Managing Mega Construction Projects; Role & Effectiveness of Virtual Teams

A thesis submitted in partial fulfillment of

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In

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By

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This is to certify that the

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Prof. Dr.Hamza Farooq Gabriel

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DEDICATED

TO

My Father and Mother

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ABSTRACT

The number of organization is construction sector are increasing day by day and the organizations are employing virtual teams in order to meet the today's global competition and customer's expectation. In order to make sure that virtual teams are effective the construction company's must evaluate their team effectiveness. It is believed that creating a highly effective project team will produce high-end project outcome that exceeds standards and therefore enhance overall productivity. The purpose of this study is to determine the factors and challenges that are associated with virtual team's effectiveness, to determine the current situation of virtual teams, tools and techniques for communicating and collaborating and work processes in practice and to propose best business model for managing virtual teams. Qualitative Research methods were used for this study, which were semi structured interviews and the case studies. The interview questions were developed for data collection. The data was then analyzed through descriptive method. Two case studies were carried out to obtain the knowledge of actual field practices carried out by using virtual teams. The outcomes from this study are anticipated to provide virtual teams with the ideas on the factors that need to be focused to improve their effectiveness. Furthermore a model has been proposed to manage these teams more effectively on the basis of this research.

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List of Abbreviations

CAD	Computer Aided Design
FTP	File Transfer Protocol
GDT	Global Distributed Team
GVET	Global Virtual Engineering Team
ICT	Information and Communication Technology
IIAP	International Islamabad Airport Project
JV	Joint Venture
MEP	Mechanical Engineering and Plumbing
PEC	Pakistan Engineering Council
PMC	Project Management Consultant
PROMISE	Project Information Management System
RFI	Request for Information
SWOT	Strength Weakness Opportunity and Threat
VPN	Virtual Private Networking
VT	Virtual Team

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CHAPTER 1

INTRODUCTION

1.1. Brief Description

The project team is right in the front-line of the project‘s planning and implementation. Project teams can be cross-functional, cross cultural, self-managed and virtual type. The individual members of the team participate in the project planning process and provide technical expertise, ideas, input and motivational support that can help the entire team to form quality deliverables within the assigned budget and according to schedule. Virtual teams are the one that can be geographically separated as witnessed in most mega projects now a days. Increase of globalization and recent technology development has taken the business to a new orbit. Many of these changes have been driven by the dramatic continuing impact of the progress in information and communication technology (ICT). The concept of virtual teaming has been around for more than 20 years. However, it is the execution strategy of a larger scale multi- office engineering services began in construction industry was only from the past decade. Business model for many of the construction companies in five years will be global implementation of core (McQuary, 2003). Global execution is limited, it requires from the location of the fixed IT infrastructure to global collaboration. According to McQuary (2003) some of the challenges contractor is facing, are to attract, retain and educate the labor force. The purpose of this research is to determine the challenges that are associated with the effectiveness of the virtual teams, to

determine how these teams communicate with each other and propose best model for managing these teams.

1.2. Background

It is not only data processing and manufacturing industries that have moved to overseas but increasing number of construction companies have also moved the engineering design and development work to overseas countries. In today's global business environment, engineering cost is the most important interest for contractors and the owner. Most importantly, the owner wants a low-cost, and asks contractor for assuming more risk. Companies are beginning to consider different strategies in order to reduce the cost of capital projects. In addition, companies want that they should be able to release the final product early to market as much as possible. Therefore, benefits or revenue can be realized much earlier and thus, diverting more attention towards schedule driven projects. Around the clock, work schedule for construction has been recognized as value-added to schedule projects that drive the global virtual engineering team (GVETs). Changes in technology, information systems, global economic conditions, social value, labor force statistics, the political environment, the production process have great influence on the products and services delivered by engineering team. Effects of these forces are severe, catastrophic, dynamic and unpredictable, on the organizations that are not ready and cannot respond to it (Church et al. 1996). The organizations currently in ever dynamic, constantly changing and complex environment are facing important and unparalleled challenges (Rezgui, 2007). All types of economic activities in globalization are moving in the direction to support the economy and the technological gap between developed countries and developing countries. It can be

explained mainly by the difference of understanding between two sets of software technology and software environment among various countries (Zhouying 2005; ACS and Preston, 1997). Consequently, this problem must be taken into account that the rapid development in the electronic information and communication medium in the past few decades resulted in distributing work faster, more easily and more efficiently (Hertel et al., 2005). In response to globalization, increased de-centralization and business processes, numerous firms have a common goal that is to increase the organizational output on lowest cost. They have responded to the dynamic environment, geographical boundaries, and cultural boundaries by introducing a virtual team work, joined by communication technology across organizational boundaries. Virtual teams are gaining popularity (Cascio, 2000). Due to vast improvement in information technology and ease of internet access, the communication around the world has been made possible and thus many companies are now showing great interest in virtual teams (Hertel et al., 2005). Information technology is providing the foundations for new reforms in organizations. Virtual teams, represents one such reform that has provided the construction companies with higher level of flexibility and responsiveness (Powell et al., 2004). Virtual teams are important mechanism for organizations that are trying to take advantage of the scarce resources across geographical boundaries (Munkvold and Zigurs, 2007). But comparing in today's competitive global economy, organizations can create virtual teams of talented people that will enable them to respond quickly to changes in the business environment. This type of function in organizations will provide the advantage in this competitive environment (Bergiel et al., 2008).

1.3. Justification

In the planning and implementation of any construction project the good construction team is necessary. Project teams can be conventional or virtual. The project team members as a whole or as individuals contribute in providing the output within the allocated cost and time. Virtual teams are those that are geographically separated and coordinate with each other through some electronic medium to get the output required (Horwitz et al, 2006, p. 473).These teams can be distributed within a country i.e. regionally or either globally. They may face "*communication challenges, cultural challenges and task challenges*" (Malhotra, 2003). "*Virtual teams may therefore work across distance, time, and organizational boundaries*" (Langevin, 2004). As virtual teams are far flung from each other so it is an important aspect to recognize that how these teams communicate with each other, what information and communication technologies are used and what are the problems these teams face in communicating and sharing knowledge with each other.

The drawbacks in virtual teams are miscommunication or lack of communication, lack of trust, disagreements and conflicts on different issues and power struggle (Rosen et al., 2007).The virtual team needs new methods of management for its better supervision and make virtual team a success on any project (Jarvenpaa and Leidner, 1999).According to Lowe (2009) the performance of any team can be increased considerably by focusing on the fundamental teamwork rules. Thus it is necessary to determine the factors that can considerably affect the team's performance and focusing on these factors will help the project managers to

improve the performance of the team on the project and thus developing effective project teams.

Members belonging to different teams and organizations have different attitude towards decision making strategies and hierarchy (Brett et al., 2006: 87).Virtual teams cannot fully replace the conventional teams as they are not useful in every circumstances, but virtual teams allow an organization to be more effective and flexible as different members of team belong to different culture and location without any geographical restriction. The research has been going on whole over the world on virtual teams but no such research has been carried out in Pakistan with respect to construction industry.

1.4. Objectives

The objectives of this study are:

- To determine the challenges those are associated with the effectiveness of virtual teams.
- To determine the current situation of virtual teams, tools and techniques and work processes.
- Development of a best business model for managing virtual teams effectively.
- Case study of how these teams work and communicate with each other (Field practices).

1.5. Relevance to National Needs

As construction industry is one of the main industries of Pakistan and many mega construction projects involving virtual teams have been undertaken and completed

in near past. This research will help virtual teams to work more efficiently by taking into account the criticality of the factors and how to make the communication among these teams more effective.

1.6. Social Problems affecting Virtual Teams

As the disperse teams have various characteristics so they are affected by various social issues. The virtual teams are more sensitive to the social issues rather than the conventional teams. In Pakistan the virtual team implementation on the various projects has not been practiced very effectively and various social problems have been faced.

In opinion of Kankanhalli et al, (2007) there is more potential of conflict to take place in virtual teams as the members work across the geographical and time boundaries. This conflict results to inappropriate communication as members of the team stop communicating effectively. It leads to the less interaction and low productivity.

1.6.1. Physical Dispersion and Time boundaries

In virtual teams the members work at various locations and different time zones. In Pakistan most of the projects are done with the conventional teams thus the people in the field find it difficult while working with the virtual team that how to tackle these issues related to time zone and less physical interaction. According to Gibson and Gibbs (2006) it is difficult for the members of virtual team to coordinate with one another as there is less time for the meetings and most of the meetings take place outside of standard working time. Due to less physical interaction and geographical dispersion there is increase in coordination requirement which results in delays and also affects the productivity. Kankanhalli et al, (2007) believed that

geographical and time zone boundaries results in communication delays which lead to the conflict. The delay in the communication leads to misunderstandings and poor relationship of members of the team.

1.6.2. Communication Technology

The most of the communication and coordination that takes place among the virtual teams is by use of various technologies. In Pakistan there is not much knowledge that how to take the full advantage from the technologies that are readily available. In opinion of Tan and Wei (2007) the computer mediated communication leads to delay feedback. Wong and Burton (2001) believed that use of information and communication technology leads to misunderstanding especially when the information is unclear.

1.6.3. Cultural Diversity

In Pakistan we find a lot of cultural diversity among the people of various regions. The cultural diversity is one of the major cause of many social problems that takes place among the virtual teams. Gibson and Gibbs (2006) stated the culture as the way people think, feel and behave. The culture diversity results in various challenges such as; decision making conflicts, problem with accents and direct versus indirect coordination. In most of the western culture the communication is direct and explicit it means that it does not need much interpretation; that is why westerners often face problems in understanding non-westerners. Due to different accents and less fluency there is frustration that takes place among the team members. They also stated that cultural diversity leads to the conflicts in decision making that results in misunderstanding (Brett et al., 2006).

1.6.4. Organizational, Age, Gender and Functional Diversity

In Pakistan there are lot of problems related to organization, age, gender and functional diversity. The members that are from various organizations have different attitudes towards the hierarchy and authority (Brett et al., 2006). The members from various organizations have different culture towards the hierarchy and may feel that decisions are to be made and approved by higher level managers; while some members belonging to flatter structure organizations may feel satisfy by making their own decisions. This difference in the attitudes leads to the conflicts. The functional diversity takes place due to the difference in the educational background, experience and expertness of various team members. The difference in the background of the members may result in feeling of superiority and inferiority and leads to problems in communication. The difference in gender and age leads to the weaknesses and creates disagreements (Kankanhalli et al., 2007).

1.6.5. Structural Dynamism, non-routine tasks and interrelated tasks

The life cycle of the virtual teams is based on the tasks performed by these teams. The coordination and integration among various members becomes important as the task becomes difficult. The members may have to perform different roles and task; therefore they should be able to adapt various situations otherwise it results in conflicts and disagreement (Bell and Kozlowski, 2002). As the task to be accomplished becomes more difficult there is more requirement of the coordination among the member's leads to the various problems. When the roles of the members are inter-related the team work and communication become very important.

1.7. Advantages

Project teams play a vital role in the success of any project that is to complete it with in allocated budget and proposed time. Virtual team is relatively a new concept in construction industry. A lot of research is going all around the world and there are many areas regarding virtual team's concept which still need to be studied to make the virtual teams more effective and efficient. There is need of improvement that how these teams communicate and using communication technologies effectively. Thus this research will help us to exploit the challenges that play vital role in effectiveness of virtual teams. What are the best ways for virtual teams to communicate with each other and model will be proposed to manage these teams effectively.

1.8. Areas of Application, Scope and Limitation

As virtual teams have been employed on many construction projects in Pakistan thus the scope of this study is to provide framework for these teams, challenges associated with these teams and how to counter these challenges.

The data collected for this research is from construction industry and most of the companies are already implementing global distributed teams (GDT) for their projects. The data collected with regard to the advantages of the distributed teams may have some amount of biasness as the companies may be trying to defend their decision of implementing virtual teams on previous projects. Therefore it will not be appropriate to assume that all the companies in the construction industry are supporting the trend of using global distributed teams (GDT) for their projects.

Most of the interviews were performed with owners, consultants and contractors from Pakistan. Although few interviews (7) were taken of international managers

but interviews with significant international experts were not performed. So the research has some limitations by the international perspective.

This research identified different success factors and the best practices but as this is a broad study so detailed analysis of these factors was not carried out for this research.

1.9. Thesis Organization

Thesis is organized in five chapters with Chapter 1 introduces the research topic along with establishing the research context, Chapter 2 includes literature review, Chapter 3 covers the research methodology, Chapter 4 presents the analysis and results, Chapter 5 presents the case studies and Chapter 6 concludes the dissertation by presenting findings and discussion along with recommendations for future works.

1.10. Summary

This chapter has presented the topic of this study, the overall research work and the current state of the virtual teams in Pakistan construction industry. The motivation for the selection of this topic is to understand the concept of dispersed teams and create its awareness among the primary stakeholders of construction industry, and to identify factors that affect the effectiveness of virtual teams. A thorough understanding of the research topic would come after the detailed literature review which is discussed in the next chapter.

CHAPTER 2

LITERATURE REVIEW

2.1. What Is Virtual Team?

Virtual teams are such organizational form that transform the work place and enable organizations with extraordinary elasticity and responsiveness.

2.1.1. Virtual Teams: Genesis and Trends

Although the work teams were used in U.S. from 1960s but it was the Total Quality Management movement of 1980s that enhanced the use of teams and quality circles. The self-managed and empowered teams were used by most of the companies in late 1980s and early 1990s. The line-level employees took the responsibility of decision making that was conventionally used to be made by the management in order to reduce time cycle, better service and to reduce red-tapism. It was by 1990s that the most of the companies such as Good Year, Motorola, Taxes Instruments and General Electric started to export the concept of team to their overseas affiliates in Asia, Europe and Latin America to incorporate human resource practices (Kirkman et al., 2001). There is a worldwide interest in virtual teams due to rapid improvement in communication technology and globalization (Kirkman et al., 2002). There is increase of popularity in organizations to opt for virtual teams in this era (Walvoord et al., 2008; Cascio, 2000). Martins et al. (2004) concluded from his research that all organizational teams are virtual to some degree with few exceptions. We have moved to work with the people from

all around the world rather than just being working with the people by whom we can physically interact (Johnson at el., 2001).

2.2 .Definition of Virtual Team

The literature reviewed showed the lack of depth in the definition of virtual teams. Although a lot of work is going around the globe on virtual team but it has been difficult to define what '*virtual*' means across various institutional framework (Chudoba et al., 2005). The '*team*' is defined as a small group of people with different skills who are thoroughly passionate towards common goals, objectives and working strategy for which they are equally accountable (Zenun et al., 2007). The basic purpose of these virtual teams are to get beyond the geographical or time separations (Cascio and Shurygailo, 2003). It is by the improvement in information and communication technology that virtual teams are able to work across the time and space boundaries. The '*virtual team'* is a term that covers a large range of activities and types of technology supported workspace (Anderson et al., 2007). The members of the virtual teams are geographically separated and are located at various locations. In order to communicate and coordinate with each other the members use the information technology (Peters and Manz, 2007).

Gassmann and Von zedtwitz (2003) defined "*virtual team as a group of people and sub teams who interacts through interdependent tasks guided by common purpose and work across link strengthen by information, communication and transport technologies*". The other definition shows that virtual teams are the geographically dispersed teams that coordinate their efforts and inputs through information and communication technologies (e-mail, video conferencing, telephone etc.) Different authors have different views (Hertel et al., 2005). Leenders et al. (2003) defined

virtual teams are the individuals at a particular project executing the work and are often geographical and temporal distributed, having the parent company situated at another location. Lurey and Raisinghani (2001) defined virtual teams as the number of people working together irrespective of time, space and organizational boundaries. The one of the most accepted definition of virtual team is "*a group of geographically, organizationally and / or time dispersed workers brought together by information technologies to accomplish one or more organization tasks*" (Powell et al., 2004).

The extent of geographically scattered virtual teams may fluctuate greatly from only one member that is located at different location from the rest to all the members of virtual teams located at various locations (Staples and Zhao, 2006). Bal and Teo (2001a) summarized that team will be regarded as virtual if it fulfills the four common characteristic and other criteria that are mentioned in Table 2.1. Virtual team allows enterprises to hire and retain the best talent by cutting off geographical limitations. The temporary aspect of the team is less significant (Lee-Kelley and Sankey, 2008). But some of the researchers such as (Bal and Teo (2001a) ; Paul et al (2005) and Wong and Burton (2000) included the temporary aspect of virtual teams in defining them but the other authors like Gassmann and Von zedtwitz (2003b) used the temporary word for some members of the team.

