is confident that this obstacle can be overcome by issuing high number of interview questionnaires at an early stage.
CHAPTER 4: DATA ANALYSIS, FINDINGS AND DISCUSSION

7.1 Introduction.

The primary research was performed at Ireland using multiple data sources from semi-structured interviews with Project Managers, software engineers, and documentation review. Interview conducted were transcribed, coded, summarised and simplified and notes from observations, clustering and categorizing results, compared and contrasted data and highlighted relations between common patterns and verified by the participants.

Apart from interviews and in order to gain additional insight into the virtual team projects, the researcher conducted various observations of communication practices, strategies and technologies and the Observation protocol was used to take notes during and just after observations. The information that has been generated and gathered by the researcher has been used to see how communication technologies and strategies are managed within global virtual team projects.

The primary research methodology used for this project was in the format of a semi structured consisting of 10 questions. The interviews was conducted via skype, phone-recordings to various project managers with virtual project team experience in IT sector. The respondents were dispersed throughout the Ireland, the United States and India. Five responses were gathered from participants and the responses are grouped according to each question and analysed qualitatively.

The interview was designed to get a broad sense of the communication issues associated with virtual team projects and how they are dealing with these communication issues. Further specifically, the interview was designed to get a sense of the reasons of IT organizations are using virtual project teams, to confirm whether or not communication technology with virtual team project more effective compared with traditional collocated teams, to get an idea of the central issues of communication technologies and strategies and to look for possible future communication technologies of global virtual team projects in IT sector and its most likely barriers.

With the responses to the interviews undertaken it was hoped that a determination could be made as to whether there were some fundamental or unexpected differences between the secondary research data (Literature review) collected and the responses to the interview. This
would then potentially lead to some interesting insights into how global virtual project teams in IT might be managed more effectively.

7.2 Background on participants:

Participants were mostly selected from a global IT organisation and experts chosen had extensive knowledge and immense experience in managing virtual project teams in IT sector. The participants consists of Project Managers and software engineers who managed separate virtual team projects, with different levels of business experience and different educational backgrounds. A synopsis on each participant is detailed briefly below and a synopsis is provided in Table 3

Job titles of the participants includes project managers, testing software engineers, and Hr managers. Ages ranged from 26 - 55 years. The participants’ years of experience in virtual team projects averaged minimum of 4 years. All participants in this research held various positions in virtual teams as project managers and software engineers.

7.3 Research Data Analysis, Findings and Discussion

What are the benefits and problems in virtual team projects due to communication technologies in IT Industry?

Respondent A and B say that virtual team defined as "A team that is linked through communication rather than face to face”, Harvard Business Review. Major problems virtual team faces exist in two areas; firstly on the technical side of the project, namely lack of technology support and miscommunications and secondly, most of the virtual team lack in leadership qualities, human efforts and mistrust. Most of the respondents mentioned that key benefits of communication technologies are cost performance, quality improvement and expanded availability of experts.

Respondents reflects that communication technology can enable Experts to be brought into the creative process without the complexity of relocation or direct employment requirements at a lower cost. All respondents explained that communication technology in Virtual teams improves production through expanding the typical eight-hour workday to literally a twenty-four-hour workday. This allows ideas to be endlessly explored and evolved regardless of the time zone. Indeed, it also leads to higher quality output as each virtual team member is able to function at his or her "primary production" time regardless of the clock time.
According to them there are over ten years of efficient data available to measure virtual teams cost saving. With distributed virtual team members across the globe, many tend to work within their own homes, thus the IT corporate overhead costs are seriously reduced due to an elimination of office needs, minimalized travel, no relocation costs, and a "just-in-time" workforce. All of the participants of this research agree that communication technology costs within virtual team projects have been reduced significantly over the past five years, the cost savings from virtual teams have become even more dramatic and becomes one of the key benefits.

According to Respondent C and D, Virtual teams do not share a common location, and are often dispersed geographically or globally in different countries. Also they stressed that since IT is a competitive industry it need to be innovative and try to improve new communication technology to improve virtual team’s performance. Respondents recommend that data and Information related to virtual team project must be available for everyone to access at any moment from anywhere on some secured cloud or data-storage platform.

As explained by respondent E and F ‘Virtual teams are group of individuals who work across time, space, and organizational boundaries with links strengthened by webs of communication technology”. IT organisations seek for a global creative edge which drives towards more extensive use of geographically dispersed, or virtual teams. Respondents explain that communication technology in virtual team projects are more effective for task-oriented assignments. They also state that communication technology used in virtual team projects are mature accessible and affordable. However, they still do not fill all of the virtual team's needs. Respondents recommend that due to technology gaps, virtual teams in IT industry still lean towards getting together physically to conduct creative work.

Respondent G and H states ‘’Virtual teams are a group of people who work together to attain specific objective in which one or more of the member have a defined workspace in the same location. Both of the respondents believes that there are several potential issues associated with coordination across virtual teams, such as:

- Communication difficulties due to cultural differences.
- Communications difficulties due to time differences such as one team finishing their day while another is starting theirs.
- Communications limitations due to not being able to convey things using all possible means, such as nonverbal communications, interactions amongst participants, etc.
Asynchronous coordination between teams due to different holidays, site closures, etc. The use of different terms and definitions, combined with the potential that some participants might not be speaking a "native language" when communicating, which could potentially cause misunderstandings or gaps in processes and procedures. It can also be difficult for those of us who speak "native English" in those cases where we are working with others from Scotland, England, Ireland, and even some of the American dialects, there can be difficulties in comprehension due to different definitions for the same word.

**Are there any significant relationships between performance of virtual teams and application of Communication technologies?**

Respondent A and B agrees that communication technologies are more essential for virtual team performance. Respondents explains that there are certain communication technologies such as web X, Video conferencing through skype, viber provides are well suited for completion of task and it enhances high correlation between virtual team performance and communication technologies. Respondent B who is the project manager at cisco systems stresses that usage of video conferencing technology with virtual team projects delivers successful results and improvises virtual team performances and increases the productivity of resources. Respondent A says that quality of decisions taken by virtual teams in IT sector uses e-mail and other electronic verbal communications to greater extent than the media richness theory which can be difficult to organise. He also explains that there is a steady relationship between virtual teams performance by using communication technology, which means that “the more you provide your virtual team with the latest in technology equipment, the high performance your team will reach”.

Respondent C and D states that some communication technologies may not significantly outcomes effective and positive virtual team performance. The right choice of communication technologies means that the technologies expertise virtual team members, task of virtual team projects, and the communication technology should fit the culture, the technology expertise of the team members, and the task of the virtual team. For some virtual teams in IT industry, using video conferencing technologies like web-x, skype and instant messaging might be the best choice to effectively improve their performance, whereas e-mail are the best choices for other virtual teams.
Respondent E explains that communication technology do not possess significant relationship by its usage but rather in how they are used by virtual teams and whether the use of specific technologies is defined properly. An example of this is a situation where a conference call is made between a PM and a Vendor where during the call, an agreement is made to delay payment by 1 week to allow the vendor to resolve some inadvertent issues. But if you don't follow the phone call with an e-mail document the agreement will be reached and acknowledgement by the vendor; accompanied by all of the relevant stakeholders, then the agreement is only as good as the person who "least agrees" to the terms reached. And unless you have a written policy and processes governing this, "memories over time" will change to suit the current situation versus what was agreed upon in the past.

Rest of the respondent says that, new and emerging communications technologies with their enhanced collaboration features create chances for virtual teams to successfully carry out their tasks and development of present successful communication technologies such as WebEx, GOTOMEETING. Linux improves virtual team performance and creates effectiveness as compared to the performance of face-to-face teams acting out the same tasks. Respondents also mention that although e-mail is one of the most important factor in virtual team performance it does not provide a rich communication allowing virtual team members to explore the social and physical aspects of other virtual team members. Further overreliance on e-mail can also hamper the progress of critical virtual team projects.

_Do present communication technologies satisfy key needs of virtual team projects in IT sector?_

Respondent A found that current communication technologies used in virtual team projects almost satisfy the key needs for virtual team projects by increasing the productivity of their resources and improved performance but respondent stresses that present communication technologies still can't beat face to face interactions in which one can read the body language of participants and potentially develop a stronger rapport. On the other hand, sometimes not seeing the person face to face also prevents people from judging one another based on looks.

Respondent B says no. Respondent explains that virtual teams in IT industry have to integrate zone difference factors. There are few drawbacks using current technologies such as emails that fully does not satisfy the needs of virtual teams. For example in the case of video-conferencing though it is effective when there is web slow down the video conferencing technology does not portrays the same experience as usual due to low-standard bandwidth.
Respondent B recommends that development of present technologies is utmost in order to increase virtual team performance. Development of current communication technologies should be made based on the user feedbacks.

Respondent C and D says Yes. Present communication technologies are meeting the needs of each specific team and it minimizes the potential issues associated with virtual team communications and the team is able to work effectively using the current tools.

For example in case of video conferencing non-verbal expressions of virtual team members such as facial expressions can be noticed. Moreover it enables the project managers to identify whether virtual team members are satisfied with the decisions. Respondents concludes that current communication technologies such as video conferencing, web-ex and web 2.0 entirely meet the needs of virtual team projects in IT industry and it also reduces miscommunication, information overload and improves the virtual team performance.

The remaining respondent says no. Respondents explains that still most of the virtual teams use email, telephones in spite of advancement in communication technologies. Respondents stresses that start-up virtual teams are not using the available tools and communication technologies such as web-based video conferencing, web-ex, social media effectively.

Respondent E states that virtual teams are not been taught how to use the tools properly and moreover they follow incorrect processes and procedures which results in project failures. Respondents recommends start-up virtual teams to use video conferencing communication technology, which incurs low cost to improvise their performances.