Table 2. 1: Characteristics of Virtual Team (Bal and Teo, 2001)

Characteristics of virtual team	**Descriptions**
Common criteria	Geographically scattered over different time zones

	Gathered for attaining the same goal
	Enabled by communication technologies
	Involved in cross-boundary collaboration
Other characteristics	It is not a permanent team
	Less members in the team
	Team member are experts
	Members of the team belonging to various companies

Geographically dispersed teams can be defined as: geographically small interim groups, organizations and time dispersed knowledge workers who coordinate their work mainly using electronic information and communication technology to achieve one or more organization objectives.

2.3. Types of Virtual Team

In general, we can distinguish the various forms of "*virtual*" work in accordance with the degree of interaction between the numbers of parties. The first is the "*telework"* which means that the members of the team work completely or to some extent outside of the main company with the help of information and communication technology. "*Virtual group*" is present when several teleworkers combine and report to the same manager. The members of the dispersed group when interacting with each other to attain same goal are "*virtual team*". Finally, "*virtual communities*" are large group of distributed people around the globe who coordinate via internet and have common goals and objectives. On the contrary, virtual communities are not used within an organizational structure but are usually

initiated by some of their members. Examples of virtual communities are open source software projects (Hertel et al., 2005). Teleworking is regarded as an alternative way that organizes the work by the use of ICT and helps the members to manage their labor activities from different and remote places (Martinez et al., 2006). The advantage of Teleworking is that it saves the cost by diminishing time consuming commutes to central offices and provides more opportunity to the employees to coordinate their work and fulfill family responsibilities (Johnson et al., 2001). The different types of virtual teams were classified by Cascio and Shurygailo (2003) on the basis of two primary variables that is number of managers and the number of location as shown in Table 2.2

Table 2. 2: Types of Teams (Cascio and Shurygailo, 2003)

1.	Tele Workers	The team of single manager at single location.
2.	Remote Team	The team at multiple locations with one manager.
3.	Matrixed Tele Workers	Different managers of team at same location.
4.	Matrixed Remote Team	Different managers of teams at different locations.

2.4. Advantages and Disadvantages of Virtual Team

In the last ten years the words such as "*Virtual*" , "*Virtualization*", "*Virtualized*" has been used by the researchers in discussing the social and economic problems(Vaccaro et al.,2008) but the benefits and drawbacks of virtual teams are still not clear. The main benefit of virtual team is that they have adaptable

infrastructure. Anderson et al. (2007) suggested that in order to improve the trust between the members of virtual teams it is necessary to use efficient communication in the preliminary stage of team formation. Dispersed teams are those who do not have the same location and time zone. (Stoker et al., 2001). More productive collaboration far across the distance has been made possible by virtual teams (Gassmann and Von zedtwitz, 2003a).

As a disadvantage virtual teams can lead to miscommunication, less trust and conflicts (Rosen et. al.2007). Time to market has also been reduced by virtual teams (May and Carter, 2001). The use of virtual teams has been made suitable by the improvement in information technology (Branek and Martz, 2005).The organizational and cultural differences are also a serious threat to the effectiveness of these teams. Technology plays a vital role in the success of virtual teams (Thomas and Bostrom, 2005). Following are the part and parcel for the successful implementation of the virtual team's i.e. suitable use of IT, self-management attributes and awareness of culture and project management competency (Lee Kelley and Sankey, 2008). The advantages and disadvantages of virtual teams are shown in Table 2.3 and Table 2.4 respectively.

Table 2. 3: Advantages of Virtual Team (Lee Kelley and Sankey, 2008).

Advantages
Reduction in time and cost, reduce travelling cost, it over takes the constraint of time, space and organizational differences
Quicker Time to market
Experts from all over the world are able to work with each other by use of electronic means

Efficient and fast decision making
More productivity in less time
Resources are limited but has more competitive advantage and thus have better results
Highly cohesive
Highly performed self-assessed teams
More task orientated teams
Quick response to ever changing business culture
Fast response to the requirements of global market by making reports available online and communicating online with other team members
Improvements in the output of the team
More effective and efficient team
Better satisfaction of owner

Table 2. 4: Disadvantages of Virtual Team (Lee Kelley and Sankey, 2008).

Disadvantages
Application of technological requirement is difficult
Less face to face collaboration
Less control of the activities and Decrease in monitoring of them
Conflict resolution is difficult
Proper training is required for team members
Difficult to maintain trust among the members of the team

2.5 .Virtual and Conventional Teams

Virtual teams are the one that with the help of communication technology work across the space, time and cultural differences which conventional team does not do. But the best practices followed in the field are same for both conventional and virtual teams (Bergiel, 2008).Traditional teams are the one in which the members work beside each other. Whereas, in virtual teams members are at different locations. In conventional teams the work is coordinated and can be performed by different team members by working together whereas in virtual teams the tasks are more structured. Conventional teams rely on face to face communication whereas virtual teams use information technology to communicate. Table 2.5 shows these differences between the virtual and conventional teams (Kratzer, 2005).The computer mediated communication make virtual teams different to traditional teams.

Table 2. 5: Virtual Team Vs Conventional Teams (Kratzer, 2005)

Fully conventional team	**Fully Virtual Team**
Members of the team are located at the same place	Members of the teams are located at various location
Synchronous communication	Asynchronous communication
Task is completed by mutual coordination	Coordination of other team member is required very few times

2.6. Physical team versus Virtual Team

The physical teams versus the virtual teams were classified into six types by (Pawar and Sharifi, 1997) as shown in Table 2.6.

Table 2. 6: Physical team vs. Virtual teams (Pawar and Sharifi, 1997)

Activity	**Nature of Physical Teams**	**Nature of Virtual Teams**
Interaction	Share office and non-office related information.	Information exchange between members is minimum.
Resources utilization	Able to share the resources with other team members.	Each member has access to same technical and non-technical structure.
Control on the project	Better response to the requirements as monitoring of the work is easy.	Limitation of the authority to force any penalty on delay or failure of the task.
Working atmosphere	Difficult to get proper information outside the collocated teams.	Sharing of ideas with other team members is minimum.
Educational and Cultural Background	Team members have same cultural and educational background.	Team members have different language, cultural and educational background.
Compatibility with technology	Minimum issues of technological incompatibility	Requires more technological compatible staff from the outset.

Traditional teams will not completely be overtaken by virtual teams. Although virtual teams are now part and parcel of work arrangement but they are not suitable for all types of scenarios (Nemiro, 2002).

2.7. Challenges for Virtual Team

There are many challenges which are being faced by virtual teams including trust (Malhotra, 2007; Paul, 2004b and Bal and Teo, 2001b). Efficient communication is one of the most important factor in successful implementation of virtual teams (Beranek and Martz, 2005 and Bouchard, 2004). As virtual teams have many benefits but many drawbacks come along with them (Prequp, 2006). Cascio (2000) said that there are five main drawbacks of virtual team: less face to face communication, low trust, lack of physical interaction, lack of social get together and more concern with predictability. Virtual teams face more challenges because they interact through technology and there are less face to face synergies (Gaudes, 2007 and Hardin, 2007). There are less general conversations and social interactions among the members of virtual teams which is a challenge for these teams (Furst, 2004).

2.8. Requirement for Effective Virtual Team

The literature review shows that the factors associated with effectiveness of virtual teams are still not clear. Most of the research has shown that proper and timely communication must be ensured among the team members (Anderson, 2007). Proper communication at suitable time among the member of the team builds the trust in each other (Jarvenpaa and Leidner, 1999). Factors that are associated with social interaction must be considered closely at the start of the creation process of

virtual team and are very important to make these teams effective (Lin, 2008). The social dimension of the team is directly influenced by communication and it adds to the overall performance of the team.

The communication between virtual teams can be improved by de-centralization and direct reporting structure (Wong and Burton, 2000). The proper understanding of the scope, objective, work requirements, interdependency of tasks, roles and responsibilities and expertness in their own work positively affects the quality of the work (Malhotra and Majchrzaks, 2004). For effective virtual team leadership the following attributes were suggested by (Shachaf and Hara, 2005):

- The leader should be in regular contact with other team members, provide them with proper and continuous feedback and clearly define the tasks given to them.
- The suggestion and opinions of the team members must be appreciated and problems that the team members faced should be cared about by the leader.
- All members of the team should know their roles and responsibilities, their mentors, and their authority.
- The leader should have consistent attitude throughout the life of the project and should not be very "Bossy".

The Figure 2.1 below shows the model presented by Bal and Gundry (1999) for effective virtual team working.

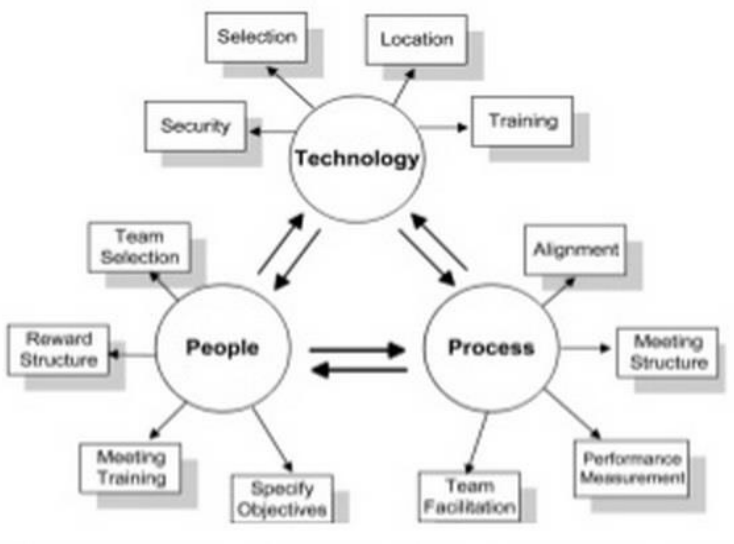

Figure 2. 1 Model for working of effective virtual team (Bal & Gundry,1999)

2.9. Working of Virtual Teams: Technological Point of View

Following are the technological point of view for the working of virtual teams.

2.9.1. Selection

The effective and efficient communication faces considerable obstructions in virtual teams (Walvoord, 2008). The presence of best technology is not solely responsible for making virtual teams effective since they require internal and external support mechanism to make these teams successful (Lurey and Rai Singhani, 2001). The selection of technology for information sharing is very critical and the implementation of this technology is also very significant (Mikkola, 2005). Virtual teams are groups of different people from various disciplines that work on same tasks by use of technology (Dekker, 2008). So how efficiently technology is implemented within the team add to the project and makes the output more or less vulnerable (Anderson, 2008).Table 2.7 shows different tools that are used among virtual teams for communication.

Table 2. 7: Virtual Team Communication (Anderson, 2008)

Tools	**Examples**	**Uses and Advantages**	**Immediacy**	**Sensory Modes**
Internet Messaging and Chat	Yahoo Messenger MSN Messenger BlackBerry Messenger Skype Viber	Low cost Instant interaction Low setup requirement Less interruptive than a phone call	Synchronous Asynchronous	Visual Text and limited graphics
Web Conferencing	Net Meeting WebEx Meeting Space Go To Meeting	Live Audio Dynamic Video White Board Application sharing Moderate Cost and Setup effort	Synchronous	Visual Unlimited Graphics Optional Audio
Groupware/Shared Services	Novell Groupwise Lotus Notes Microsoft Exchange	Calendars Contact list Arrange meeting Cost and Setup efforts vary	Asynchronous	Visual
Remote	Net Meeting WebEx	User controls a PC without being	Synchronous	Visual Audio

Access and Control	Remote Desktop Pc Anywhere	onsite Cost varies Setup Varies		Tactile
File Transfer	File Transfer Protocol Intranets Collaborative Websites	Shares file of any type Cost Varies Moderate Setup efforts	Asynchronous	Varies with file content
Email	Numerous vendors and free applications	Send messages or files Cost and setup efforts varies	Asynchronous	Visual Audio in voice mails.
Telephone	Plain old telephone service Voice over internet protocol	Direct calls Conference calls Cost varies Low setup effort	Synchronous Asynchronous for voice mails	Audio

2.9.2. Location

Geographically dispersed teams have allowed the organizations to hire the experts for a specific work from around the world. It provides greater flexibility for the individual to work either from home or from offices (Bell and Kozlowski, 2002). Table 2.8 shows the relationship between tools time and space in dispersed teams.

Table 2. 8: Time /Space matrix (Bouchard and Cascio, 2004)

	Same Space	**Different Space**
Same Time Synchronous	Face to Face meeting, brain storming, vote, PC and projector electronic white board, GDSS, chat	Chat ,Teleconference, Video conference ,liaison satellite, audio conference, shared white board, shared application
Different Time Asynchronous	Team room ,document management system, discussion forum ,E-mail, work flow, project management	E-mail, work flow, document sharing, discussion forum, version control , meeting schedulers

2.9.3 .Training

There is increase in the satisfaction of team members and cohesiveness if the proper training is given (Hertel, 2005). Training is one way of increasing collaboration between the team members of virtual teams (Anderson, 2007).

2.9.4. Security

One of the concerns in virtual teams is sharing of information through internet as data is very sensitive so proper security; firewalls are required (Bal and Teo, 2001c).

2.10 Working of Virtual Team: Team member's point of view

The team member's point of view for working of virtual team is as follows;

2.10.1 Team Selection

The selection of team members is one of the most critical factors that create a difference between the successful and unsuccessful teams (Bell and Kozlowski, 2002). As members of virtual teams are geographically and organizationally dispersed thus their selection is difficult (Bal and Gundry, 1999). So it is the responsibility of the leader of the virtual team to make sure that project scopes and objective are clearly defined, everyone should know its role and responsibility and there should be supportive climate (Hunsaker, 2008).

2.10.2 Rewarding System

The team members of virtual team should be rewarded on the basis of their performance to motivate them (Bal and Teo, 2001b and Hertel et al., 2005). It was found out that the rewarding system in virtual teams highly motivates the team members and they recognize it as an external support (Lurey and Rai Singhani, 2001).

2.10.3 Training

In team building training is one of the most important aspect that cannot be neglected. The team members of virtual team need special training as compare to conventional team. Different types of training include collaboration and communication training, information technology training and management skills (Bal and Teo, 2001c).

2.10.4 Define objectives

The virtual teams require the delegation of power and authority to different team members more effectively (Hertel et al., 2005). Thus the team leader or team

manager acts as a coach and moderator in virtual teams (Kayworth and Leidner, 2002). Team leaders should define clear objectives to team members as early as possible to achieve high performance and make teams successful.

2.11 WORKING OF VIRTUAL TEAM: WORK PROCESS

The work processes of virtual teams are as follows;

2.11.1 Alignment

The work processes and work flow should be properly understood by every member of the team (Bal and Gundry, 1999).

2.11.2 Meeting System

It was argued that virtual teams are less cohesive due to lack of face to face interaction (Shin, 2005). There is lack of motivation in virtual teams because the team leader is physically absent (Kayworth and Leidner, 2002). A formal team structure is implemented by team managers as members have very less physical interaction. The spoken language challenges were overcome by virtual teams through synchronous written document (Shachaf, 2008).

2.11.3. Measurement of Performance

Highly performed virtual teams have following characteristics; clear and well defined goals, trust and bonding among the members and respect for each other (Kirkman and Rosen, 2004).

2.11.4. Team Accountability

Clear roles and responsibilities are given to virtual team members. Proper scheduling, giving the deadline and proper coordination are required to increase accountability (Massey, 2003).

2.12. CHALLENGES OF VIRTUAL TEAMS IN CONSTRUCTION INDUSTRY

The challenges faced by virtual teams in construction industry are;

2.12.1. Communication

According to Haris (1993) the nonverbal aspects of communication makes 65%-93% of message's meaning which is lost in virtual teams due to less physical interaction. As team members are not collocated thus it is harder to make these teams united, cohesive and coordinated (Alexander, 2000 and Bennett, 2001). As computer mediated technology is required to transfer information thus there are greater difficulties in virtual environment.

2.12.2. Language Difference

The different members of the team have different mother languages thus they encounters difficulty in communicating among each other.

2.12.3. Physical Interaction

Less face to face communication create hurdles in and collaboration and as a result it affects team effectiveness (Jarvenpaa and Leidner, 2004). In order to build strong relationship some researchers argue periodic physical meetings among the members of the team for better communication (DeMeyer, 1991 and Gelegher and Kraut, 1994).

2.12.4. Time

Time can be a benefit or drawback depending on the work time. Time problem occurs when synchronization is required for the people who are not located at the same place. Gorton and Motwani (1996) argued that the teams that are not co-located can gain advantage because of the time difference between different places.

2.12.5. Data Security

As virtual teams collaborate, communicate and share data through internet and information technology so it is necessary for the project manager to make sure that the project related documents and data should be properly safe from the hackers and competitors on the internet.

2.12.6. Motivation

Motivation is one of the key characteristics of highly performing teams whether they are conventional or virtual. Virtual team members should not be overwhelmed by the feeling of isolation. The members of dispersed teams may react differently to various situations that are “Out-of-sight” and “Out-of-mind” reaction. There are two factors which were observed by Harrison (1994) to determine the efficiency of anything to motivate people at a project is:

- Characteristics of people involved
- Characteristics of their environment (House and Mitchell, 1974)

2.12.7. Difference of Culture

As virtual teams involve the members of different cultures so they have different moral values and traditions which may proceed to conflicts and misunderstandings (Evaristo, 2001). Cultural differences are huge challenge for global virtual

engineering teams (Dube & Pare, 2001). The national cultural differences play a vital role in overseas projects (Dube & Pare, 2001)

2.12.8. Conflict Resolution

Conflicts are common in construction projects. Due to lack of face to face communication and interaction it is more likely that conflicts may take place in virtual teams.

2.12.9. Trust

For the success of virtual teams and project implemented using virtual teams, trust is an important factor (Jarvenpaa and Leidner, 1998). Forming trust in virtual teams is one of the biggest hurdles in the successful implementation of these teams (Glisson, 2002). To ensure the maximum use of information and communication technology (ICT), the trust among the team members is very important (Bandow, 1998)

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Introduction

This chapter explains the research methodology used in this study. Different techniques and methods used for this research are mentioned in this chapter. Although qualitative and quantitative methods offers clear insights to virtual teams but processes of virtual teams need multi-faced research approaches (Steinfield, 2001).

3.2. Procedure of the Research

Various techniques have been used in this study. These techniques include interviews, case study research method and analysis of the content. The description of these techniques has been provided in this chapter. This section explains different processes of the research which were used to obtain the objectives of this study.

3.3. Literature Review

A thorough review of current literature was conducted having the topics such as managing the virtual teams, challenges of the virtual teams, building of effective virtual teams and offshore outsourcing by the engineering team. The literature review was conducted from both the academia and from the industry practices which had the following aspects; globalization of engineering teams; virtual teams in construction industry; structure of the team; communication and collaboration tools and the critical factors. Global market data of past, present and future trend of

global offshore outsourcing was reviewed from the sources such as research papers and journal papers.

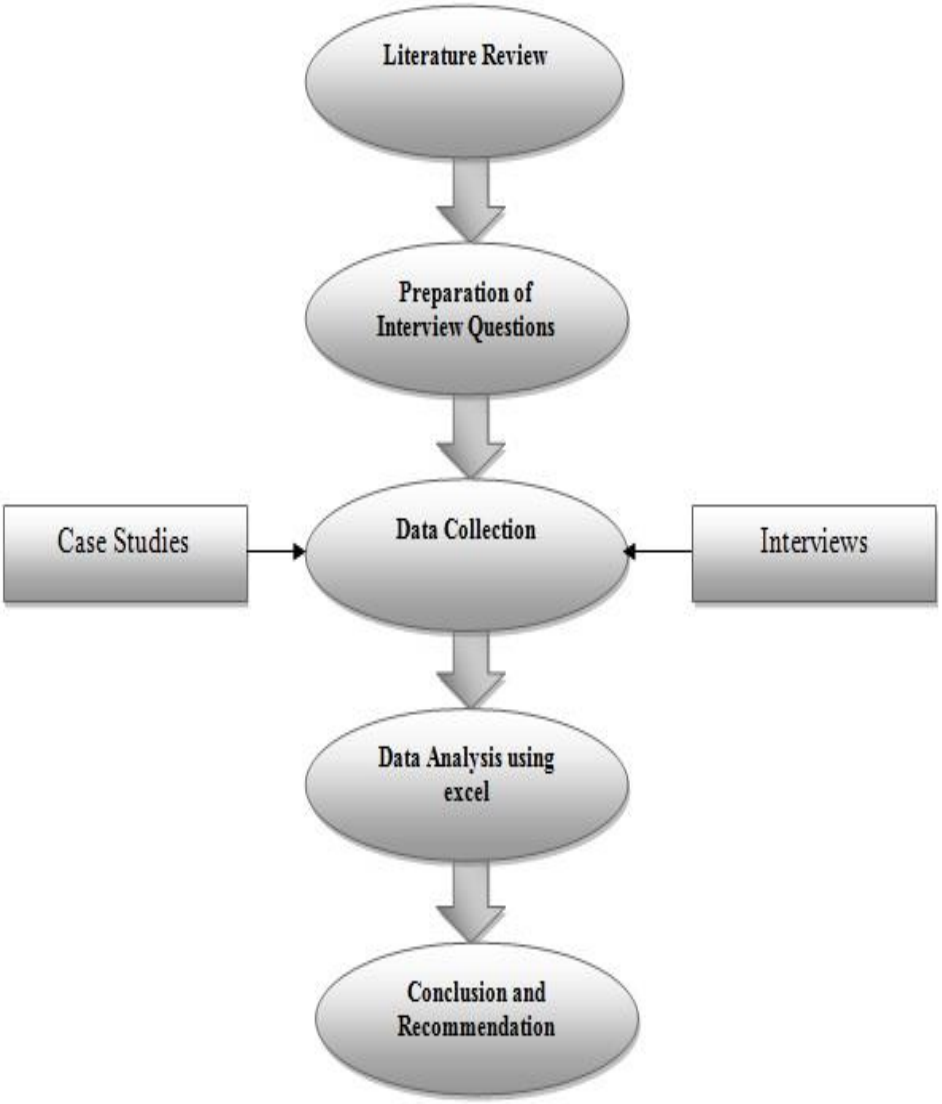

Figure 3. 1: Flow-Chart of the Research

Figure 3.1 shows the flow chart that a thorough literature review was conducted on the research which has been done on virtual teams up till now. The literature

review chapter has been explained previously. The next step was to compile the interview questions which would help to attain the objectives of this study. The interview questions were than finalized. The next step was to take the interviews of the field practioners who have the experience of working with the virtual teams. The interviews were conducted by engaging the interviewees at the suitable time available to them. Then two case studies were performed to get the knowhow of the practices going around the field. The data collected from the interviews and the case studies was then analyzed using MS-Excel to get the suitable results. At the end conclusions and recommendations have been made on the basis of these studies.

3.4. Semi-structured Interviews

The in-depth interviews were conducted with the executives and team members of virtual teams (both domestic and international) to obtain the qualitative results from this study. Usually there are two approaches to incorporate interviewing research method; one is structured interviews in which interviewees have very little space to deviate from typical responses (Dexter, 1970). The other method is to conduct unstructured or semi-structured interviews which can be used in any of the following situations (Guba and Lincoln, 1981):

- When the interviewer is dealing with the subject that requires special knowledge;
- When the interviewer requires in depth knowledge of some subject;
- When the interviewer is trying to discover something rather than verifying it;
- When the interviewer is trying to find out the causes of something;

- When a face to face interaction is required to the interviewer with the respondent;
- When the interviewer is trying to unleash some explanation that is held by the interviewee (Dexter, 1970); or
- When the interviewer is trying to make out the meaning from some conditions and atmosphere.

When the interviews are taken it is necessary to consider that the interviewer is biased. Biasness is the "*tendency to observe the phenomenal in a manner that differs from the true observation in some consistent fashion*" (Simon and Burnstein, 1985). One way to reduce this biasness is to develop unstructured or semi-structured interviews or by asking the questions to the interviewee that do not require him to be in particular frame work. Content analysis procedure is another way to analyze the data of the interview. Content analysis is a way of processing the information in which the knowledge communicated is changed into data that can be compared by the use of systematic categorization rules (Holsti, 1969). In this study the method used for content analysis was to carefully listen to the recordings of the interviews taken and then developing the relationships between the different facts and figures discussed in that interview.

The interviews taken for this research were with the project managers, construction managers, domestic and international executives of the construction industry. The priority was given to the managers and the executives because of the fact that they are the personnel usually involved in the decisions making of the organizations to whether go or not go for the use of global virtual engineering teams. The lessons

learnt, the knowledge and the experience of these field practioners were very important for this research.

The preliminary semi-structured interviews were conducted with national and international construction industry specialists. All the interviews were performed face to face on the basis of the availability of the interviewees at their locations. All the interviews were recorded and the permission of recording the interviews was taken from the participants. The average duration of interview was 60-80 minutes. The development of interview question was on the basis of literature review and brain storming sessions with the specialist of construction industry.

To develop more understanding of virtual team concept the questions of the interview were divided into different sections that is demographical information; organizational level decision; project related decision; implementation of best practices; examples of case study and concluding questions.

The purpose of attaining demographical information was to acquire the knowledge that how much experience does the interviewee have with the geographically dispersed teams and what is his level of accountability. The organizational decision part was more related to development of the overseas offices of different companies and what skills and development is necessary to maintain the performance at highest level in virtual teams. The third section of project related decision was more specified to the requirement of information technology, cultural backgrounds and motivation of the team members at a particular location where projects are being undertaken.

The fourth section was more related to the past experiences of the interviewees who had implemented some projects with these dispersed teams. The most

important factors and the best practices were gathered by these examples. The next section was to attain the information of successful or unsuccessful projects that were completed in virtual environment. The last section was to get the thoughts of the interviewee about the increase of the virtual teaming trend in near future and any other important information that they want to consider for this research.

3.5. Sample Size

Different researcher had different point of view regarding the number of interviews that have to be conducted for qualitative study. According to DiCicco-Bloom & Crabtree (2006) 8 or more interviews yield reliable results whereas according to another study by Elmar & Mark (2009) the sample size in the exploratory kind of study can be determine by conceptual saturation and interviews are enough when information starts repeating itself.

The 40 interviews were conducted for this qualitative study.

3.6. Data formation and Result Analysis

The data received from the interviews was summarized in the form of graphs and tables. Counting on the responses from the particular questions the final results were formulated in the form of the percentage or any other suitable format. On the basis of the interviews and case studies the success and failure factors were organized in decreasing order of importance. In order to achieve the objectives of this research the interviews and case study data was carefully analyzed.

3.7. Location of the Interviewees

Figure 3.2 shows the location of the interviewees. The 28 % of the interviewees were from Punjab, 20% from Federal and KPK. Whereas 15% of the interviewees were from AJK and 17% International interviewees.

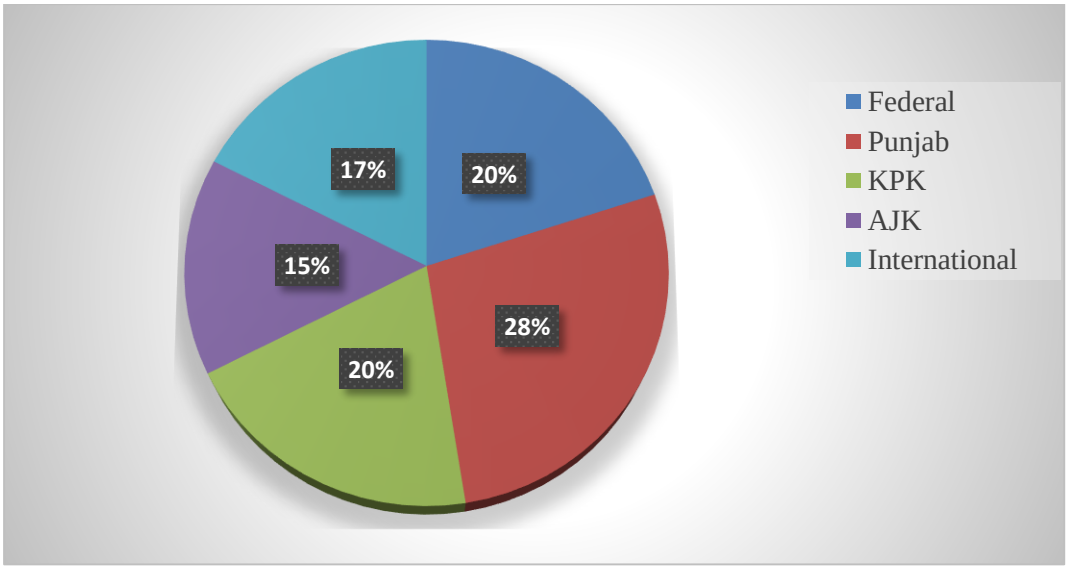

Figure 3.2: Location of interviewees

3.8. Case Study Research Method

Two different case studies of different projects were implemented in order to gain the proper knowledge of how virtual team works on various projects. The case study research was performed by using interview method with the managers and executives who have vast experience in managing projects with geographically dispersed teams. According to Yin (1989) the case study research method is very highly rated in areas where;

- The question of the research asks ‘how’ or ‘why’.
- Control on the events is small.
- The study focuses on contemporary events.

Case Study was based on Semi-Structured Interviews targeted to the experts and professionals of VT giving them a Topic rather than a set of questions, and refining through funnel approach. In funnel approach open ended questions were asked from the interviewees in the beginning to get the general information then the clarifying questions were asked to get the maximum and refined information. At the end the close ended questions were asked to get research specific points.

The case study highlighted those factors which makes implementation of virtual team successful or unsuccessful in construction industry. The case study was completed by taking interviews of the members of virtual team working at that project. The case study includes two projects that are undergoing at different time periods. The case study explains the use of information technology, transfer of data, issues in management and key success and failure factors associated with these projects.

CHAPTER 4

DATA ANALYSIS AND RESULTS

Virtual team implementation is at the early stage with in the construction industry. From the collection of data during the research it has been found out that this is an area of relative importance within the construction industry. But still there are many hurdles that are to be passed through to reach its complete implementation. The phase of collecting data is to determine the virtual team concept within the construction industry. The attention has been given to find out the impacting factors, current use of virtual teams in construction industry, future of the virtual teams in construction industry and success or failure factors.

The different members of various teams who had the experience of working with global virtual engineering teams (GVET) were selected for this research. The respondents were contacted through telephone calls, emails and skype calls in order to select the suitable time for the interview. The subsequent charts in following section highlight the responses from the research as well as the overview of the results.

4.1. Data Collection and Survey Results

Figure 4.1 shows the summary of the data collection for this research. 40 interviews were conducted for this research including the case study interviews. The result of these interviews showed that 20% of the interviews were from owners, 20% were from contractors, 32% were from consultants and 28% were from designers.

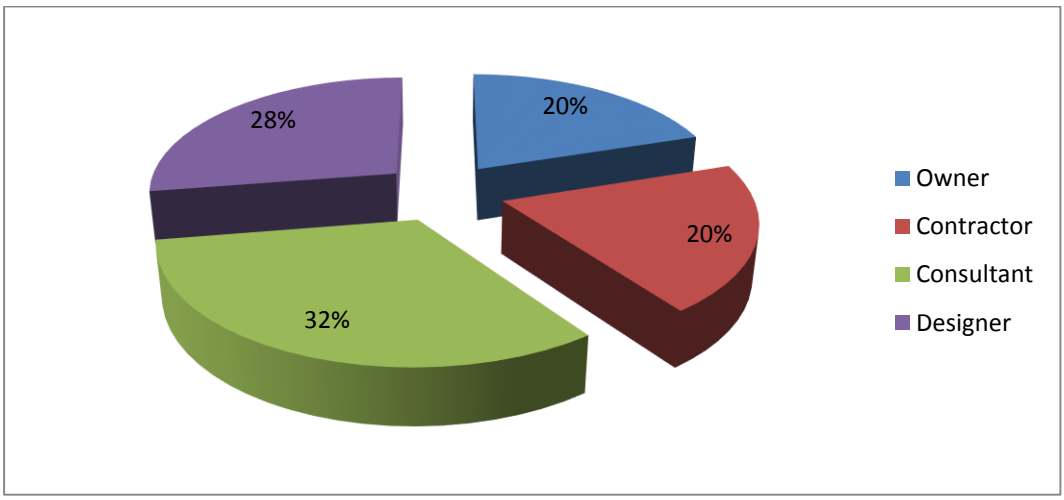

Figure 4. 1: Types of Participants

Figure 4.2 represents the number of interviews taken from the local engineers, managers, executives and from the international engineers, managers and executives. It shows that 82% of the interviews were from local managers and engineers and 18 % of the interviews were from international engineers and managers.