**What are the successful communication technologies used among virtual team projects in IT industry?**

Respondent A explains that in today’s world there are emergence of different communication technologies in virtual environment but from his experience respondent A stresses most successful communication technologies are videoconferencing and electronic media such as Skype, Viber, and other IPVoice software devices, which results increasing the virtual team performances. Likewise Cloud applications are also used in virtual team projects for storing data that will help the virtual teams to access information whenever they want, anytime-anywhere. Respondent also includes that Email is still a good means of communication within virtual teams.
Respondents B and C emphasis that the most successful communication technologies used by virtual team’s project today were E-mail, video conferencing and audio conferencing. Respondent states that “we usually use video conferencing at least once in a week to communicate with virtual team members regarding the progress of the project or important aspects that needs my decision; it saves cost and time” Respondents also states that he leads different virtual team project at different locations across the world, he makes sure all his virtual team members finishes their projects within the given timeframe by communicating through CMC .So there is no need to travel.

Both the respondents says that “sometimes differences in opinions arise in choosing the suitable communication technology to interact with the virtual team members, especially through video conferencing, sometimes non-verbal expressions are more essential and important to see my team members’ facial expressions, whether they are satisfied with my decision or not:”. When the projects attain success, it gives pleasure to see the happiness in virtual team members during video conferencing says respondents. Respondents stress that video conferencing technology not only satisfies the needs of virtual team members but also improves the virtual team performances and achievements during the communication in video conferencing.

Respondent D, who is a project manager at Microsoft, states that often email is been used to communicate but he also mentioned that during the initial stages video conferencing is been highly utilised in order to make major decisions related to the project. Respondents emphasis that when there is a need for a urgent technical and management meetings they tend to use video conferencing as it saves cost and increases the performance of virtual teams and also creates teamwork among the team members. As the project goes on, they already have a clear picture about the project. Instant messaging and emails are frequent and sufficient but when it comes to decision making video conferencing technology is highly used to virtually communicate with the team members.

Respondents E and F: argued that improved communication technologies suit the virtual team projects. Communication technologies such as WebEx, video-conference, Screen sharing, whiteboard sharing, Shared drives, email, IM shapes the communication and helps in providing helpful and positive communication to assist virtual team members in properly responding to the team members. It also downplays non-productive team disputes and promotes civility and effective virtual team performance in virtual team projects.
Respondents explains that that due to geographical distance, establishing a feeling of trust and virtual team performance, within global project teams in IT sector is hampered. The only way to unite the entire virtual teams is to use communication technologies. Respondents emphasized that “The only way we can bring virtual team members together is through the video conferencing technologies and it also creates oneness among the teams members and increases virtual team performance.

The remaining respondents reveals that he leads lots of virtual team projects across various time zones, it is necessary that there is a need of structured communication technology between virtual teams so that the project objective is tracked and it is seen that there is fulfilment of its objective. Respondents explains that virtual team projects depends on what technologies are available to each of the virtual teams, the policies and procedures which govern their use or the lack of the same, the urgency of the communications, and adherence of the same by the teams and their members. Respondents also states that communication technology such as WebEx, GOTOMEETING, Lync, e-mails, chats application, and all sorts of electronic verbal communications certainly increases a sense of oneness in the virtual team and it tends to diminish the cognitive distance between virtual project team members.

These communication technologies reinforce the shared knowledge between virtual team members by reducing the geographical limits as they affect the motivation for sharing knowledge which is related to the project. Moreover, the respondents says that he uses social media and video conferencing as a major communicative tool to communicate with virtual team members across the globe. Respondents also recommends that IT organizations should encourage communication through social channels as it has several benefits to the project team work across borders. It enables reaching out to many people and creates body of knowledge. It becomes instantaneous and assures that the knowledge related to the project already exists among virtual team members. Respondents concludes that through usage of modern communication technologies such as video conferencing, social media and WebEx, virtual team projects can be done easily at reasonable cost.

*What are the future communication technologies to enhance the productivity of the resources in virtual team projects?*

Respondent A emphasises that General Meta-computing Infrastructures among virtual team projects in IT industry will create a larger impact in future. He says that general meta-computing infrastructure is a communication technology for the seamless interconnection of
geographically dispersed virtual teams to solve problems that cannot be solved using current communication technologies. Elements include super-computers, high-speed networks advanced storage and visualization devices. Respondent stresses that when this technology brings the vision to reality, virtual team projects benefit significantly. Moreover, it provides the mechanism to overcome previously stated challenges of technology inequity, miscommunication and information overload. Respondent explains that Meta-computing provides extensive availability of dispersed resources and information to all virtual team members, eliminating the technical and accessibility issues of advanced technologies for team members. Meta-computing infrastructures also will be able to provide the "glue" among multiple technologies, such as providing interaction between a holographic virtual team member image and interpretive sketching.