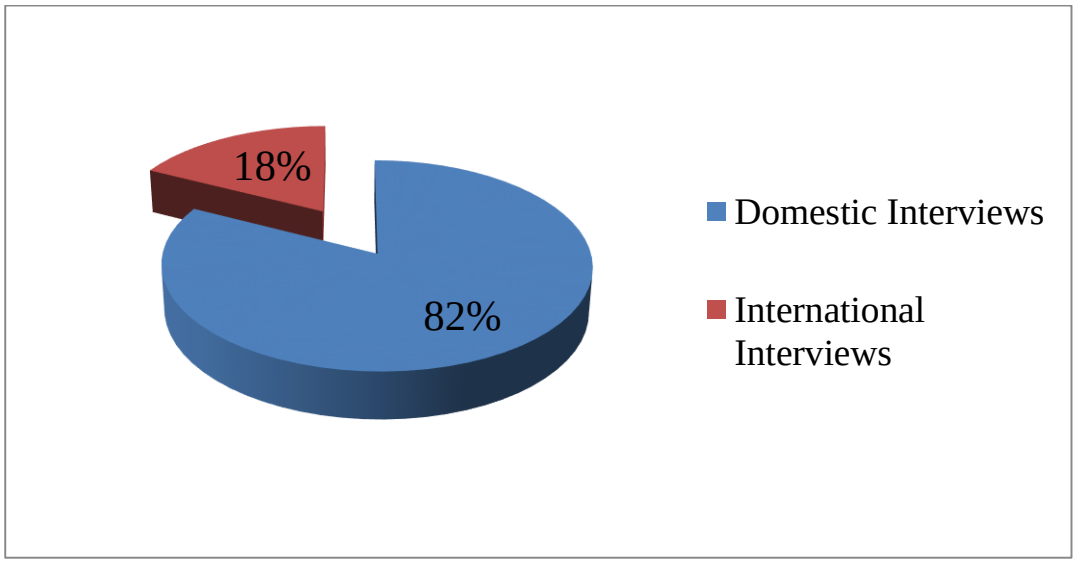

Figure 4. 2: Participants of the interview

Figure 4.3 represents the types of the positions of the participants and percentage of team members. The most of the participants were engineers (67%), 20% of the

participants were the projects managers, 8% were architect and the lowest number of participants were superintendents which makes the 5% of the interviewees.

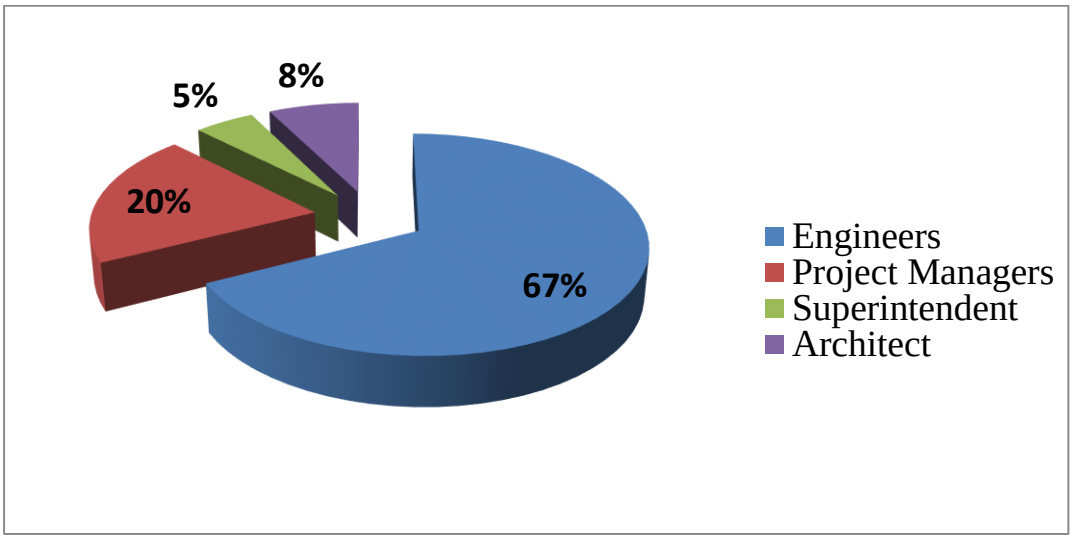

Figure 4. 3: Percentage of participants by Job position

Figure 4.4 shows the amount of the experience of the interviewed participants in the construction industry. Only 2 of the participants had the experience between 0-5 years. 13 out of 40 participants had the experience between 5-10 years, 10 had the experience between 10-15 years and 15 out of 40 interviewees had experience of more than 15 years.

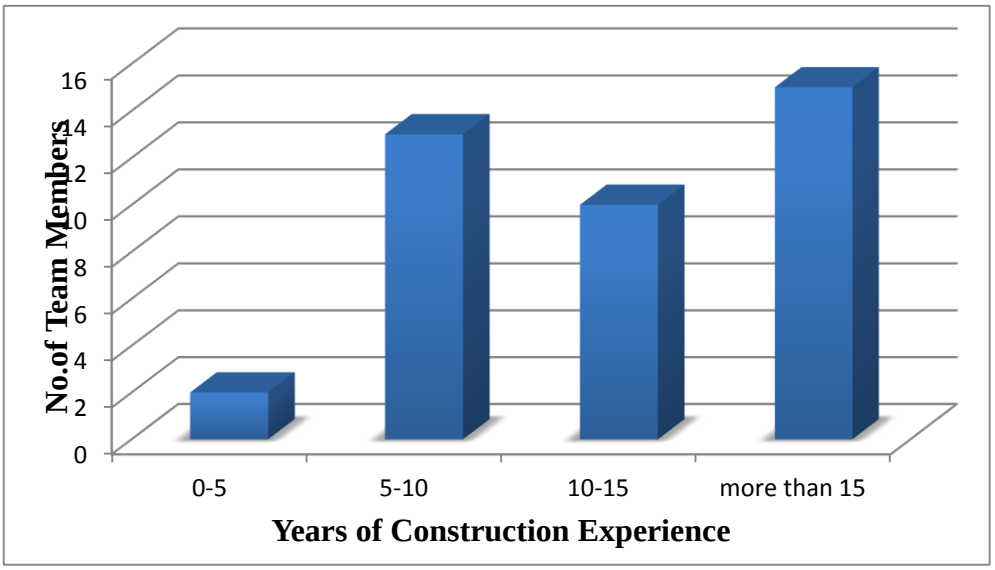

Figure 4. 4: Years of experience of the participants

Figure 4.5 shows that most of the projects performed by the virtual teams are highway projects. Commercial and Government projects comes 2nd whereas other projects such as esidential or educational projects are less executed by virtual teams.

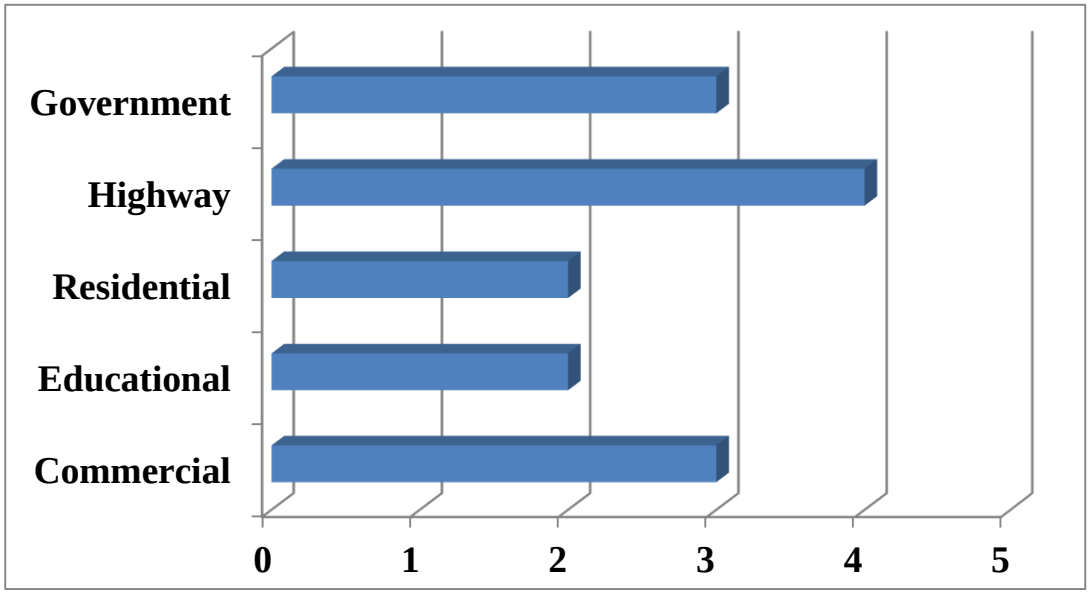

Figure 4. 5**: Types of Construction projects performed by Virtual Teams**

Figure 4.6 shows that the 72% of the projects undertaken by the virtual teams have the contract value in between 20-50 billion PKR. 21% of the projects value less than 20 billion PKR and the remaining 7% of the projects have the value more than 50 billion PKR.

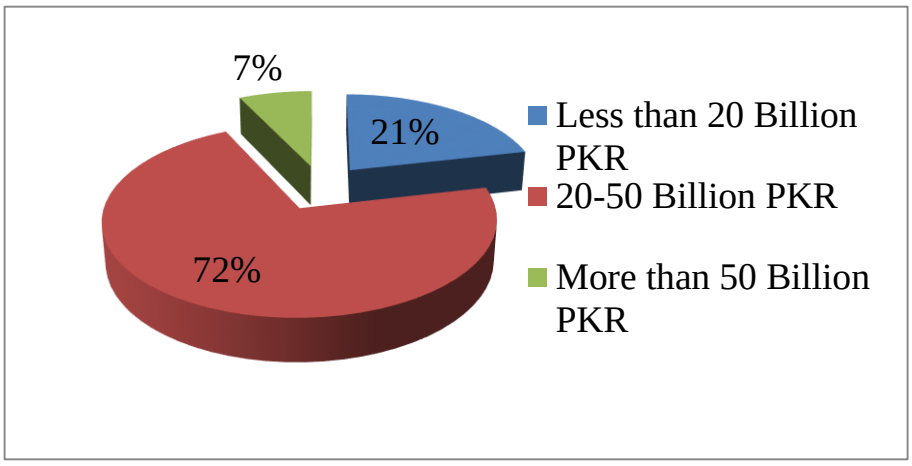

Figure 4. 6: Contract value for the projects performed by Virtual Teams

Figure 4.7 shows that the most of the interviewed participants (58%) had more than five years' experience working with virtual teams. 35% of the participants had the experience of 1-5 years working with the virtual teams and only 8% of the participants had less than one year experience of working with these types of teams.

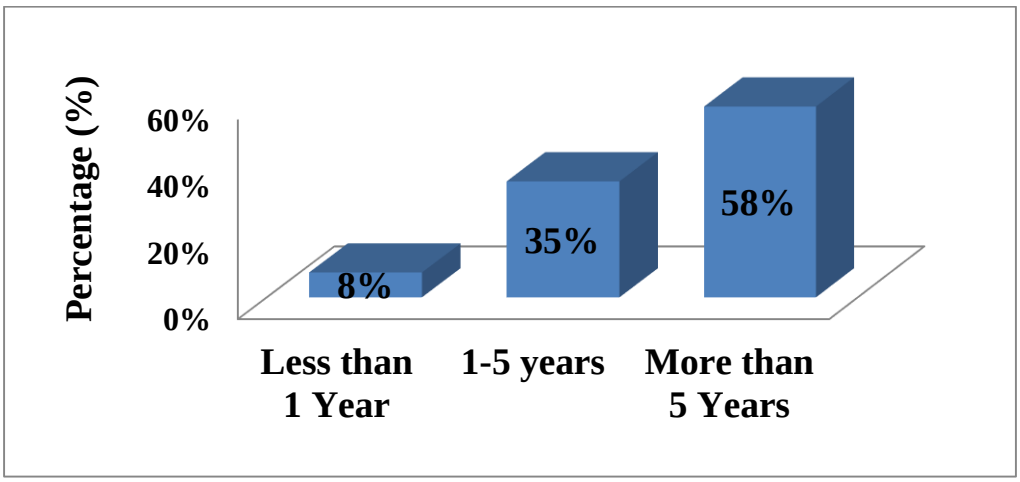

Figure 4. 7: Personal Experience with Virtual Teams

Figure 4.8 show that 80% of the companies are using virtual teams on many projects. 13% of the companies are using virtual teams on the 1st project whereas only 7% of the companies are implementing virtual teams on all the projects performed by them.

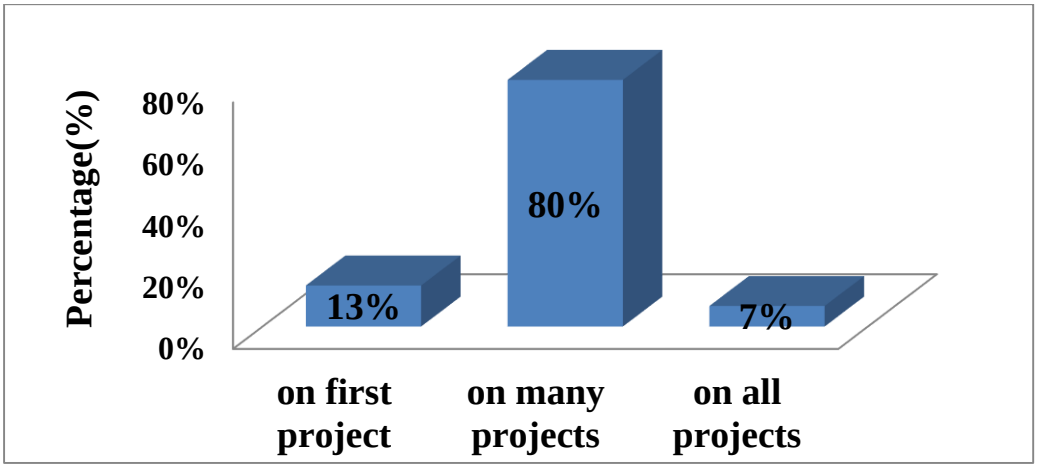

Figure 4. 8: Frequency of company use of virtual teams

Figure 4.9 shows that 80% of the construction companies that are working in virtual environment have opened their overseas engineering design offices, 13% of the teams that are working overseas do not have permanent overseas offices in order to carry out work in virtual environment and 7% of the companies are in the process of opening the foreign offices.

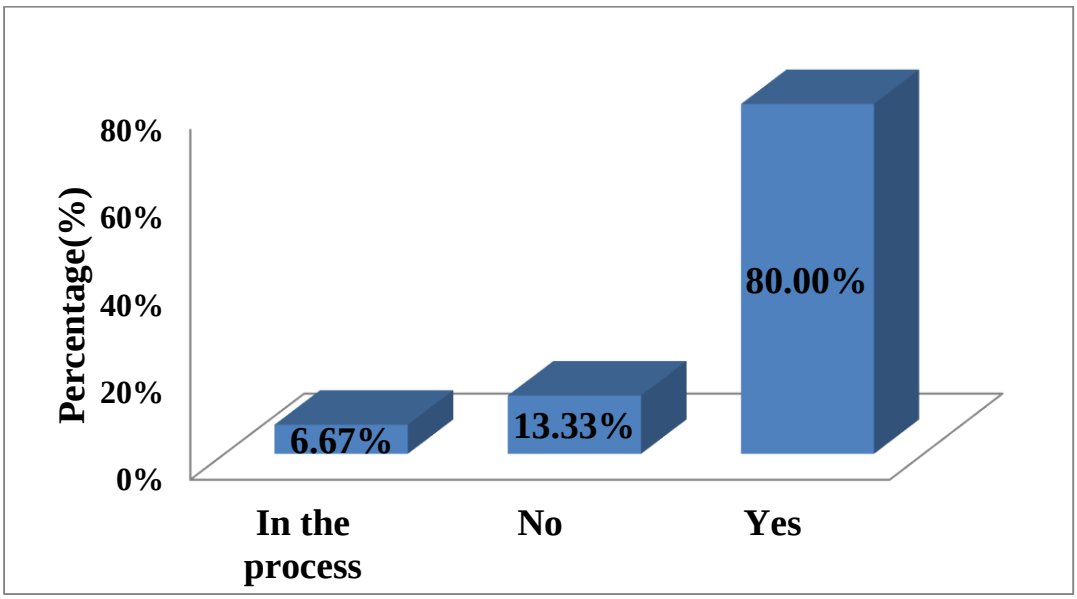

Figure 4. 9: Offices Participating in Virtual Teaming

87.5% of the respondents argued that the home country rules, regulations and policies do not limit the use of virtual teams. Only 12.5% of the participants said that use of virtual team gets limited by some countries policies and regulations

Figure 4.10 shows that 37.5 % of the respondents indicated that the projects performed by virtual teams have the same productivity as when performed by conventional teams. 32.5% of the respondents observed that the productivity increases whereas 30% were of opinion that productivity decreases.

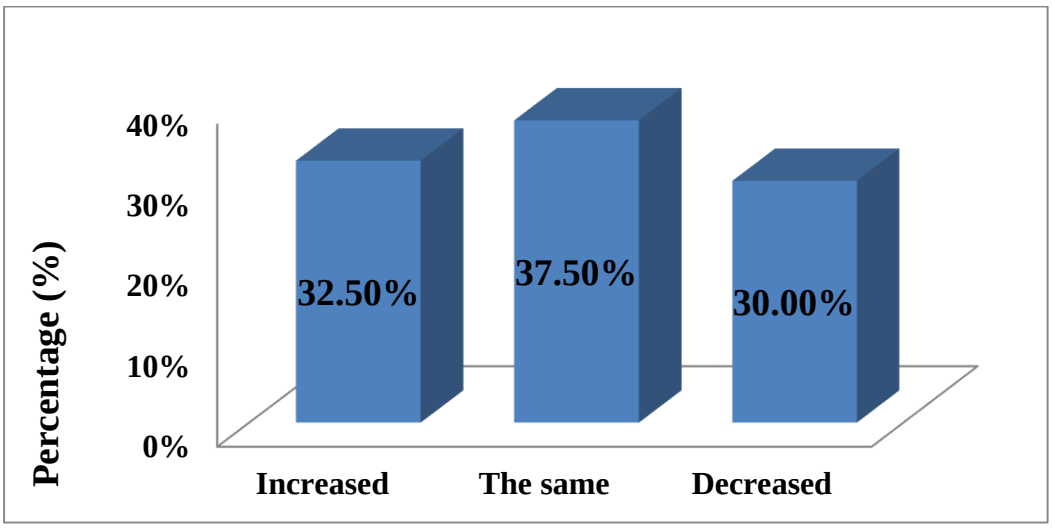

Figure 4. 10: Engineering Productivity Impact

It was asked from virtual team members that do they find it difficult to fulfill the requirements of virtual team. 70% of the interviewees responded that they do not find any difficulty in fulfilling the requirements of the owners with the virtual teams whereas 30% of the respondents said that they have some difficulties in satisfying the owners completely in virtual environment

It was asked from the members of the virtual team that if they encounter language problems during communicating with foreign team members. 93% of the participants said that language is not a barrier as English is used as a common language to communicate between the members. 7% of the participants said that language does cause some problems but it is extremely rare.

There was a question asked to the participants that whether technology is creating any hurdles in the use of virtual teams. According to Figure 4.11 most of the participants (82.5%) said that the communication and collaboration tools are getting better day by day and technology available for communicating, data transferring and information sharing is quite suitable whereas 12.5 % of the participants said that technology creates problems few times. Whereas only 5% of

the participants argued that suitable technology is not available for the virtual teams.

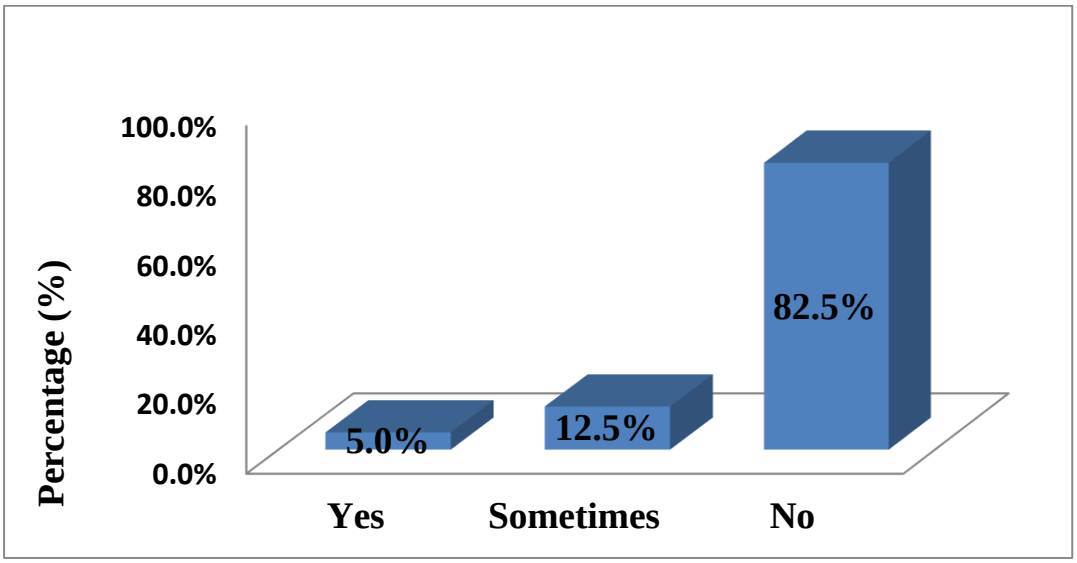

Figure 4. 11: Technology as a major Concern for Virtual Team

In today's virtual environment the project manager or a leader does not only have to deal with the technical difficulties of a project, but it also requires managing the relationships between the team members coming from different cultures and nations (Mar-Yohana, 2001). It was found that 75% of the respondent thinks that virtual teams do enhance the amount of time spent on any project by the project management team, whereas 25% of the participants think otherwise.

As members of virtual teams are not present at the same location thus managers have the difficulty in communicating with these team members. In communicating with the fellow team members in dispersed team, electronic collaboration and communication tools plays a pivotal role. So managers must have multiple options of communicating with his team members.

Figure 4.12 shows that how managers communicate with their fellow team members. As in virtual teams managers do not have sufficient chances to have

physical interaction with the team members and to praise and reward them on their better performances. How do managers overcome this challenge? The Figure 4.12 illustrate that phone calls to the members of the team is a preferred option with 34.29% response. Collaborative tools accounts for 28.57% of the responses. Direct visits to the team members located at different positions accounts for 21.43% of responses. Reviews in writing have the least percentage that is 15.71%.

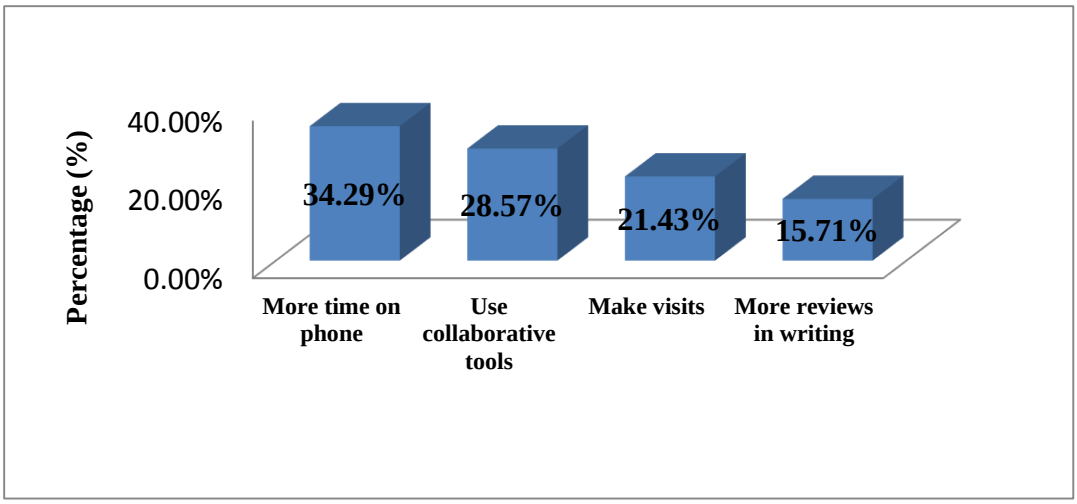

Figure 4. 12: Impact on Management Response on Virtual Team Members

It was recognized from the literature review that trust is one of the very important factor for the successful implementation of the virtual team. Figure 4.13 shows the result for the problem of trust in dispersed teams. 67.5% of the respondents said that there is less trust among the team members of the virtual teams. It was interesting that 30% of the respondent felt that it does not make any difference. Whereas only 2.5% of the participants said that there is increase of trust in virtual teams and its members.

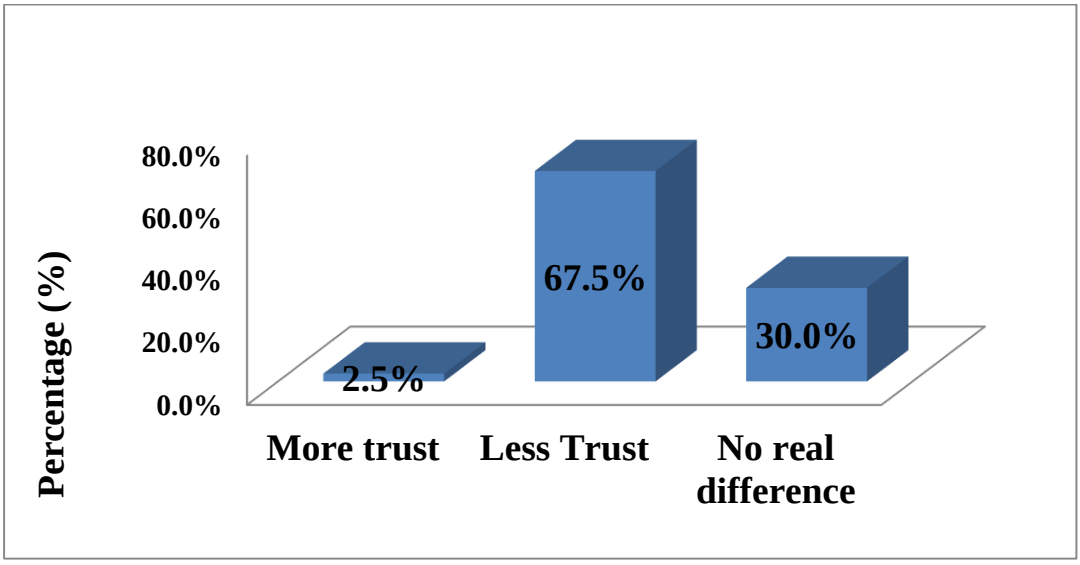

Figure 4. 13: Impact of Virtual Teams on Team Trust

There was a section in the interview question that focused on the tools used for virtual team implementation. Figure 4.14 shows that email is one of the most popular tool used by the members of the virtual team with 100% usage, whereas web conferencing, video conferencing, project specific websites, virtual private networking(VPN) and file transfer protocol(FTP) were accounted for 55%, 70%, 42.5%, 30%, and 42.5% by the respondents respectively.

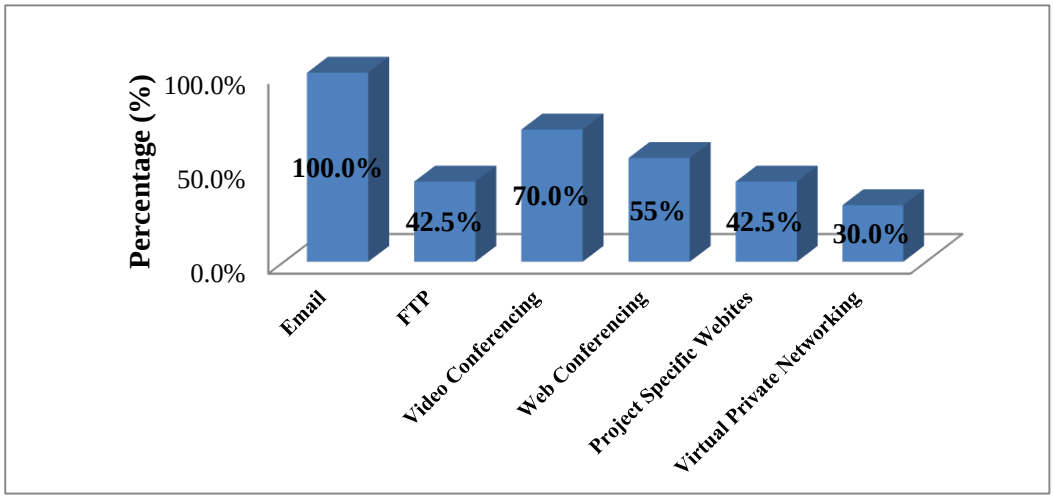

Figure 4. 14: Tools used for Virtual Teams

4.2. Further Observations from Interview Data

This section focuses on the suggestions of construction industry executives on the success factors of the virtual teams and the practices that should be observed in

order to make the virtual team implementation more valuable. It focuses on the practices that should be undertaken in order to optimize infrastructure for virtual team in the following areas that is organization, communication, quality, technology, scope definition, working sharing and project control. After detail analysis of all the interviews the following description has been developed.

The lead office is the head quarter based in the home country which directly serves the client and perform engineering tasks on construction project whereas support offices are the alliance partners or the sub-contractors who take on the responsibility of performing engineering services and report it to the head offices.

4.2.1. Organization

The interviews expressed that with respect to organizational category for implementing virtual teams the following things are vital for the success:

- The staff hired and employed in virtual team environment should be expert in its field and must have the required skills such as different language skills and experience of different cultures.
- Must have the experience of working with lead offices and implementing its work practices.
- Should be flexible to new ideas, processes and must be able to work in different time hours.
- Must have the knowhow of the standards and codes used in various countries.

The skills of the team members to communicate with each other are also very important. If there is the language difference between the head and alliance offices, the interpreter of vast experience will play a vital role especially in cross-cultural

negotiations. The interviewees suggested that there should be proper training given by the company on the laws and regulations and codes of the country where project has to be performed, training on the information technology that is to be used, language and communication skills must be enhanced, training on cultural awareness and training on the work processes must be given. It should also be made sure that customer philosophy, specification and different practices must be completely understood. The rewarding system has to be developed in all offices of the virtual teams in order to motivate the engineers. The support offices must be given proper recognition and respect. The management techniques must be defined within the structure of the organization. It is also very vital that the culture which enables influence on the safety culture should be emphasized and formed.

4.2.2. Communication

The interviewees suggested that it should be made sure that there is no miscommunication among all the offices that are taking part in the execution of a project. The language difference may result in futile errors and thus should be managed efficiently. There are some measures recommended by the managers and the executives such as; the employers hired must have multi-lingual skills and in order to make communication clear and consistent there should be a facility of interpreters; dictionaries must be developed in order to translate technical terminologies; and also developing information sharing and conformation mechanism.

It was also expressed by the employees of the virtual teams that to make sure the engineers completely understand the work processes, they should be given the responsibility of documenting the work processes and procedures. Knowledge

management systems have gained wide popularity with in the companies in order to have the knowledge of the location between the offices of the company. The lessons learned data base is one of the most common form of knowledge management system.

The results suggested that the success of virtual team implementation lies in the fact that there should be a great trust between the members working in the different offices at different regions. It can be improved through physical interactions and traveling to the other places where team members are present. The most effective strategy to get 100% out of the experienced and experts virtual team members is by rotating personnel. In order to have transparent communication the periodic meeting should be conducted as they are very important. These meetings can include the conference calls between the head and alliance offices; by weekly review meetings of the projects between the managers; face to face meetings in between the leaders of the group and at the key points of the project life cycle.

4.2.3. Quality

It was also suggested by the interviewees that the goals of the customer and the stake holders present at various location must be accurately communicated. The proper and thorough quality assurance plan should be form, develop and must be enforced. At the start of the project all the members of the team must be made aware of the quality requirements. It was also indicated by the respondents that all members of the team knows the requirements of the quality expected and have the required codes and the references. In order to meet the engineering process requirement the proper training and suitable quality control reviews must be ensured.

4.2.4. Technology

It has been expressed by the interviewees that in order to support the team work the information technology use must be standardized at all the offices involve in the project. The practices recommended by the respondents are: accounting system and earned value system must be integrated and coordinated; it should be made sure that information and communication technology (ICT) infrastructure is present before the project starts; presence of high speed internet and protected links for the communication must be made sure; and the usage of the application must be standardized e.g., CAD must have standardized level for structure, the step up of font page in the word, etc. The interviewees suggested that the use of suitable technology for communicating and collaborating must be ensured, the suitable tools for communicating might include the video conferencing system and web based tools for better sharing of the presentations and whiteboards. The members of the team must be trained in using the information technology. It is because the best can be taken out of the selected tools and technology for information when team members have full command over them. The training must be given on data management systems, CAD execution plans and various softwares. The use of the hardware must also be standardized so that hardware conflicts do not take place.

4.2.5. Definition of Scope and Sharing of Work

In this part of the research the things that were conceded to be important by the interviewees were properly defined the requirements of the project and identification of the objectives of the all project stakeholders. The customer support is necessary to implement the virtual team strategy. The few factors that should be given importance during the investigation of the location of the projects

or working partner's ability is to find out the competencies that may occur at the location, experience, language ability, laws of the country that should be obeyed and rules and regulations of the local employment. There should be proper sharing of the work that must be absolutely clear and must be in alignment with the goals of the project. Work sharing must include policy limitation of the trade it must be made sure that there are no hurdle in the technology transfer between various countries. Sharing of work must also consider any requirements of the security regarding the working files, area of the work or any trade issue. All offices that are taking part in any project must have clear defined roles and responsibilities. For example, responsibility of any particular work, key contacts for the work, different practices, different rules and processes of work. There should also be the description of how to resolve any issue. Another important point is to identify when to transfer the information and to whom this information should be transferred.