Respondent B and C talks about automated language translation and new communication technology that have the ability to communicate with different virtual team members with different native languages. Automated language translation technology allows the formation of virtual teams regardless of the language they speak including those who have language impairments or disabilities. As one of the key aspects of creativity, virtual environment of free flowing ideas is more crucial. Respondents concludes that this improved communication technology is more effective only when all virtual team members can "think in their native tongue" and communicate simple to complex thoughts without losing the proposed or intended meaning in the translation.

Respondent D and E stated about newly-developed Web-based video conferences and audio conferences. Both said that the decision quality, group development and process satisfaction will be higher in the standard-bandwidth conditions. Now its prime time for IT industries to invest in videoconferencing technology because Internet and other technical advances provide reliable services to geographically dispersed teams (virtual teams).Indeed development in web-based video conferencing reduces technical difficulties, miscommunication and information overload.

They observed that tremendous variance in the quality of video conferencing exists and if web seems to slow down the video and audio tracks become distorted or one-sided. Both the respondents recommend that improvement in Web-based digital audio or video conferencing technology probably might manage to succeed more consistently with virtual teams, particularly if they have “back-up” technologies such as conference calls.
Moreover, advancement in web based communication technology empowers virtual teams around the globe the willingness or ability to deal with technical shortcomings through the advancement in video conferencing communication technology. Respondents concludes that video conferencing is bound to become more and more prevalent in the future as it becomes easier and stress-free to implement even from a laptop or tablet.

Respondent F explains that advancement in “The Internet and the web, as surprisingly is bringing individuals, small groups, and virtual teams back to the centre stage. As more people interconnect online, they increase virtual team’s capacity for both independence and interdependence. The global Internet creates massive participation of virtual team members and it enables them to communicate anytime and anywhere. Respondent D recommends that since face-to-face meetings leads to high cost, the next best thing to do is to invest in video conferencing or same-time web-based interactive communication technologies. Usage of interactive media enables fast-cycle online discussion forums and conferences...

The remaining respondents’ talks about new communication technology, a mobile device combined with the use of asynchronous Computer-Mediated Communication, which uses a wireless Internet connection. Respondents’ states that advancement in present communication technologies depicts the notion that virtual team projects will know where the virtual members are present and it can help team members to make smarter choices. Respondent explains that advancement in present communication technologies such as Microsoft office communicator, lotus notes, same-time communicating software, lotus notes, can design whatever sort of environment they feel they will be most creative in and visualize all members "around the table" together or sitting on the shore.

Respondents emphasises that advancement in presence communication technologies directly deals in the process of assisting with the virtual team's challenge of information overload and managing twenty-four-hour accessibility. Moreover, advancement in communication technologies in a long term becomes more sophisticated. It directly addresses current creative virtual team needs and improves the virtual team performance as well as increased usage video conferencing technologies enables productivity of virtual teams in IT organisations. Respondents stresses that advancement in present communication technologies can electronically extend the reaches of the person's natural senses such that he or she is able to experience a remote environment without physically being there".
**What are the most likely barriers that will prohibit the implementation of the future Communication technologies?**

Respondent A explains development of General Meta-computing Infrastructures among virtual team seems to have more barriers than the other future communication technologies. The barriers include mistrust of government intentions once the communication technology is implemented, and the threat of the data being used for criminal activity. Apart from technological barriers respondent A states that there are some political as well as economic barriers for developing this technology and they are as follows:

- Restrictive national policies (political barrier)
- A social bias or mistrust against invasive technologies (social barrier)
- Financial inequity amongst virtual team members (economic barrier)
- The lack of globally adopted interoperability standards (technology barrier)
- Broad communication bandwidth accessibility (technology barrier)
- Adequate processing power (technology barrier)

Respondent B and C explains that advancement in present technologies may not have technological barriers but economic barriers might arise financial inequity, intellectual capital ownership and most importantly a lack of a large business market to drive technology investments strictly to meet creative virtual team. Respondent B and C stress that virtual team projects in IT industry might struggle with the advancements in present technology such as video conferencing in which there is a need of high-standard bandwidth and other technological competence.

Respondent D and E found that the main barrier of web-based video and audio conferencing is the cost and high technical overhead. Both the respondent explain that the IT organisation investing in web-based video conferencing requires huge investment, time and cost. Respondent also says that there are possibilities of web-slow down, which affects the quality as well as inability of all the virtual team members to effectively access and use the technology.

Respondent F reveals that automated language translation technology might lead communication technology-related barriers in virtual team projects. In some instances, asynchronous communication media proved to be a barrier to problem solving and decision
making. In still other virtual teams the unwillingness of team members is to exploit existing technology but it paralyze knowledge sharing.

The remaining respondents says that the following factors would hinder new technologies from being available to virtual teams:

- Cost,
- High technical overhead.
- Slow corporate adoption.
- Lack of or improper training regarding the technology.
- The inability of all of the team to effectively access and use the technology.
- A lack of and/or improper procedures surrounding the user of the technology.

**What kind of impacts future communication technologies create in virtual team projects?**

Respondent A states that impacts of future communication technology highly depends on what the communication technology can specifically do and how it is used by virtual teams. For example in the case of holography, it is used to allow virtual teams to watch other virtual team members’ body language more effectively than just doing video calls. Respondent would say that in any new technology the benefit is greater than the "burden" associated with employing it.

Respondent B and C explain that Video conferencing is bound to become more and more prevalent in the future as it becomes easier and easier to implement even from a laptop or tablet. With programs such as WebEx, Fuze Meeting and GoToMeeting virtual team members can attend virtual conference calls. Both the respondents found that Video conferencing through skype has gained significant market with virtual team members and younger generation because of its versatility. Furthermore, it tends to evaluate team performance with face-to-face communication.

The remaining respondents emphasize that with the advent of internet and social media communication technologies, it reduces miscommunication and increase efficiency and performance. Increase in the usage of internet and social media by virtual team members and IT organisations enables virtual teams to improve collaboration and ability to modify the documents and information related to their projects online. This advanced communication
technologies change how to interact with the Internet and improve the applications available for virtual teams in IT industry to communicate.

Both the respondents stress that Web 2.0 communication technology improves information exchange and communication within virtual teams. Virtual team projects in IT sector are now able to use Web 2.0 tools such as blogs, communities of practice, cloud, wikis, Web conferencing, online document sharing and collaboration, and social networking sites. This communication technology provide access to virtual team members and project managers to run and manage applications and software in an online platform, which allows virtual team members to operate from anywhere and anytime. The tool available for virtual teams that is beginning to gain popularity is social networking.

8 CHAPTER 5: CONCLUSION, LIMITATIONS AND RECOMMENDATIONS:

This chapter contains the conclusions, limitations and recommendations regarding the findings of this study. IT organisations which manages its virtual team projects in the most effective and efficient way and delivers projects successfully on a consistent basis are likely to be the leader within their industry (Larson and Gray, 2011). Communication technologies is widely recognised as a key critical factor in the delivery of successful virtual team projects (Mohan and Paila, 2013).

The purpose of the study is to gain a better understanding of communication technologies and investigate the awareness of this subject amongst project managers and virtual team members of virtual team projects in industry. This research purpose has been achieved by answering the research question and satisfying all the stated objectives. The following section provides a summary of the findings.

8.1 Conclusion:

This research provides a rich picture of practicing virtual team members and project managers use of communication technology and collaboration in an IT project context. The findings of this research recommends that advancement in current and future communication technologies do play a vital role in supporting virtual project work activities. The results and findings of this research should be useful for IT organizations faced with a growing collection of media and technological opportunities and with the challenges of learning how to choose the suitable communication technologies for their projects which leads to increase in
productivity of resources and virtual team performance, productive work arrangements and communication choices.

The main purpose of this research was to investigate the phenomenon of how successful virtual teams projects in IT industry uses communication technologies to ensure success and research also involves findings from literature review and semi-structured interviews with project managers and software engineers. The researcher transcribed the interview audio and video record available at present and analysed the results. Research founds that, Literature review on usage of present and future communication technologies in global virtual team projects encountered significant impact on globally distributed virtual project team performance as well as to be successful in virtual team projects it is not sufficient to be outstanding in leadership and teamwork. Communication technology are just as important creating a sense of unity among virtual team members which is scarce.

The research also aimed at making a comparison to future communication technologies in order to better understand the barriers behind implementation of future communication technologies. The key research question was to find out how the success of the virtual team projects were affected by following the communication technologies and does current communication technologies fully satisfy the key needs of virtual teams projects in IT industry.

In general in IT projects the various reasons that influence the success of a project are communication technologies ,virtual team members and client satisfaction (Korrapati and Eedara, 2010) and the scope, time and budget of the project (PMBOK,2013) .When pinning down this specifically to ‘virtual team’ projects in the IT industry, the one more main reason apart from the two mentioned above that would contribute to the ‘success’ of the project is solving the technical issues pertaining to miscommunication and information overload .

In order to find this out the researcher conducted the primary research primarily focusing on questions from the above perspective, which are the successful communication technology, future communication technologies and solving the technical issues such as miscommunication and information overload, which are directly related to the success of the projects.

8.1.1 Successful communication technologies for virtual team projects in IT industry: From the data analysis of the primary research it can be concluded that majority of the virtual team members in IT industry are satisfied and comfortable with video conferencing and web-
Both IT projects managers and virtual team members state that video conferencing and web-ex communication technology are flexible in terms of timing and scheduling. Video conferencing saves cost and time. According to a study conducted on ‘communication technologies on project success’ all the virtual team members finishes their projects within the given timeframe by communicating through videoconferencing and web-ex. There is a strong positive correlation between video conferencing, virtual team members and success of the project. (Korrapati and Eedara, 2010).