4.2.6. Control of the Project

It was expressed by the interviewees that accurate and detail review of the cost must be done on regular basis, for example traveling cost, living cost, cost for rotating the engineers and different expenses for the experts. For the accurate reporting of the cost, the properly integrated system of accounting is required. The interviewees suggested that the schedule in the head and sub-offices must be integrated in order to fulfill the client's requirement. In scheduling the projects with virtual teams it must be taken into the account that there are different holidays at different regions so project should be scheduled keeping that in mind as it can be a very important issue in various country atmospheres.

4.3. Findings from the International Interviews

This section summarizes the point of view of the international engineers and managers on virtual team's utilization. The following data is based on the 7 interviews which were taken from the international managers and engineers.

The international and domestic interviewees were having the same point of view on the following points:

- The key players should be involved early in the project and there should be early face to face meetings between different team members;
- There should be clear roles and responsibilities, same objectives, and similar practices must be observed;
- Tool for communicating and coordinating must be standardized and there should be equal compatibility in the usage of software, hardware and various tools.

There is a theory regarding the team research and goal setting which has shown that the effectiveness of the team increases when the team members have the common goals and objectives. The international interviewees identified some of the factors that were to increase the use of young engineers, get international work and projects should be completed economically.

4.3.1. Knowledge Management Systems

The main factors for introducing knowledge management systems are: The use of best practices by the key employees; the use of the knowledge of the key players and retaining it; enabling the periodic improvement; responding to the needs of the customers more abruptly and to decrease the need of the rework. The international

interviewees also described that implementing knowledge management system helps in virtual team's implementation.

4.3.2. Motivation and Reward System

The international interviewees agreed that the recognition and incentives system has helped to motivate the members of the dispersed teams. The recommendations they made included the development of projects specific incentive program. Recognition should be made when key goals are achieved and must be celebrated. There should be some incentives that should be related to the performance of overall project, not the performance from any one type of the team. There should be executives visiting from the head offices to the sub or alliance offices in order to increase the morale of the individual and discussing various issues with the team members. It is also vital that one understands the things that are valued by the other people. It is also better to transfer the power of the decision making regarding rewards and incentives of the management present at the local office.

4.3.3. Differences of Culture and Cross-Culture Communication

The issues related to culture and bad governorship may proceed to the issues and conflicts that are very difficult to handle. So it was recommended that the differences in the cultures must be handed carefully and suitable projects managers must be selected.

4.3.4. Experience

The international interviewees explain that by executing more projects with the virtual teams they have now better understanding of the challenges related to these

teams and thus they can handle them more easily which has drastic effect on the project performance constraints such as cost, time and quality.

4.4. Examples of the Challenges Encountered from Interviews

In this part of the study we will discuss some interesting issues that took place with the interviews when they were working with the virtual teams.

4.4.1. Video Conferencing

"*When video conferencing takes place there is a bit of lag which took place in between asking of the question and thus appearance of it at the other screen. For example there is a lag of 5 seconds in asking a question and having it come back from the other end. It looks like a long time thus the conference loss its suitability and thus this activity becomes a waste of time*."

4.4.2. Language

"*There are some words which when the people speaks in another language did not means the same in English for example when one of our team member said that ignore this it meant in French that he was not knowing that thing but on phone call it was coming back as that if I don't know and I am not really caring about that*."

4.4.3. Redesigning

"*There are some team members who keep on saying that in the west it is designed like that whereas the local designer thinks that they are fools and local designer don't do it that way*."

4.4.4. Measurement Formation

"*There was a common model designed between two companies and when it was tried to merge the model of the both companies it was not according to scale. It was due to the fact that the each company did the standard stuff according to each other's offices and the setup of basic measurement was just not the same*."

4.4.5. Miscommunication

"*The engineering company was asking for the approval of the materials to be used. They were asking that can we use this material. And the answer was yes. But it would have taken the company round about two years to get that material approved. As it was not answered completely and properly so by using email you do not get the full story*."

CHAPTER 5

CASE STUDIES

It was very important for this research to carry out a detail case study. It was helpful in getting the better idea of the real project execution by using these virtual teams strategy. The interviews were performed with the domestic and international engineers and managers to get the complete information that was required. There were 2 case studies which were performed at two different projects which are implementing virtual team strategy. The content analysis was then performed on the interviews which were taken in order to explain the ongoing practices in the field.

5.1. Case Study 1

The first case study selected was the new ISLAMABAD INTERNATIONAL AIRPORT PROJECT (IIAP ISLAMABAD).

5.2. Important Details of the Project

It is one of the mega projects which is undergoing in Pakistan. There are multiple, domestic and international teams working on this project. This project is a great example of geographically dispersed teams as different teams from various parts of the world are contributing in this project.

Figure 5.1, 5.2 and 5.3 shows the under construction and architectural view of terminal building.

Figure 5.1 : Under construction view of terminal building

Figure 5. 2: Under construction view of terminal building

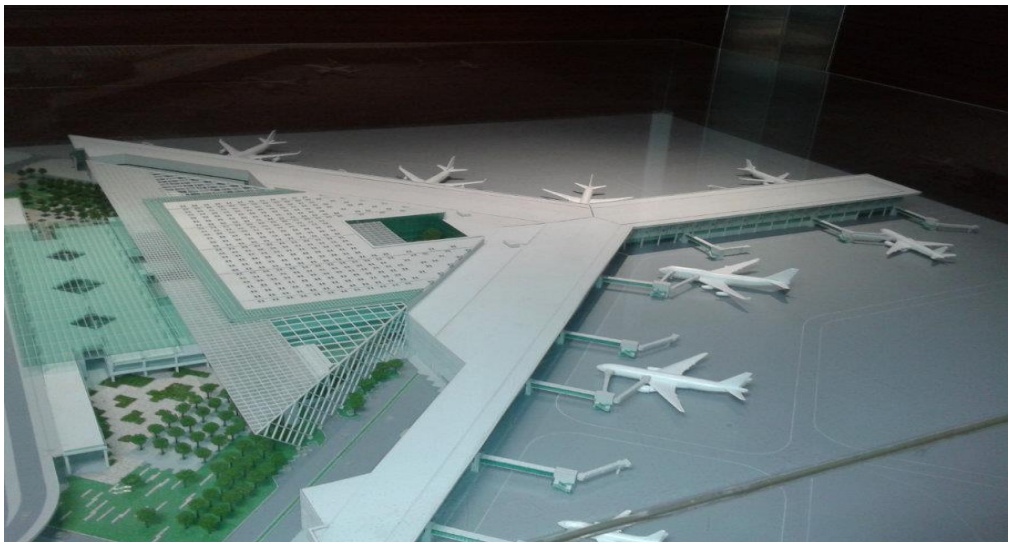

Figure 5. 3: Architectural view of Terminal Building

Now important details of the project will be discussed and also the teams involved from all around the world as shown in Table 5.1 and Table 5.2 respectively.

Table 5. 1 Salient Features of Airport project

Total Area of the Airport	3800 acres
Total Runways	2
Terminals	9
Total lifts	28
Terminal Building Area	180,930 sq. meter
Cost of overall Airport Project	120 Billion PKR
Cost of Terminal Building	21 Billion PKR
No. of storeys of terminal building	4

The project started in December, 2006 and is accounted to complete in April, 2017. The different teams involved in the project as shown in Table 5.2

Table 5. 2 Teams involved in Airport project

Contractors	**Design Consultant**	**PMC**
Lagan-Technical-Habib (JV)	CPG	Louis Berger
CRFG-CWE-TTP (JV)	Mushtaq and Bilal	
CSCEC-FWO (JV)	ARCOP	
Sambu - Sachal- Habib Rafique		
Al-Tariq Constructors(Pvt.) Ltd.		
Jaffer Brothers-GECISA-		

Murshid Brothers(JV)		
Lagan-Technical - Habib(JV)		
Siemens Pakistan Engineering Co. Ltd.		
Bexin-Gammon (JV)		
M/s Abid Brothers Contractors (Pvt.) and Gul Garden (JV)		

The main focus of over study was on terminal building of the airport which has the following specifications as shown in Table 5.3

Table 5. 3 Details of Terminal Building

Covered Area of the Building	1.8 million sq ft.
No of Storey	4
Cost	21 Billion PKR
Starting date	8 June, 2011
Expected Completion Date	27 December, 2015

Table 5.4 shows the different teams involved in execution of terminal building.

Table 5. 4 Teams involved at Terminal Building

Contractor	CSCEC (China) –FWO (Pakistan) (JV)
Design Consultant	CPG (Singapore)-Mushtaq and Bilal-ARCOP (Pakistan)
Project Management Consultant	Louis Burger (America)

This is the single largest work package of the project whose cost is about 21 Billion PKR. The China State Company (CSCEC) is working in a joint venture with FWO as the contractors. The CPG which is the Singapore based company are the lead design consultants whereas the project management consultant are the Louis Burger Group which is an American based company.

5.3. Engineering Services Strategies

In the execution of the terminal building 70% of the work is going to be commenced by CSCEC and 30% by FWO. The division is made possible with respect to the expansion joints in the terminal building. The most of the work is done on item rate basis. The shop drawing of the work which is to be executed by China State company comes from the head office of the CSCEC which is based in China.

There is a representative of the design consultant present at the site who can give decisions. The PEC has the rule that the foreign consultants should have the joint venture with the local consultants thus CPG has 60-40% JV with ARCOP, Mushtaq and Bilal. The local consultants are added in order to incorporate local environment as they know the local culture better than the international. For example the international companies design the work according to international standards and then local consultants have to apply them with regard to the local environment that is what kind of flooring and ceiling is liked in the local environment will be better understood by the domestic companies.

When there is any issue or a problem that has to be conveyed, the photographs are taken, the videos are made and the instructions or decisions which the

representative thinks is suitable and should be implemented is recorded and is sent back to head office of the representative country. The instructions are not directly given to the contractor but it is through the proper channel of the project management consultants.

RFI's are submitted to project management consultants (PMC). The PMC then forwards it to the design consultant and then the decision is made by the design consultant representative. Any query or problem gets recorded and the recorded file is sent to the head office which has to be replied with in the 28 days.

The server which is used at this project is the FTP Server which is used to upload and transfer files by both parties. Every decision which is made by representative of the virtual team will be own by the head office of that company. There are project specific project managers of every project and different department of the company has president, vice-president, principal engineer and senior engineer. So it is the whole hierarchy which works for the specific project of the virtual team. Weekly reports are generated for every discipline along with the pictures and the recordings and the comment of the representative. Then these reports are sent to the head offices. By weekly meetings between the design consultants, contractors, PMC, and clients takes place. All the discussions, issues and various problems are recorded and on basis of these monthly reports are formulized.

5.4. Organizational Structure of Shop Drawings

The organizational structure for the shop drawings is as follow:

5.4.1. Shop Drawings

The following are the steps involved in the preparation and submission of the shop drawings.

- Preparation of shop drawings
- Submission of shop drawings to PMC (Project Management Consultant)
- Submission of drawings to design consultant through FTP server.
- Approval of shop drawings and resubmission to PMC.
- Approved shop drawings handover to contractor and allow to execute.

5.5. Tools used for Data Sharing

The following tools are used for data sharing among various teams;

FTP Server for data sharing and transferring (File Zilla)

5.5.1. File Transfer Protocol (FTP)

The File Transfer Protocol (FTP) is a standard network protocol use to transfer computer files from one host to another host over a TCP-based network, such as the Internet.

FTP is built on client-server architecture and uses separate control and data connections between the client and the server. FTP users may authenticate themselves using a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it.

5.5.1.1. File Zilla

The File Zilla tool has been used in the project for data and information sharing. It is the client of FTP server and Figure 5.5 shows the use of File Zilla at the project.

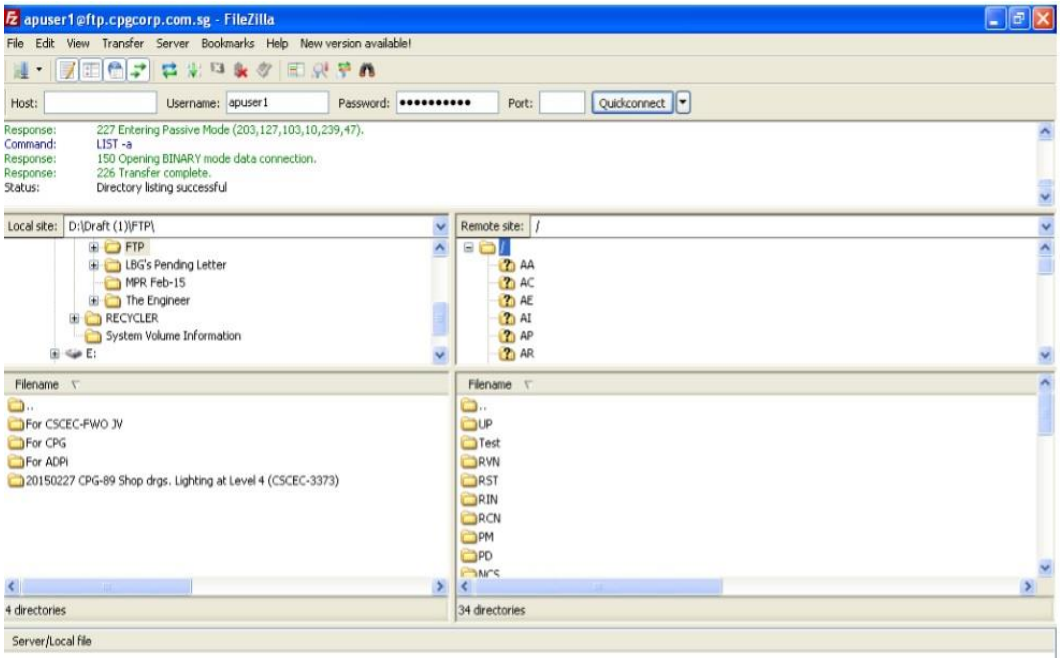

Figure 5. 4: Screen Shot of File Zilla

5.6. Tools used for Communicating and Collaborating

Following are the tools used for communicating and collaborating:

- Skype (Video Calling, Conference Calling)
- Email
- Phone

5.6.1. Skype

It is one of the most popular tools for video calling, conference calling and instant messaging among all over the globe. Skype is widely used by the top brass for the video callings and conference calling. It is best online meeting tool eulogized by managers because of its better quality and reliability. Within virtual environment of construction industry skype has become very required tool for conducting online meeting, conferences of top level management and mid-level management.

5.6.2. Email

Email is also very significant tool used for communicating with each other. In dispersed team environment it is necessary to have an email account and knowhow of using it. Without email it is not possible to go forth in business environment. Although in Pakistan email is considered less significant as compared to the western world but among all other countries email is mostly used for day to day communication.

5.6.3. Phone

Phone calling is also vital tool used among virtual teams, when things are to be discussed urgently, mostly telephone or mobile phone calling is used to job done.

5.7. Discussion

It has been argued by the interviewees of case study 1 that human networks, technology, change management and social capital are the important factors for the virtual teams. These factors are discussed as;

5.7.1. Human Networks

Interviewees have shown concerns about the lack of physical interaction during the life cycle of virtual teams particularly during the start of the project where goals, objectives and scope of the work can be communicated and coordinated. The interviewees suggested that there is need of better protocols of communication and collaboration with proper code of conduct and standards.

It is the physical interaction that develops better relationships among the team members. Due to lack of face-to-face interaction in virtual environment these relationships are difficult to develop. The communication among virtual members

is mostly through email. Email develop bridges between the members but it does not develop any bond or relationship. The relationship between the company and individual is temporary and thus it effects the overall performance on the project.

So it is required to develop participatory culture in the virtual team to create bonds and network ties. In order to make sure that members participate in the decision making and problem solving, the following factors must be considered critical; cohesiveness, collectiveness and strong social relationships.

5.7.2. Social Capital

The interviewees showed concerns about the organizational hierarchy and bureaucratic culture. The problems such as mistrust, less cohesion, lack of motivation and dissatisfaction were raised and political atmosphere develops mistrust and ruthless competition. It was suggested by the respondents that participatory culture, information sharing, open communication increases the cohesion of the team which leads to more trust and respect. It results in satisfaction of the employees and their overall performance.