8.1.2 Advancement in present communication technologies or Future communication technologies:
The question asked to the respondents was if they would recommend implementation of future communication technologies or advancement in current communication technologies which enhance increased virtual team performance. It could be seen from the analysis of the interviews that majority of them would recommend IT organisations invest in the advancement of present communication technology due to massive virtual team performance and increased productivity of their resources. Whereas in terms of investing in future communication technologies it leads to high cost, political and technological barriers and advanced virtual environment. Since all the respondents in this research were professionals with experience of working in global IT virtual teams projects, the results and findings obtained could be taken as recommendable. The research also founds that the major challenge would be IT organisations investing in communication technologies. From the interviews it could inferred that advancement in video conferencing would be best suited for start-up virtual team projects as well as they are more likely to have design changes quite frequently.
The researcher asked the question to all the respondents that do present communication technologies fully satisfy the needs of virtual team projects in IT industry. The answer was no. They stressed that video conferencing technology provides high benefits and improves virtual team performance but not all virtual teams in IT industry uses video conferencing. All the respondents recommend IT organisations to invest in current communication technologies such as video conferencing, web-ex, web 2.0 and other verbal technologies to be more successful and have a positive impact on communication technology than other factors such as leadership, which resolves technical issues such as miscommunication and information overload. The researcher suggests that results should also form a starting point for IT project managers and virtual team members working in diverse locations to resolve international issues and technical issues related to use of communication technology.

8.2 Limitations:

This study adopted a standard approach to determine the awareness of communication technology among project managers and virtual team members. However, it is important to acknowledge the key limitations of this study and they are as follows:

- The mode of research undertaken is qualitative in nature. The researcher interviewed five professionals from the information technology industry. These samples vary in
age, gender, nationality, designation and years of work experience. Researcher choses Limited approach because the time period was limited. In addition, given that it Research believes that a lot more could have been done if there was more time and resources available (Benet, 204, p. 69).

- The researcher was not successful in getting any Chinese professionals interviewed who play a major role in the development of the IT world and is one of the fastest spreading cultures on the planet today.
- In addition, the respondents hesitates to reveal information about future communication technology which is going to create massive impact in virtual team projects in IT sector.
- The study is also limited in terms of its generalization. Since most of the respondents worked in the IT, the findings of the study may not be in agreement with the attitudes of project managers involved in virtual team projects in IT industry projects from various countries.

8.3 Recommendations:

- Since the research question, “What are the future communication technologies that can be used among the virtual team projects to facilitate increase in the productivity of the resources’ has been answered positively, the researcher recommends further research should be done on the same topic. It was observed in the data analysis and finding that the majority of respondents hesitate to reveal the information about future communication technology. Also, this aspect is highlighted in the limitations.
- Since most of the respondents hesitate to reveal information about future communication technologies, it is not possible to access further more information on the role of project managers and virtual team members. Therefore, researcher further proposes study on the role of project managers those are adopting new communication technologies to improve the productivity of virtual team resources.
- Due to the limitation of time period researcher’s sample consisted of eight professionals, therefore, researcher further proposes study involving larger sample sizes from various IT organisations that will help to increase the knowledge about communication technologies used in virtual teams.
Furthermore, a study that focuses specifically on video-conferencing technology could be undertaken to overcome the limitations of communication problems in virtual teams. Researcher recommends that future study should focus on more communication technologies.

9 CHAPTER 6: APPENDIX 1

9.1 List of interviews:

<table>
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<tr>
<th>S.NO</th>
<th>NAME OF THE RESPONDENT</th>
<th>DESIGNATION</th>
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<th>INTERVIEW DURATION</th>
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<td>1</td>
<td>SIDDHARATHAN ARUL</td>
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<td>Hertz</td>
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9.2 Timeline of the research:

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<td>1. Read literature</td>
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<td>3. Develop Questionnaire and the Interview questions</td>
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<tr>
<td>4. Validate the questionnaire</td>
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</tr>
<tr>
<td>5. Arranging Provisional interview dates and observations</td>
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<td>6. Distributing Interview Questionnaires to respondents</td>
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<td>8. Comparing with literature, draw Conclusions and Recommendations</td>
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<td>10. Final Consolidation</td>
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9.3 Interview questionnaires:

- What is virtual team?
- What are the benefits and problems in virtual team projects due to communication technologies in IT Industry?
- Are there any significant relationships between performance of virtual teams and application of Communication technologies?
- What are the successful communication technologies used in virtual team projects?
- Do present communication technologies satisfy key needs of virtual team projects in IT sector?
- What are the future communication technologies to enhance the productivity of the resources in virtual team projects?
- What kind of impacts does future communication technologies create in virtual team projects?
- What are the most likely barriers that will forbid the implementation of the future Communication technologies?

Interview questions to respondents:
Hi Bob,
My interview questions are as follows:
1. What is virtual team and what are the benefits and problems arise of communication technology virtual team projects in IT sector?
2. Is communication strategy more efficient for virtual team projects in IT sector?
3. Are there any significant relationship between virtual team performance and the usage of Communication technologies?
4. What are the present communication technologies used in virtual team projects?
5. Does Current communication technology today fully satisfy key needs for virtual team projects in IT sector?
6. What are the future communication technologies that can be used among the virtual teams to facilitate increase in the productivity of the resources in virtual team projects?
7. What kind of impact or changes of future communication technologies in virtual team projects?
8. What are the most likely barriers that will prohibit the implementation of the future Communication technologies?
B) Hi Mahesh,
It was a pleasure to conduct the interview with you.

See my answers below:

1. What is virtual team and what are the benefits and problems arise of communication technology virtual team projects in IT sector?

Benefits - Cost savings in both, travel time, etc., and increased productivity due to travel, allows you to engage resources that would have otherwise been impossible to have.

Problems - a) Time Zone Differences b) Minimal non-verbal communication c) Difficulty in measuring engagement.

C) Answers to your interview questions

Gopinath Kumar Sugumar
January 16, 2015 12:28 AM

1) Does current communication technology today fully satisfy key needs for virtual team projects in IT sector? Various communication technologies that support company's virtual teams are instant messaging (IM), E-Mail, Telephone, Video Conference.

Instant messaging – For queries, daily task updates (Daily)
E-mail – Daily task assignment, Reports, Announcements, Project Roadmap (Daily)
Telephone – Scrum calls, Queries (Daily)
Video Conference – Facilitate intrinsic face to face interactions to precipitate the issues of non-verbal cues (monthly once)

2) What are the future communication technologies that can be used among the virtual teams to facilitate increase in the productivity of the resources in virtual team projects?

Real time information about the projects
For example: An automated excel sheet can be shared among the team members where they can create, edit and update their daily tasks, in a separate sheet diagrams such as Pie charts, Bar charts can be chosen based on the project to see the real time updates of the virtual teams in one place all together. The automated excel sheet help the project managers to track the efficiency of individual resources used in their project. They can also make sure the resources work according to their clients SLA.
9.4 Types of interviews in qualitative research:

![Diagram of interview types]

9.5 APPENDIX 2: REFLECTION ON LEARNING PROCESS

9.5.1 Reflection on learning:
The researcher’s enrolment into the MBA programme was highly motivated by a genuine interest in project management and should be viewed as an important complement to existing management experience. The MBA programme helped the researcher to deepen the understanding of international management theories and tools and techniques of project management. This can be seen as a logical step in order to progress professionally. With the opportunity of carrying on a research project in MBA program the researcher has developed his skills in the research field.

9.5.2 Learning Process:
Live as if you were to die tomorrow. Learn as if you were to live forever.” Mahatma Gandhi
Synonym of learning in the dictionary is “the act or process of acquiring knowledge or skill”, in the Psychology aspect learning is the “modification of behaviour through practice, training, or experience”. (Dictionary.com, 2013). L& Lassen, L. M. (2006) describes learning style, as a way in which each learner begins to concentrate on, process and retain new information. However, depending on the setting, each individual is likely to use different types of learning styles.
Emerald (2013) emphasizes that learning is a process of enlightenment of the mind. It reproduces the knowledge acquired of an individual and how they construct. He also states that “active learning” has taken precedence over various methods. In this type of learning process the student is an active participant by means of regular activities, feedback and discussion etc.

The researcher has gained immeasurable and immense experiences and transferrable skills through learning process and it gives the researcher a sense of accomplishment which has impacted the increase in his self-confidence.

9.5.3 Learning style:
According to Kolb (1984), concrete and immediate experience should serve as a basis for reflection and observation which then leads to the continuation of the learning cycle. Knowledge results from the combination of grasping and transforming experience. Kolb (1984) incorporates various types and styles involved in the learning process as follows:

Divergers (reflective observation) who observe, gather information, and then use imaginative ability to produce possibilities and the values of the experience. The learner can see various viewpoints and are emotional. Diverger are basically ‘why’ question people, social and participative learners with the ability to view the big picture and work productively to achieve it. Divergers can easily be influenced and are receptive of constructive feedbacks. (Kolb, 1984)

Assimilators (abstract conceptualisation), who are logical and more interested in abstract ideas. They possess a cognitive approach they are thinkers, they are the ‘what more?’ question people who are accurate in nature with an inductive reasoning ability and prefers organised and planned pattern of learning and gaining knowledge.

Convergers (active experimentation), who are practical problem solvers, decision makers who would like to question “How” the concepts and ideas are unfold and put their ideas into action to practically do the task. The convergers are independent workers who works with facts constantly striving for efficiency by executing the required changes and acts individually. Convergers are technically oriented.

Accommodators (active experimenter), adopts hands-on and practical approach, their ability lies in action oriented. The learner with a “why not?” question are attracted to challenges and practical learning seems to be more effective for these leaners.
Accommodators are prone to take creative risks whenever opportunity arrives and are found to be quick learners with a problem solving ability through lively and active experiments.