It was also suggested by the interviewees that in order to facilitate virtual teaming the informal social networks must be encouraged. These informal social networks are complemented with virtual work space in order to share sensitive information regarding project. It was also expressed by the interviewees that strong relationships, ties are required in order to avoid any conflicts. Human networks are effective only if the social conditions that reinforce collaboration are met. This reveals the importance of reliable behavior. This shows the important role that social capital plays in computing organizational value reinforced by strong human

networks. It is the participatory culture that results in trust and respect for others at various levels in construction sector.

5.7.3. Technology

The interviewees suggested that the controlled access to the information increases the trust in technology. It also revealed that the organizations implementing virtual teams are lacking in clear vision and ICT strategy. Off-the-shelf solutions are not able to deliver. As in virtual teams there is tendency to rely completely on technology which results in dissatisfaction of members. It must be recognized that IT is not independent because it is not the technology it-self but it is the way people use the technology to communicate, collaborate and supporting knowledge management practices. Therefore the success does not depend solely on the IT or IT skills but depends on the suitable social contexts that can fully take advantage from the ICT.

It is also expressed that the coordination through groupware is highly encouraged and the discussion forums have been regarded important in sharing knowledge and information within the teams and across various projects.

5.7.4. Change Management

The interviews expressed that change management includes both technical and human problems. Keeping in view the technical side interviewees showed concerns about the changing nature of ICT and continuous need of adapting to new technology that is introduced at various projects in which they have taken part. It was observed by the respondents that the members are more effected by this continuous adaption to new technology than being effected by the team structure itself. It was pointed out that this continuous adoption to the technology has

negative effect on the satisfaction of the members with the team experience and performance. On the other hand when the team members are able to overcome the ICT related challenges it results in promotion of knowledge sharing culture. There is lack of flexibility in ICT solutions as there is change in needs of the organization and users.

With respect to human issues the interviewees agreed that knowledge value creation will result in the development of new approaches in managing human resources, information and knowledge sharing with in the organizations. In order to be effective the knowledge management must be incorporated with the participatory culture while keeping the team structure and discipline-oriented nature of construction industry into account.

5.8. Case Study 2

The second case study was carried out on Sheraton Hotel Project which is undergoing in Bahria Town Golf City, Islamabad. It is a 5 star hotel. As there are many types of 5 star hotel such as business hotel or leisure hotel. It is a resort hotel. Its built up area is 1.7 million sq. ft. and has 370 rooms. The operator of this hotel would be Sheraton. It is a 20 storey hotel including 8 basements. It is divided into different level such as pool level, deck level, lobby level, ball room level. It is the reflection of the hotel in Dubai known as Atlantis. The Figure 5.5 shows the architectural view of Sheraton hotel.

Figure 5. 5: Architectural View of Sheraton Hotel

5.9. Specific Details of the Project

The following section will deal with the important details and specifications of the Sheraton hotel as shown in Table 5.5.

Table 5. 5 Salient Features of Sheraton Hotel Project

Type of hotel	5 Star Hotel
Covered Area	1.7 million sq ft.
No. of Storeys	20 (8 Basements)
Cost of the Project	20 Billion PKR
No. of Rooms	370
Start date of the Project	July, 2010
Completion date of the Project	December, 2016

5.10. Teams Involved in the Project

There are different teams which are involved in this project such as it has different consultants of; interior designing, MEP, landscaping, structure work, water features and security etc. Table 5.6 shows the teams involved in this project.

Table 5. 6 Teams Involved at Sheraton

Developer	Bahria Town (Pakistan)
Operator	Sheraton (Dubai)
Architect	Beame (America)
Interior	Wilson (Singapore)
Landscaping	Cracknell (UK)
Contractor	Habib Construction (Pakistan)
Project Management Consultant (PMC)	Projacs (Qatar)

The main teams involved in the project up till now are the developer that is Bahria Town, operator that is Sheraton brand of Starwood. The main architect involved is American base. The interior works consultant is Wilson Company which is Singapore based. The project management consultants are the Qatar based company that is Projacs. The contractor involved up till now is Pakistan based that is Habib Construction.

5.11. Engineering Service Strategies

There are different brands of Starwood such as Four Points, Sheraton. This project will be operated by the Sheraton brand of Starwood. The teams involved at the project are subdivided in two categories;

- Site based
- Head office based

Each entity has been subdivided into 3 divisions for the coordination that are:

- Site Execution
- Site base design
- Project design development

Sheraton is included in project design development division. The site supervision and management is in hands of the Qatar based company that is Projacs.

It is tried at the project that there is a local recruitment for the site specific section so that local man power can be used as more as possible. It is also tried at the project that resident engineer and quantity surveyor are local if the local expertise are not available then help from the head office is taken. As, cost is the biggest challenge for the virtual team so it is always tried to recruit bigger part from local nutshell, so that there is less dependency on international office. The Figure 5.6 and Figure 5.7 shows the under construction view of Sheraton hotel.

Figure 5. 6: Under construction view of Sheraton Hotel

Figure 5. 7: Under construction view of Sheraton Hotel

The tools which are to be used at the project should be according to project constraints, objectives and the risks related to the project. So the tools must be customized with respect to the project. The case study shown that scope of the work is the most important aspect and should be properly defined. Clear roles and responsibilities are mentioned in the project matrix and specific timelines to complete the tasks are given and also who is responsible by whom one should coordinate and to whom it will be submitted all is coordinated and communicated.

The results suggested that internet is the key for the success of the virtual teams and integrated tools are required. These integrated tools are not suitable. According to the case study the matrix organization is successful in virtual team environment and the pyramid organization structure does not work.

It was expressed by the managers at the project that if the cost versus value is taken into consideration the virtual teams are better than the resident teams as there are much better expertise and knowledge from all around the world. If one can control communication tools and process eventually he will be able to control the team.

There are controls and systems available to control the processes; not for controlling the team. It is specified in the project contract the use of the technology. It is the key of the challenging factor that is the use of same technology that is the specification of tools and techniques should be there.

One of the participants of case study observed that integrated tools are not available and it is the organizational structure that will define communication protocol and the reporting time ultimately the project manager will be responsible for the performance of the team as a whole. We do not rely on the ability and experience of the team members, we have the system and the processes and everything is recorded.

5.12. Team Building

The team building process involved following processes:

- Recruitment (Ability to work as a team member)
- Operate within a system and processes
- Mentoring by the project manager

5.13. Rewarding Criteria

The interviewees of case study expressed that performance of the team members are reviewed quarterly and annually on the basis of set criteria of the company and the best one's are compensated on basis of one's performances review.

5.14. Project Management

It was suggested by the respondents that project manager must have the knowledge of the local culture of the home country where the project is taking place or if possible local project manager should be hired. The project management plan is

created which includes all the constraints such as cost, time and construction management. This plan is than presented in a meeting which includes client, contractor or any other party involved in the project.

5.15. Time Zone Difference

The time zone difference is taken as an opportunity as team can work 7 days a week.

5.16. Dash-Board Report

The following steps are involved in the creation of dash board report:

- Clear and well defined project objectives
- SWOT analysis
- Risk assessment
- Key performance indicators
- Benchmarks and deadlines

Dash-board report is a one page report which is an x-ray of the project. The following Figure 5.8 is the example of dashboard report which includes all important information.

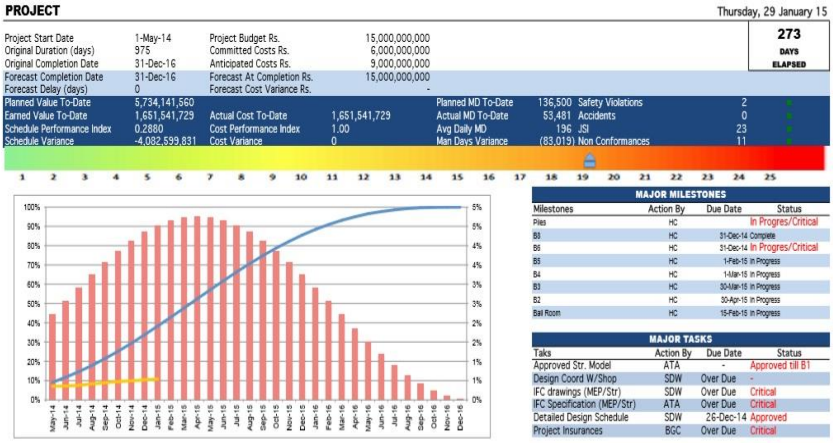

Figure 5. 8: Dashboard report of the project

5.17. Tools used for Communicating and Collaborating

Following tools are used for communicating and collaborating:

- PROMISE (Project Information Management System)
- Skype
- Outlook
- Phone

5.17.1. PROMISE (Project Information Management System)

It is an in-house tool of the company and it works as a central place. Every team members are connected to it as all the members of the team are connected to the central place and every piece of information which is exchanged and shared is easily accessible. Thus there is more control and team is controlled more effectively. Smart Track is one tool of which is offered by PROMISE.

5.17.2. Smart Track

Sheraton has a collaborative tool that is Smart Track. It is a web based application. All the teams involve in the project are connected to it. The exchange of information between the team members is accessible all the related members of various teams. As the document comes to any one's tasks basket document controller puts the information so that the various team members involve get the required information. It also gives the information regarding this task assigned to which member by whom the action is required, what is the due date and who is responsible for the specific task. Following are the few glimpses of the Smart Track Program which is used for collaborating purpose in virtual environment. The Figure 5.9, Figure 5.10 and Figure 5.11 shows the use of smart track at the project.

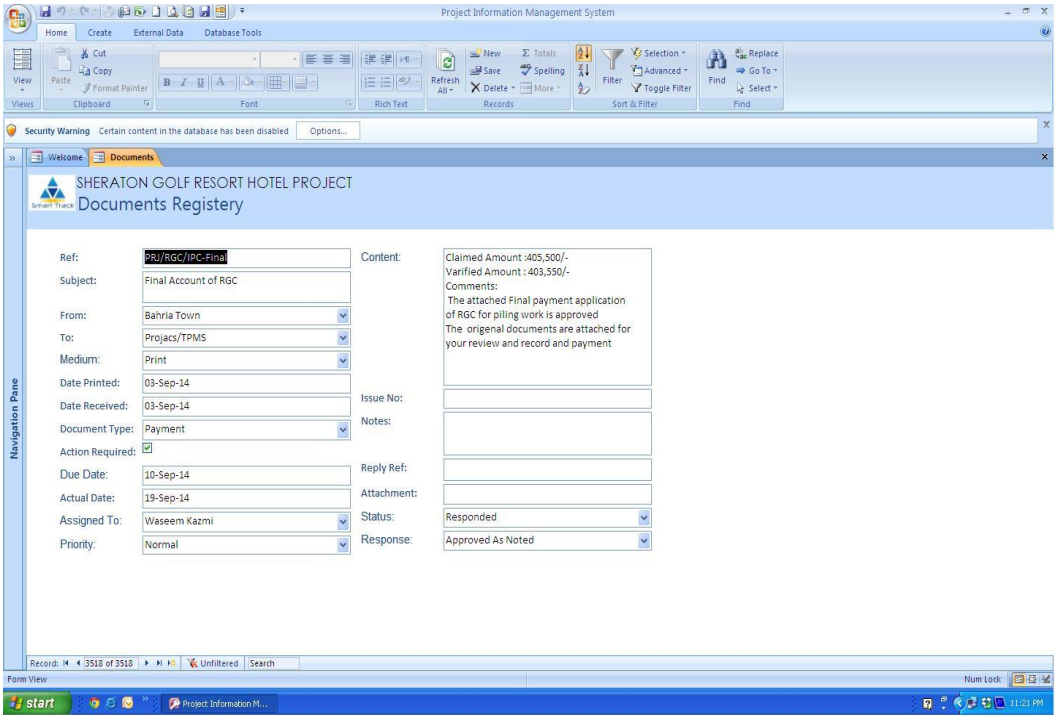

Figure 5. 9: Screen Shot of Smart Track

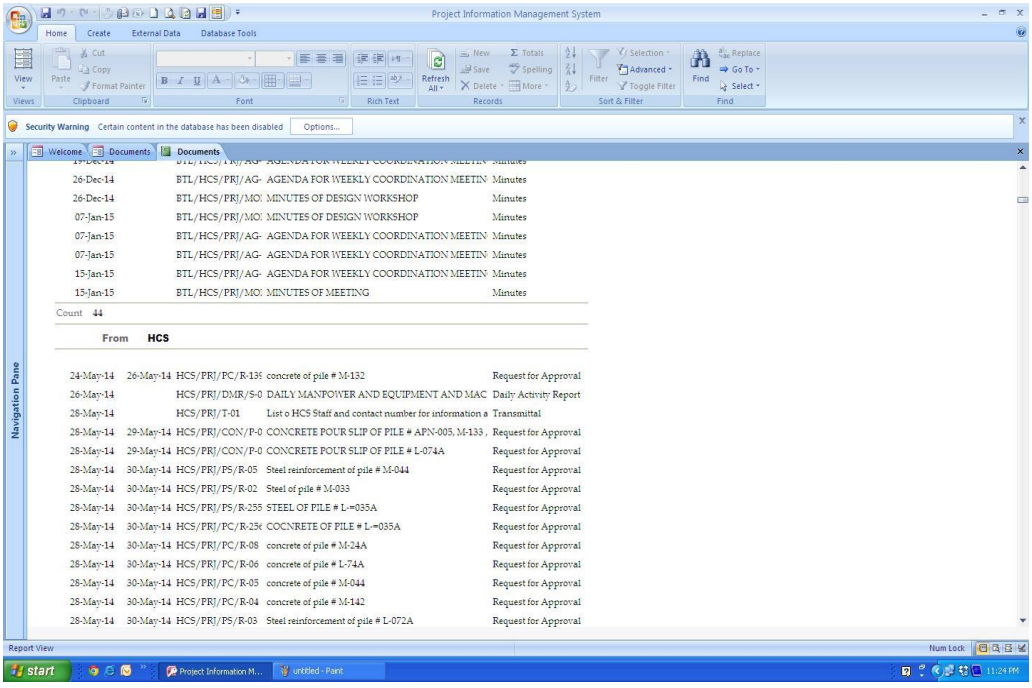

Figure 5. 10: Screen Shot of Smart Track

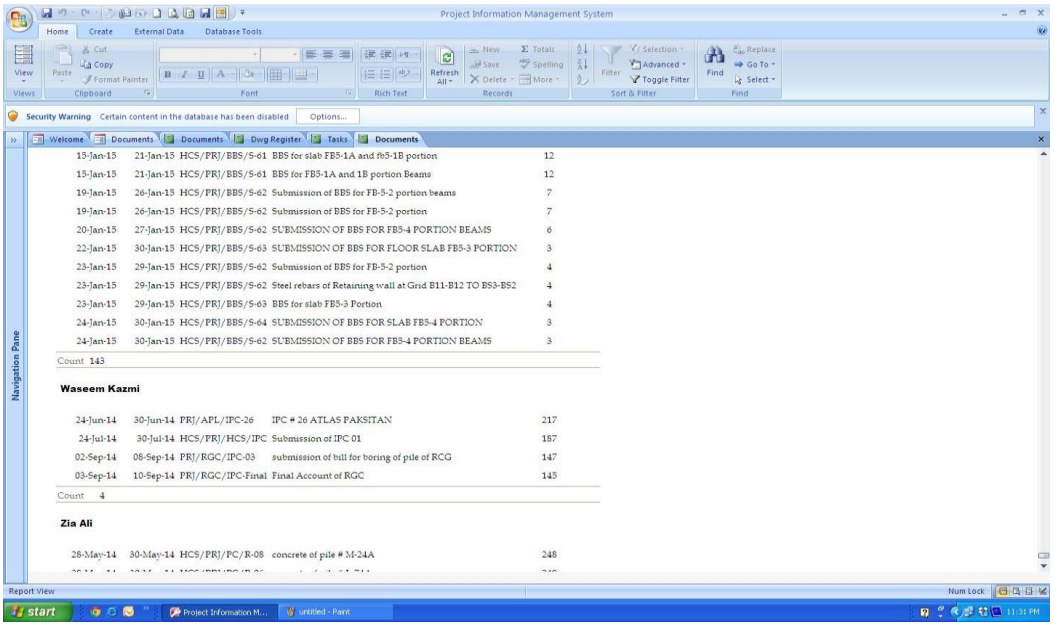

Figure 5. 11: Screen Shot of Smart Track

In the above figure one can see how various parties are interacting with each other with the help of Smart Track by PROMISE. While the application is keeping all the track record of their online interaction and keeping them update of the status of this document like reference of document, subject, its priority, due date, document type, status whether responded or not, to whom it is assigned to and content of the document.