These learning styles are similar to Honey and Mumford (1986) preferences of learning – Activist (who learn by doing), Theorist (like to understand the theory behind the actions); Pragmatist (experiment theories in real world) and Reflector (learn by observing and thinking about what happened). The researcher discovered that both of the learning styles were true in a way that the researcher was a logical thinker who also acts rational and prefers to be practical and realistic. But soon after working on the dissertation the researcher undertook interviews, this time the results were slightly different in that the researcher now had a strong preference for reflector. The reflector is one who collects data extensively, which might result in longer research and postpones the formulation of conclusion for as long as possible.
The researcher has experienced this throughout the dissertation phase especially in the literature review chapter. The literature review made the researcher use reflective observation, active experimentation. As there was need of understanding what communication technologies successful virtual team uses in IT organisations, the researcher also uses preference style that is Activist while making the interviews, analysing the findings through interviews.

9.5.4 Self-appraisal:
The course MBA program in Project Management provided great learning in multiple business areas such as project management tools and techniques, planning and control, business strategy, marketing, finance and International Management which thought me about my own skill set, confidence, strengths and weaknesses and prepared me for interviews and public speaking which improved my abilities and helped me gain trust in my abilities as well it gave me knowledge needed to sustain in a professional environment. I struggled a lot at the start of the dissertation, however once I got into the flow I enjoyed it thoroughly because I started feeling my research is capable of adding value. I also believe that I have done a fair job by structuring and using lots of references to the study. On the MBA in Project Management I witnessed myself improving my writing skills in addition to analytical and research skills.

The additional knowledge acquired while undertaking interviews and writing the dissertation addressed some of the gaps in my management skills. I found that the research has developed my knowledge in specific areas such as project management and business strategy. The secondary research undertaken helped me in comparing and understanding the communication technologies used in various virtual team projects and how it increases the virtual team performance. The primary research undertaken not only widened my knowledge on project management tools, techniques and research skills, but also helped me to overcome the disappointments at the time when participants or respondents did not revealed the exact information, which is needed.

9.5.5 Research and Analytical Skills
Writing the dissertation was my first encounter since it is the first time that I was writing a dissertation and specifically the education system back in India is very different from what I experienced here. The subjects were so new that they put a lot of pressure on me and which leads to lot of critical challenges. I acquired skills in research field and got to know many acclaimed science databases, which made my study much more professional. I also got an
opportunity to learn and use referencing standards such as Harvard referencing method. The process of selecting the research topic, delving into the academic literature of an unknown subject, choosing and designing the research methodology, has created an astonishing learning experience. Not only my communication and people skills improved in conducting interviews and presentations but also my decision making skills improved by choosing the literature and the research topic.

9.5.6 Problem solving skills:
My study was focused on communication technologies in successful virtual team projects and future communication technologies for improving the productivity and performance. Even though I had exposure to similar studies with communication technologies in my undergraduate this was completely different. The main challenge I faced in this research was trying to find the possible future communication technologies since it was not revealed properly in recent articles.

To overcome this problem I had to keenly focus on conducting interviews with project managers who work in virtual team projects, articles, journals and data from science direct and the various databases helped me to increase the chance of finding relevant studies. Yet another problem was the accessibility of participants or respondents since the study was done during Christmas seasons. Four of the interview sessions had to be cancelled and conducted on a later stages as the respondents went away on holidays.

This delayed the data collection process. I tried to compensate this extra hours through extensive research on multiple data bases and active search for articles and journals related to my research topic.

9.5.7 Future Application
The learning and experience of undertaking the MBA program and writing a dissertation have an impact on skills and knowledge that are regarded as most important in today's work environment. These critical and analytical skills include strategic, analytical, time-management and self-management techniques. Working with new different people for projects and assignments helped me to gain truthful experience and in-depth understanding of the things I required to change my working style and to increase my working efficiency.

MBA and dissertation has brought a holistic change in me and has changed the way I perceive and observe things. The most essential thing, which I learnt from this MBA course and specifically from this dissertation, is to be organised. During the dissertation, the more I
kept journals, articles and write-ups organized, the better I could work on it. Indeed this made me realize that being organized makes things function smoothly.

9.5.8 Conclusion:
Overall the MBA program was valuable and helped me to acquire immense knowledge and skills needed for my professional growth and development. It helped me to gain more confidence. The personal experience of undertaking the MBA and writing the dissertation was truly challenging but very rewarding towards the end. I am looking forward to a new learning adventure in my future endeavours. The successful completion of my dissertation accompanied by learning experience at Dublin Business School will always remain a valuable asset in my career and future aspirations.
CHAPTER 7: BIOLOGIOGRAPHY:


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McGarvey, R. (1997). So far, so good: Even physical distance can’t stop your employees from going above and beyond. Entrepreneur, 25, 80.


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