5.17.3. Outlook

Teams at the project are using Microsoft Outlook for email purposes as it gives more control over the information that it to be shared. Heavy files can be attached and one can include calendars also to specify the deadlines.

5.18. Critical Success/ Failure Factors

The following success and failure factors were recognized through the case studies. The following Table 5.7 summarizes these factors:

Table 5. 7 Success and Failure Factors of virtual team

Success Factors	**Failure Factors**
Regular physical interaction, clear and effective communication	Lack of physical interaction and poor communication
Effective communication and collaboration tools	Language and cultural barriers, less knowhow of domestic work practices
Standard communication and work processes	Lack of leadership and management
Scope of work clearly defined	Frequent changes in the scope of the work and slow response to it
Well defined roles and responsibilities	Improper use of technology

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

In order to remain competitive in the construction industry, the use of virtual teams by the companies is increasing day by day. This chapter gives the summary of this study and its contribution to construction industry. This chapter also includes the recommendations for the future research.

6.1. Research Summary

Although, many challenges have been faced by the virtual team. But this is the need of the hour to use these virtual teams in order to compete in the construction industry with in the country and all over the world.

As virtual team is a group of individual who are geographically dispersed and coordinate and communicate through the use of the information technology. They also need to overcome the barriers of culture, language and time in order to perform particular tasks. The construction industry faces many challenges when using virtual teams on the projects including:

- How to transfer tools, processes and technologies in various offices?
- What tools and structure of management is effective to manage these teams?
- What are the governmental policies and requirement in various countries?
- How to tackle language and cultural differences between locations?
- How to develop the team building process, motivation and training with in the virtual teams?

In order to achieve the objectives of the research the forty interviews were conducted with the experts in the fields and also the two case studies to get full knowledge of virtual team's implementation, its challenges, recent status and the future trends.

The best practices were identified and defined and that were 1) effective communication; 2) regular face to face interaction; 3) integrated communication and collaboration tools; 4) properly defined work procedures; 5) clearly defined scope of work; 6) clear roles and responsibilities.

A model has been developed on the basis of research to manage these teams in an effective and efficient manner. Another contribution of this research is that success and failure factors are documented along with various examples.

6.2. Proposed Model for Effective Virtual Team Management

A model has been developed with the help of the case study and the interviews conducted. The following model shows the frame work of how to manage virtual teams effectively. The scope and the objectives of the work should be clearly defined at the start of the project by the owner. If scope of the work is not well defined virtual teams can never be successful so clear scope of work is most necessary for successful virtual teams. All factors that have been explained below are govern by the scope of the work.

The first step for the teams to be managed effectively is the team building stage. Building a team is a very important stage for virtual teams. The team building includes 3 steps; recruitment, training and mentoring. The first step for team building is the selection of team members who should be expert and have the experience of working with the distributed teams. The second step in team building

is the training of team members. The training includes the particular working style of the company, knowledge about various tools and techniques used by the company and training on how to work in different cultures and environment. The third step of team building includes the mentoring of team members by the managers.

As in virtual team most of the data and information sharing is done through internet so there is a need of project base centralized web location where each team member can share document and information and it should be well protected. So it is necessary for the projects that are executed by virtual teams that project based website or working space is developed and implemented from the very beginning of the project.

The communication and collaboration is one of the most important factors that make the virtual teams successful or unsuccessful. So the tools to be used for communication and collaboration should be well integrated and must be specified at the start of the project. Each member of the virtual team should be well versed of these tools and should use them effectively and efficiently.

All the members should have clearly defined roles and responsibilities. If the roles and responsibilities are not well communicated it will affect the performance of the individual as well as the whole team. It should also be made possible that the members do communicate with each other and with managers on frequent basis. It should also be made sure that all members participates in the team meetings and give proper input.

There should be a master schedule which must include all the deadlines and the benchmarks which are important for the team at the project. The manager should

make sure that each member is completing his task at the given time and according to the specifications. It is important to remind the team members of the deadlines of various tasks. Manager should try to be in coordination with all team members and they should be given the feeling that they are the part of team and are not working in isolation.

There should be key performance indicators (KPI) for the evaluation of the virtual team members and the virtual teams as a whole. The KPI's for the members will be; either they are completing the tasks according to schedule, presence and input during team's meetings and either they are making full use of the technology available. Figure 6.1 shows the model that has been proposed for managing virtual teams effectively.

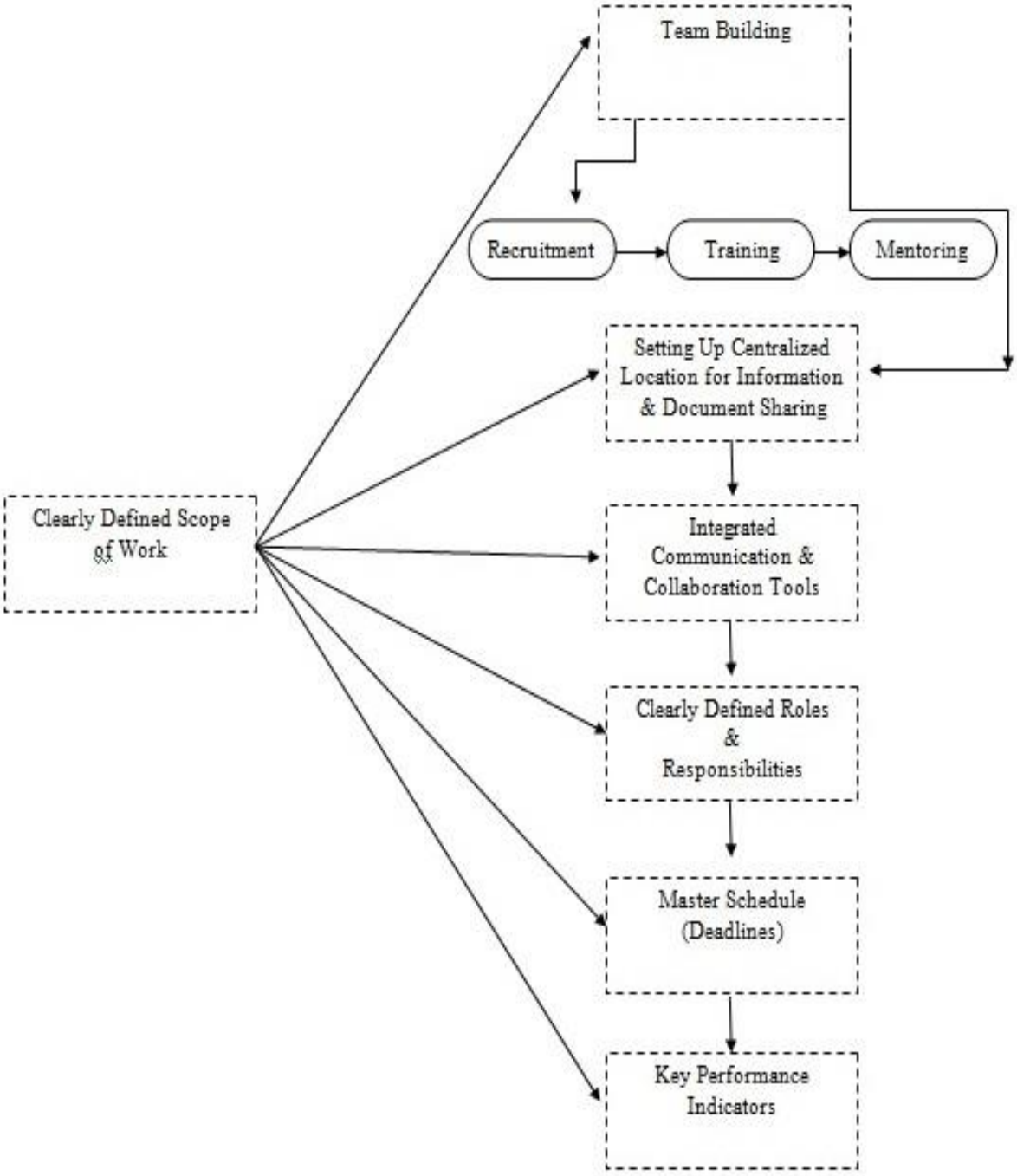

Figure 6. 1: Proposed Model for Effective Virtual Team Management

6.3. Need for further Improvement in Communication and Collaboration Tools

As the use of virtual teams in our country is at its early stage so there is less experience of the technology available for effective communication and collaboration. As it was found out that at most of the projects there was no specific project based tools that were being used by these virtual teams. So we are listing and explaining some important tools that are being used internationally and our engineers and companies should use these tools as much as possible to make these virtual teams more effective.

6.4. Meeting and Conferencing Tools

The following undermentioned tools should be used to take full advantage of virtual teams.

6.4.1. Web Ex

It is one of the best meetings and conferencing tools available all around the world. It can be used for remote meetings, webinars and training. It has a paid subscription of 1900 PKR which allows 8 participants per meeting with free mobile access. It also allows the desktop sharing, video conferencing and voice conferencing. It also allows you to record the meeting. The number of participants can be increased to 500 per meeting by the paid subscription of 5000 PKR per month.

6.4.2. Instant Messaging System (IMS)

It is one of the most used ways of communication now a day. As the workers have become more mobile and it is harder to track anyone down so IM is used to track

who is available and who are not available. Secondly email is not as productive as it used to be. Thirdly IM is not only about the chatting, it offers voice and video conferencing and allows remote workers to be part of it. Now as the instant messengers are available at all plat forms so it is easy to get in touch with the team members.

6.4.3. Document Management System (DMS)

In order to administer document electronically the document management system is one of the most effective systems available as it makes sure the fast and clear access to the documents required, their creation, their searching and their editing. The most popular plat form for document management is Microsoft share point.

6.4.4. Cloud Computing

Cloud computing is the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer. Hence the members of virtual teams should be given the knowledge and training about the cloud computation and it should be encouraged.

6.5. Future Research

The further research can be made by looking into the following:

- Examining the personality of the team members of virtual teams and how the personality characteristics contribute to the effectiveness of the team, depending on five personality traits.
- The research can be carried out on virtual team effectiveness by quantifying the team effective factors. Method for selecting team members on the basis of the evaluation of probable effectiveness of the team members.

- If the performance of the team is defined then by the assessment of the team features, the more quantitative analysis can be performed in order to define the effective virtual teams and its impact on the performance.

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Appendix A

Interview Protocol

An unstructured interview protocol was developed with questions to provide ample opportunities for interviewees to elaborate. The interview questions provided multiple probes into the descriptive and theoretical questions posed below. They were designed to elicit how individuals made sense of their experiences as member of virtual team.

A 60-80 minute interview session is set-up by the researcher (interviewer). A face to face interview is chosen for this purpose as it is convenient for both parties. Prior to the interview process, an interview guide was developed to ensure the objectives of the interview are achieved. Once the interview is over, the researcher should thank the interviewee for spending some time being interviewed

Appendix B

Demographical Information

The demographical information was to get the general information and the knowledge of the experience of the interviewee. It included following information:

Interviewee:

Company Name:

Phone number:

E-mail:

Date:

Time:

Job title:

Years of experience:

Gender:

Job level:

Level of education:

Virtual projects completed:

Appendix C

Interview Questions

Interview Questions

This section contains questions that were asked during the initial interviews. All the questions are structured with a main question and possible follow-up questions. Further questions were asked to elucidate on issues as discussed by the interviewees.

Background Information

1. What is your title and responsibilities in your company?

2. How many years of experience do you (personally) have with global virtual engineering teams (may be with different organizations/companies)?

3. How many years of experience does your company have with global virtual engineering teams?

4. Were you involved in the decision-making stage when your company chose to structure their use of the global engineering work force for a particular project?

Organizational Level Decision

1. Have you opened any permanent overseas engineering offices? If so, why have you opened them? Where are they located and how large are they?

a. What are labor cost rates for different geographic regions?

b. What were the start-up costs for your international office(s)?

c. What items did you consider when opening the permanent office?

d. How much work (as % or $ value) do you perform in each office?

2. Has there been any negative reaction from your domestic engineers related to your opening of international office?

Project Level Decision

1. What items do you consider when deciding whether to use engineers located in other countries to perform engineering services on your projects?

a. How do you consider each item? What quantitative and qualitative method do you use?

b. Is intellectual property a significant concern for your company that impacts your decision to use non-domestic engineers?

2. Does your company have a systematic process to guide the executives when determining the location that the engineering services for a particular project will be performed?

a. What information and factors are considered in this decision process?

b. How are they considered?

3. How do you select the location (either regions or countries) in which you perform the engineering services for a project?

4. How do you typically distribute the work?

a. Is it by phase, by system, or some other method?

b. Please provide an example.

c. How do you make this work distribution decision?

Best Practices for Successful Implementation

1. What do you feel are the critical items that allow you to be successful at developing effective global engineering teams?

2. To obtain a better understanding on the best practices for the successful implementation of global virtual teaming, we have divided best practices into the

six categories: Technology, Management, Strategy, Organization, Economics, and Institution.

• In Technology

What do you believe are the critical technology factors for being successful at effectively implementing global engineering teams?

Do you feel that real-time collaborative technologies are mandatory for effective communication?

• In Management

What do you feel are the key success factors for effectively managing the team members?

• In Strategy

How important is it that your global engineering approach fit within your corporate strategy?

• In Organization

Is there a particular organizational structure that you feel is best used for effectively implementing global engineering teams?

What are the key elements in that structure that is imperative for success?

• Economics

With regards to costs & benefits, how do you or when do you characterize that the use of global engineering work force is a success?

• Institution

Does your company have well defined, written policies for managing your global engineering team? How important do you feel these formal policies are to the success of a team?

3. Do you feel that technology is limiting your ability to effectively administer projects with engineering teams that are geographically dispersed?

a. How well is the project control tools integrated?

b. Do you use a standard technology process for administering projects?

c. Do owners frequently define technology specifications?

4. How do you manage dispersed teams of engineers?

a. Who do the engineers report to?

b. How do you transition between project phases?

c. What is your quality control approach?

d. Could you describe the frequency of coordination meetings, first meeting timing and duration, and early involvement of key functional leaders?

e. Could you describe your company's team building process, training (both in work processes and company culture), and morale building for engineers that are not collocated with the core team?

f. How do you recognize and reward good performance with global virtual teams?

g. What is the impact of language and cultural difference between locations? How do you manage them?

Case Study Examples

1. Could you give me an example of a successful project that was executed based on the effective use of engineers from another country?

a. What were the project characteristics, for example the size and type of the project, type of contract?

b. Why do you consider the project a success?

2. Could you provide an example of an unsuccessful project, if any? Please share a few thoughts on the lessons learned from the project.

Concluding Questions

1. What is the current trend within your company toward performing more projects with global virtual teams?

2. Do you have any additional comments or items that you feel are important for our research team to consider?

APPENDIX D

Case Study Interviews

Case Study Interview Questions

This section contains questions that were asked during the case study interviews. All the questions are structured with a main question and possible follow-up questions. Further questions were asked to elucidate on issues as discussed by the interviewees.

Background Information

1. What is your title and responsibilities in your company?

2. How many years of experience do you (personally) have with global virtual engineering teams (may be with different organizations/companies)?

3. How many years of experience does your company have with global virtual engineering teams?

4. Were you involved in the decision-making stage when your company chose to structure their use of the global engineering work force for this case study project?

How did you develop virtual teaming strategy for the project?

1. Why did you use global virtual teaming strategy?

2. Could you clearly define the work breakdown structure?

3. What was the contracting structure?

How did you develop project virtual teaming infrastructure for the project?

1. How did you develop information technology infrastructure for this project?

2. Please define the project execution/procedures plan.

3. How did you manage time zone differences?

How did you build the global virtual team?

1. How did you organize the team? How did you identify the team members that were required for this project?

2. What steps were taken in order to familiarize members with work process and culture in other location?

3. How did you build trust within the project team?

4. Please define the reward system used for this project?

How did you manage VT operations?

1. How did you ensure that proper quality control reviews and licensor requirements were met?

2. Did you organize frequent communication between locations? How?

3. Was there continuous monitoring at the remote office once the first phase of the project was transferred from the main office?

4. How did you monitor progress and performance?

Other information we would like to touch upon are regarding

Communications setup, package work, timetable, skills, wage rates, details on specific systems, country of engineers, how many, location of project, local content issues.

Was it effective? Level of quality, cost savings

What would you do different?

Key success items for this project

Concluding Questions

1. What is the current trend within your company toward performing more projects with global virtual teams?

2. Does your company have well equipped leaders to manage this new trend of dispersed teams?

3. Is there an effective training program within your company to train more managers or improve the leadership qualities to successfully work in such a distributed environment? If yes, then could you describe about those training programs?

4. Do you have any additional comments or items that you feel are important for our research?